Radiation Inactivation of Salmonella panama and Escherichia coli K 12 Present on Deep-frozen Broiler Carcasses

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Summary. Low doses of ionizing radiation have been used to extend the shelf life of refrigerated poultry carcasses and to reduce the numbers of Salmonellae present. This report gives results of experiments on irradiation of deep-frozen poultry carcasses which were, before freezing, artificially contaminated with Salmonella panama and with a nalidixic acid-resistant Escherichia coli K 12. The D-values (decimal reduction) obtained with the inoculated carcasses were compared with D-values obtained with carcasses which were slaughtered in the normal way.

The D-values for S. panama and for E. coli K 12 were 64.9 krad and 55.9 krad in the dripwater. Under commercial conditions approximately 100 krad were required for one decimal reduction of the Enterobacteriaceae present.

The D-values estimated on the skin were higher for S. panama than for E. coli K 12 (128.6 krad vs 57.6 krad). If it is assumed that 1 positive carcass in 10,000 is allowed, the deep-frozen carcasses should be irradiated with doses of at least 700 krad to be sure of the absence of the tested S. panama strain.

INTRODUCTION

The application of low doses of ionizing radiation results in the decrease of the level of harmful microorganisms in many types of foods. In poultry this process can also be used to extend the refrigerated shelf life of the carcasses. (Ley et al., 1963; McGill et al., 1959; Proctor & Goldblith, 1951; Idziak & Incze, 1968; Licciardello et al., 1970; Gerrits et al., 1973.)

At the present time it is thought to be more important to reduce the number of Salmonellae and the possibility of Salmonellae transfer as well. Salmonellae can be isolated from poultry skin and from the dripwater of both refrigerated and deep-frozen poultry. The presence of Salmonellae in the dripwater after thawing of deep-frozen carcasses is of special public
health interest, because of the possibility of transfer of these bacteria to other food products.

Recent investigations of van Schothorst et al., 1974, showed that 21.6% of all broiler carcasses in the Netherlands were contaminated with Salmonellae.

The difficulty in studying the effects of ionizing radiations on Salmonellae on poultry carcasses is the low number of these microorganisms typically present per carcass. For this reason poultry carcasses were artificially contaminated for these experiments. Ley et al., 1970, used Salmonellae for similar experiments by inoculating and growing Salmonellae in deboned poultry meat at 37°C. Others, like Idziak & Incze, 1968, and Licciardello et al., 1970, inoculated high concentrations of microorganisms into chicken meat which was aseptically excised from the carcass and afterward comminuted.

Recently Notermans & Kampelmacher, 1974, described how bacteria can attach to the skin of broilers during processing. For this reason a method of artificial contamination was chosen which simulates a part of the conventional slaughtering procedure. In this way the microorganisms could attach to the skin and could also reach the subcutaneous tissue during water absorption.

This paper reports experiments on the irradiation of deep-frozen broilers inoculated with \textit{S.pana}ma and with a nalidixic acid-resistant strain of \textit{E.coli} K 12 in such a way as to permit their attachment to the broiler carcass. The irradiation doses required for decimal reductions of the number of bacteria on the skin and in the dripwater were determined.

**Preliminary Experiment**

The microbiological effects of ionizing radiations are most often studied in relation to the decreases in total counts and in the Enterobacteriaceae counts on the skin of broilers and in dripwater.

<table>
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<th>Dripwater</th>
<th>Dose krad</th>
<th>Number of positive Salmonella samples</th>
<th>Enterobacteriaceae log N/ml</th>
<th>D-value</th>
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<tr>
<td>250</td>
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<td>54</td>
<td>3.21</td>
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<tr>
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<td>250</td>
<td>5</td>
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<td>approx. 100</td>
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**Skin-samples**

<table>
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<th>Dose krad</th>
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<th>Enterobacteriaceae log N/g</th>
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</thead>
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<tr>
<td>250</td>
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