

## Effects of Irradiation on Cured Ham

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#### Summary and Implications

The effects of irradiation treatment at several different steps in the ham curing process were compared. Irradiation prior to the final cooking step of the ham process produced less off-odor quality change than irradiation after cooking. This means that irradiation to inactivate pathogens on ham products will have less quality effects if administered prior to the cooking step of the ham process.

#### Introduction

Irradiation is clearly effective for reducing or eliminating pathogens from processed meats. However, irradiation also has potential to induce undesirable quality effects including color and odor changes when applied to finished processed meats. For this project, it was hypothesized that irradiation treatments earlier in the process for cured meats would reduce the undesirable quality effects of the irradiation treatment.

#### Materials and Methods

Hams were deboned, and individual muscles separated and trimmed free of fat. Muscles were combined into

batches and randomly assigned to 4 treatment groups. One group was not irradiated (control) while the others were irradiated with 4.5 kGy at three different points in the ham curing process. One group was irradiated as raw, fresh ham prior to brine injection, one was irradiated as a cured, uncooked product after addition of all ingredients, and the third group was irradiated after cooking, chilling and slicing were complete. All products were analyzed for color, lipid oxidation residual nitrite and sensory quality during refrigerated storage.

#### Results and Discussion

Lipid oxidation was greater in all the irradiation treatments than the control (table 1), however, all values are relatively low. Color of the finished hams was not affected by irradiation treatment. Residual nitrite was not depleted as rapidly during storage in irradiation samples as in the control samples (table 2). Sensory panel scores showed considerably greater off-odor associated with samples irradiated after cooking compared to all other treatments (table 3). The off-odor dissipated during storage and was no longer significant after 30 days. Therefore, irradiation treatments resulted in minimal product change for hams when applied prior to cooking. Irradiation of hams following the cooking step is likely to result in off-odors particularly during the first 30 days after the process.

**Table 1. Least squares means for TBARS values of hams with irradiation treatments.**

Treatment <sup>1</sup>	TBARS Value (mg malonaldehyde equivalents/kg meat) (n=40)
Control	0.094 <sup>a</sup>
Raw	0.12 <sup>b</sup>
Raw-Cured	0.13 <sup>b</sup>
Cooked	0.13 <sup>b</sup>
S.E.M.	0.0037
S.E. of Differences	0.0052

<sup>1</sup>Control=unirradiated; Raw=irradiated before injection; Raw-Cured=irradiated after injection; Cooked=irradiated after cooking.

<sup>a-b</sup> Means within the same column with different superscripts are significantly different (P<0.05).

**Table 2. Least squares means for residual nitrite (mg/kg) in irradiated hams during storage.**

Treatment <sup>1</sup>	Day 7 (n=8)	Day 15 (n=8)	Day 30 (n=8)	Day 60 (n=8)	Day 90 (n=8)
Control	14.8 <sup>a</sup>	14.1 <sup>awx</sup>	12.5 <sup>ab</sup>	7.9 <sup>bc</sup>	5.3 <sup>c</sup>
Raw	13.8 <sup>ab</sup>	18.9 <sup>aw</sup>	14.2 <sup>ab</sup>	11.1 <sup>b</sup>	8.8 <sup>b</sup>
Raw-Cured	15.1 <sup>ab</sup>	15.9 <sup>awx</sup>	15.1 <sup>ab</sup>	11.9 <sup>ab</sup>	9.9 <sup>b</sup>
Cooked	9.3 <sup>a</sup>	8.6 <sup>ax</sup>	9.2 <sup>a</sup>	7.7 <sup>a</sup>	6.2 <sup>a</sup>

<sup>1</sup>Control=unirradiated; Raw=irradiated before injection; Raw-Cured=irradiated after injection; Cooked=irradiated after cooking.

<sup>a-c</sup> Means within the same row with different superscripts are significantly different (P<0.05).

<sup>w-x</sup> Means within the same column with different superscripts are significantly different (P<0.05).

Standard error of the mean = 1.77

Standard error for comparisons within treatment = 1.52

Standard error for comparisons within day = 2.50

**Table 3. Least squares means for sensory off-odor scores for irradiated hams during storage.**

Treatment <sup>1</sup>	Day 0 (n=4)	Day 15 (n=4)	Day 30 (n=4)	Day 60 (n=4)	Day 90 (n=4)
Control	50.1 <sup>w</sup>	46.0 <sup>w</sup>	55.8	32.8	36.5
Raw	56.9 <sup>w</sup>	44.4 <sup>w</sup>	49.4	46.4	41.2
Raw-Cured	58.2 <sup>w</sup>	60.6 <sup>wx</sup>	50.2	50.4	43.3
Cooked	83.5 <sup>ax</sup>	71.9 <sup>abx</sup>	65.5 <sup>ab</sup>	52.8 <sup>b</sup>	51.3 <sup>b</sup>

<sup>1</sup>Control=unirradiated; Raw=irradiated before injection; Raw-Cured=irradiated after injection; Cooked=irradiated after cooking.

<sup>a-b</sup> Means within the same row with different superscripts are significantly different (P<0.05).

<sup>w-x</sup> Means within the same column with different superscripts are significantly different (P<0.05).

Standard error of the mean = 2.32

Standard error for comparisons within treatment = 5.45

Standard error for comparisons within day = 5.88

Lower sensory scores indicate less off-odor