Bacteriological Evaluation of Some Luncheon Meats in the Canadian Retail Market

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ABSTRACT

Four types of luncheon meats, bologna, chicken loaf, ham, and macaroni cheese, each manufactured by four different companies, were purchased from four major retail outlets in Ontario over a period of 16 weeks during the summer of 1975. Bacterial evaluation included determination of total aerobic plate count, coliforms, *Escherichia coli*, *Staphylococcus aureus*, *Clostridium perfringens*, salmonellae, and enterococci. Bacteria of public health significance were not a problem except for a high incidence of enterococci in all samples. *S. aureus* counts exceeded 1000/g in 20% of 30 positive samples out of a total of 159 samples. Total aerobic plate counts exceeded 5,000,000/g in 46.5% of the samples. Wide variation in bacteriological quality of the products between manufacturers was found.

A survey was undertaken to determine bacterial levels in four popular types of vacuum-packaged sliced luncheon meats (bologna, ham, chicken loaf, macaroni cheese) sold in supermarket grocery stores in Ontario. These types of meat products are cured and have been subjected to a mild heat process sufficient to yield pasteurized, cooked products. They are generally not heated further by the consumer which would destroy most of the contaminating microflora before consumption. Thus, the bacteriological quality of luncheon meats depends on the quality of raw materials, sanitation during production, and maintenance of the refrigeration chain from processor to consumer. It is evident, therefore, that responsibility for effective control of quality must be shared equally by producer and retailer. There are relatively few published data concerning the bacterial content of ready-to-eat luncheon meats (2,5,6,7) as purchased from the retail display cabinets. Allen and Foster (1) and Kempton and Bobier (4) reported that only lactic acid bacteria multiply during refrigerated storage in the types of meats they examined.

Canada has no bacterial standards or guidelines for this type of food. Other countries have such regulations (2). Most Canadian companies manufacturing these products probably use their own standards. A desire for information on the bacteriological quality of some luncheon meats as they appear on the retail market in Canada prompted this study.

MATERIALS AND METHODS

Collection of samples

A total of 159 samples of four types of luncheon meats representing four national manufacturers were collected at random from four major retail outlets in Ontario over a period of 16 weeks during the summer of 1975. All samples were retail packs weighing from 200 to 500 g and were taken directly from the market display case. Two of each type representing each manufacturer were purchased and used for determination of the temperature of the meat at time of purchase. Only samples which did not exceed the code date by 5 days were obtained. Samples were transported to the laboratory in an iced container and analyzed immediately.

Analytical procedure

For bacterial analyses a 30-g sample was obtained by aseptically removing a wedge from the center to periphery, thus including an equal amount of each slice of meat in the package. Samples were blended for 3 min in Waring blenders with 0.1% peptone water to give a 0.1 dilution. Aerobic plate counts (APC), coliforms, *Escherichia coli*, *Staphylococcus aureus*, enterococci, salmonellae, and *Clostridium perfringens* were determined by methods previously described (3).

RESULTS AND DISCUSSION

Neither salmonellae nor *C. perfringens* were isolated. Four samples contained *E. coli* with 15,14,210 and 50/g, respectively. Table 1 gives a summary of data on the range of total aerobic plate counts, enterococci, and *S. aureus* and the fraction of total samples that contained organisms for each type of sample. Enterococci were recovered from all samples, while *S. aureus* was isolated from 30 (18.8%) of 159 samples. About 46% of all samples had aerobic plate counts exceeding 5 x 10⁶ organisms/g and 23.9% of all samples were in the range of 1 x 10⁸ - 5 x 10⁸ organisms/g.

