A Research Note

Comparison of Sampling Methods for Escherichia coli and Total Aerobic Counts on Broiler Carcasses

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(Received for publication March 11, 1983)

ABSTRACT

Significantly higher Escherichia coli and total aerobic counts were obtained from broiler carcasses when 20 g of excised breast skin were blended in peptone solution than when either whole carcasses or 20 g of excised breast skin were rinsed in peptone solution for sampling.

Four methods are currently in use for determining bacterial counts on poultry meat: swab of a specified area, carcass rinsing, skin excise and direct contact. Skin excise may be combined with either rinsing or blending of the skin section.

Fromm (9) reported lowest recovery by the direct contact method. Ayres et al. (4) preferred the swab to the carcass rinse method because it generally yielded higher counts. Kotula (10) reported on the variability in microbiological sampling of chickens by the swab method. Avens and Miller (3), in comparing the swab method to skin excise plus blending, concluded that skin excise plus blending was more precise and resulted in higher bacterial recoveries. Cox et al. (8) compared the swab method, skin excising followed by rinsing in broth with glass beads and skin excising followed by blending. They reported no significant difference in counts between the excising methods, but found significantly higher counts with excising plus blending than with the swab method.

This study was undertaken to compare Escherichia coli and total aerobic counts on broiler chicken carcasses sampled by (a) whole carcass rinsing, (b) skin excising combined with rinsing and (c) skin excising combined with blending.

MATERIALS AND METHODS

For each experiment, six whole eviscerated broiler carcasses were collected on each of 10 sampling days from the exit end of an immersion chiller in a commercial poultry plant and transported to the laboratory on ice. Testing was initiated within 30 min of sample pick-up.

Experiment 1

Carcass rinse: three carcasses (1200-1400 g) were each placed in individual new plastic bags, 300 ml of 1% peptone solution was added to each and shaken vigorously (manually) for 1 min. Skin excise/blending: a 20-g breast skin section was cut from each of three other carcasses using sterile forceps and scissors. Each section was then blended with 180 ml of 1% peptone solution in a Waring blender for 30 s.

Experiment 2

Skin excise/blending: same as Experiment 1. Skin excise/rinsing: a 20-g breast skin section was cut from each of three other carcasses using sterile forceps and scissors. Each section was then placed in a separate plastic bag with 180 ml of 1% peptone and shaken vigorously (manually) for 1 min.

Thirty carcasses were sampled by each method in each of the two experiments. Total aerobic counts were determined on Plate Count Agar (Difco) incubated at 20°C for 72 h. E. coli were determined by the 5-tube Most Probable Number (MPN) technique; decimal dilutions were incubated at 35°C for 48 h in lactose broth (Difco) and portions transferred to EC Medium (Difco) and incubated at 45.5°C for 48 h. Standard confirmation procedures of the FDA were used (1).

Analyses of variance were performed on the following paired comparisons: (a) carcass rinsing versus skin excise/blending; (b) skin excise/rinsing versus skin excise/blending and (c) carcass rinsing versus skin excise/rinsing. Data for the third paired comparison were taken from experiments 1 and 2. All counts for the statistical analysis were converted to counts/cm². For weighed samples the count per 20 g was converted to count/cm² as described by Barnes and Shirnpton (6) and Barnes (5). Whole carcass rinse was converted to count/cm² as described by Simonson (12) using a mean weight of 1300 g.

RESULTS AND DISCUSSION

Our study showed no significant difference (P<.05) between the carcass rinsing method and the skin excise/rinsing method for determination of E. coli or total aerobic counts, but these counts were significantly higher when determined by the skin excise/blending method than by the carcass rinsing method (Table 1). Cox et al. (7) reported significantly higher Salmonella incidence with a carcass rinsing method compared to a rinsing or blending method with 1.4 g of neck skin. This may be due to generally low
TABLE 1. Paired comparisons of the mean log_{10} of bacterial counts from broiler carcasses determined by sampling carcass by rinsing or excised breast skin rinsed or blended in 1% peptone solution.

<table>
<thead>
<tr>
<th>Sampling method</th>
<th>Mean log_{10} E. coli MPN/cm²</th>
<th>Mean log_{10} Total aerobic count/cm²</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Experiment 1</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Whole carcass rinsing</td>
<td>1.49</td>
<td>2.34</td>
</tr>
<tr>
<td>Skin excise/blending</td>
<td>2.01</td>
<td>3.42</td>
</tr>
<tr>
<td><strong>Experiment 2</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Skin excise/rinsing</td>
<td>1.22</td>
<td>2.46</td>
</tr>
<tr>
<td>Skin excise/blending</td>
<td>1.97</td>
<td>3.39</td>
</tr>
<tr>
<td>Whole carcass rinsing (from Exp. 1)</td>
<td>1.49a</td>
<td>2.34a</td>
</tr>
<tr>
<td>Skin excise/rinsing (from Exp. 2)</td>
<td>1.22a</td>
<td>2.46a</td>
</tr>
</tbody>
</table>

Each mean based on 30 samples. Means enclosed by lines followed by the same letters are not significantly different according to analysis of variance (P<0.05).

levels of salmonellae not uniformly distributed on poultry carcasses. Low numbers may not be detected from a small (1-4 g) sample of neck skin, whereas the relatively high numbers of total aerobic and E. coli bacteria may be more easily enumerated from 20 g of breast skin by the MPN method.

Blending of excised skin resulted in significantly (P< .05) higher bacterial counts than rinsing excised skin (Table 1). Cox et al. (8) found no difference in total and Enterobacteriaceae counts when excised skin was sampled by either rinsing or blending. They added glass beads to improve efficiency of removal of bacteria when rinsing excised skin, and used fewer and smaller skin samples than in our study. Greater numbers and size of samples tested may have contributed to the significance of differences found in our results. Since total counts and Enterobacteriaceae levels were higher in studies conducted by Cox et al. (8) than in our studies, the effect of bacterial level on sampling efficiency of the two methods should have been minimal. Avens and Miller (2) showed that the tissue "blending" method estimated low numbers of bacteria with more accuracy and precision than the cotton swab method. Our results indicate that the skin blending method may similarly estimate low numbers with more accuracy than the rinsing method.

Recovery of E. coli and total aerobic microorganisms was significantly more efficient when a sample of breast skin was blended than when sampling was by rinsing of carcasses or rinsing of excised breast skin. Blending physically removes and separates more bacteria imbedded in and firmly attached to poultry skin than does rinsing. Results of Mead and Thomas (11), which showed that only a small fraction of the total number of coli-aerogenes bacteria was removed with each of six successive rinses of poultry carcasses, support our findings that E. coli and total aerobic microorganisms are more completely recovered for enumeration by blending excised skin than by rinsing either carcasses or excised skin.

**ACKNOWLEDGMENT**

Mention of specific brand names does not imply endorsement of the authors or the institution at which they are employed to the exclusion of others not mentioned.

**REFERENCES**