

Title Post-packaging irradiation combined with modified atmosphere packaging for control of bacterial pathogens on meat products

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Abstract

Foodborne illnesses caused by consumption of contaminated meat and poultry products with *Escherichia coli* O157:H7, *Listeria monocytogenes*, *Salmonella* or *Campylobacter* have been major concerns in the U.S. Therefore, control of these pathogens by irradiation combined with modified atmosphere packaging (MAP) was investigated. Ground beef patties were inoculated with *E. coli* O157:H7, frankfurters or pre-cooked pork chops were inoculated with *L. monocytogenes*, and fresh chicken breasts were inoculated with *Salmonella enterica* Typhimurium, or *Campylobacter jejuni*. Packaging in vacuum or high CO₂ MAP (99.5% CO₂ /0.5% CO for beef patties and chicken breasts; and vacuum or 100% CO₂ for frankfurters or pork chops) was used for packaging these products. Products were treated with electron-beam irradiation at refrigerated temperature with target doses of 0 (control), 0.5, 1.0 and 1.5 kGy for beef patties and chicken breasts inoculated with *Salmonella*, 0, 1.0, 1.5 and 2.0 kGy for frankfurters and pork chops, and 0, 0.25, 0.5 and 0.75 kGy for chicken breasts inoculated with *Campylobacter*. Packaging methods did not affect radiation sensitivities of the pathogens. Radiation D₁₀ - values, each in vacuum and high CO₂ MAP, respectively, were 0.47 ± 0.02 kGy and 0.50 ± 0.02 kGy for *E. coli* O157:H7 on beef patties; 0.66 ± 0.03 kGy and 0.70 ± 0.05 kGy for *L. monocytogenes* on frankfurters, and 0.60 ± 0.02 kGy and 0.57 ± 0.02 kGy for this pathogen on pork chops; 0.55 ± 0.03 kGy and 0.54 ± 0.03 kGy for *Salmonella* on chicken breasts, and 0.31 ± 0.01 kGy and 0.29 ± 0.03 kGy for *Campylobacter* on chicken breasts. Although there was no increase in numbers, *E. coli* O157:H7, *Salmonella* and *Campylobacter* survived in both vacuum and MAP during post-irradiation storage. The growth of *L. monocytogenes* was inhibited in high CO₂ MAP for 12 weeks compared to 7-9 weeks in vacuum. CO in MAP retained red ground beef color during irradiation. Sour-like aroma was detected in the products from high CO₂ MAP, while irradiated off-odor was observed in all irradiated meat.