A certain pattern in the bacterial quality of the luncheon meats of the different manufacturers was noticeable. Comparing the four manufacturers, manufacturer A contributed 34 (50.7%) of 67 grossly contaminated samples (APC > 1 x 10⁷/g) in contrast to manufacturer C who had only five samples (7.4%) in this category. About 62% of the samples of manufacturer C had APC values below 10⁵ as compared to 2.5, 20, and 26.5% for manufacturers A, B, and D, respectively. All samples contained enterococci and the same trend in
<table>
<thead>
<tr>
<th>Manufacturer Type of Meat</th>
<th>No. of Samples</th>
<th>No. of S. aureus positive</th>
<th>% of S. aureus positive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bologna</td>
<td>10</td>
<td>2</td>
<td>20.0%</td>
</tr>
<tr>
<td>Chick. loaf</td>
<td>4</td>
<td>1</td>
<td>25.0%</td>
</tr>
<tr>
<td>Ham</td>
<td>2</td>
<td>1</td>
<td>50.0%</td>
</tr>
<tr>
<td>Mac. cheese</td>
<td>4</td>
<td>1</td>
<td>25.0%</td>
</tr>
<tr>
<td>A</td>
<td>39</td>
<td>25</td>
<td>64.1%</td>
</tr>
<tr>
<td>B</td>
<td>30</td>
<td>17</td>
<td>56.7%</td>
</tr>
<tr>
<td>C</td>
<td>39</td>
<td>17</td>
<td>43.6%</td>
</tr>
<tr>
<td>D</td>
<td>39</td>
<td>17</td>
<td>43.6%</td>
</tr>
<tr>
<td>Total</td>
<td>159</td>
<td>73</td>
<td>46.1%</td>
</tr>
</tbody>
</table>

*Note: Number of samples and arbitrary count ranges (total aerobic plate count, enterococci, and S. aureus) for 159 lunchmeat samples.*
incidence of these organisms was observed as for the total aerobic plate count. The incidence was highest in samples from manufacturer A and lowest in those from manufacturer C. Approximately 19% of samples contained *S. aureus* and 20% of the samples exceeded 1000 staphylococci/g. Again, manufacturer A had the highest incidence, while the incidence of these organisms was lowest in samples of brand C.

Earlier work (1,4,6) showed that lactic acid bacteria rapidly became the predominant microflora in processed meats during storage. In the present work, no attempt was made to determine the lactic acid bacteria. There was no indication that large numbers were present. Regardless of meat type (0.1% homogenate in distilled water) the pH range was 5.7-6.5. The pH would have approached 5.0 if lactics were the main contaminants.

About 80% of the colonies from a countable plate were catalase-positive. Since none of the samples exceeded the code date by more than 5 days, it is possible that a shift from a catalase-positive to a catalase-negative flora would have occurred upon longer storage.

Results of this survey indicate that the bacterial quality of luncheon meats in the retail market is quite variable and that wide variations between manufacturers can exist. Of the four manufacturers examined, only products from manufacturer C, except for a few samples, could generally be considered satisfactory, while those from manufacturer A were of the lowest bacterial quality.

Temperature abuse of the products at the retail level was probably one of the principal contributing factors to high counts, particularly where the initial bacterial content was already high. The internal temperature of the meat samples varied between 5 and 14°C (85% of the samples between 10 and 14°C) at time of purchase.

This study, although restricted to gathering data on the bacterial content of the luncheon meats as purchased from the retail cabinet by the consumer, nevertheless suggests that the high APC values could not be solely ascribed to mishandling during retail marketing. Based on the temperature recordings, the storage conditions and handling appeared to be similar for each product in each store visited.

Reports on the sanitary conditions in each manufacturing plant were not available; such information would be valuable in interpreting the results, especially since there existed such wide variations between manufacturers. Considering that the cooking procedure used for every product should be sufficient to substantially reduce the microbial population normal to the raw product materials and eliminate the lactic acid bacterial flora in raw meat, there is no alternative but to imply a great need for improvements in plant sanitation for manufacturers A, B, and D, particularly A. The need for better temperature control in the merchandising channels is also evident from this work.

Salmonellae, *C. perfringens*, *E. coli*, and *S. aureus* were not found to be a problem in this type of product, but the relatively high incidence of enterococci is indicative of a need for better sanitation practices.

ACKNOWLEDGMENTS

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REFERENCES