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A Longitudinal Study of Bacterial Contamination in Retail Meats and Meat Products

Abstract

Beginning in September 1975, and with records continuing through May, 1997, a laboratory class in food safety has been conducted at Iowa State University in 2-week rotations of 6–9 students each. As a component of the class, inspections has been made of local food establishments and a total of 825 meats and meat products have been purchased for microbiological laboratory cultures, with 77.6% positive for total aerobic plate counts, 55.3% positive for fecal coliforms, and 54.9% positive for *Staphylococcus aureus*. Titers ranged between 102.3 and 107.2 colony forming units (CFU) per gram. Analysis by 5-year periods has identified no progress over the 23 year period in lower prevalence or lower titers of contamination by these bacteria.

Keywords

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Disciplines

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A Longitudinal Study of Bacterial Contamination in Retail Meats and Meat Products

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Summary and Implications

Beginning in September 1975, and with records continuing through May, 1997, a laboratory class in food safety has been conducted at Iowa State University in 2-week rotations of 6–9 students each. As a component of the class, inspections have been made of local food establishments and a total of 825 meats and meat products have been purchased for microbiological laboratory cultures, with 77.6% positive for total aerobic plate counts, 55.3% positive for fecal coliforms, and 54.9% positive for *Staphylococcus aureus*. Titers ranged between $10^{2.3}$ and $10^{7.2}$ colony forming units (CFU) per gram. Analysis by 5-year periods has identified no progress over the 23 year period in lower prevalence or lower titers of contamination by these bacteria.

Introduction

Inspection schedules for local food establishment inspection are made every 2 weeks during the academic year by the local city inspector with arrangements with the establishment managers, rather than unannounced as is usual for routine inspection visits. At each visit, students select foods for routine culture in the university laboratory of the course, for total aerobic plate counts, fecal coliforms, and coagulase positive *S. aureus*.

Materials and Methods

Standard culture methodology has used 25 g samples of the products prepared and cultured according to the American Public Health Association Compendium of Methods for the Microbiological Examination of Foods, Marvin L. Speck, Ed. 1st Edition 1976, 2nd Edition 1984 (1–4). Results have been recorded in prevalence of positive cultures, and titers of test organisms in positive cultures in CFU/g of meat and meat products.

Results and Discussion

During the period September 1975 through June 1997, a total of 825 meat and meat products was cultured with overall 77.6% positive for total aerobic plate counts, 55.3% positive for fecal coliforms, and 54.9% positive for *S. aureus*. The percentages of positive cultures by product categories are shown in Figures 1a-c. Total aerobic plate counts (APC), fecal coliforms (FC) and *S. aureus* (Sa) prevalence were all highest in ground meats with APC-93%, FC-81.6%, Sa-71.8% positive. Lowest percent

positives were with cooked preserved products for APC-38.2% and Sa-31.2%, but for FC were four cured fermented products-4.9%. Coliform bacteria appeared to be especially sensitive to cures, predominantly nitrites with ascorbate and to fermentation for long-term effectivity.

For further comparisons, the meats and meat products were subdivided into raw meats, processed meats, and sandwich spreads/salads. Raw meats included fresh chilled meats, ground meats, variety/organ meats and fresh sausages. Microbiological cultures yielded APC-86.7%, FC-67.7% and Sa-61.8% positive. Processed meats included cured cooked products, cured fermented products, cooked preserved products, and cooked foods with meats. Microbiological cultures yielded APC-55.7%, FC-27.9%, and Sa-38.2% positive. Substantial reduction in all categories of bacteria was achieved through processing, including curing, fermenting, cooking, and canning. Sandwich spreads and meat salads, prepared ready to eat had bacterial counts even higher than the raw meats. Microbiological cultures yielded APC-90.7%, FC-68.5%, and Sa-69.8% positive.

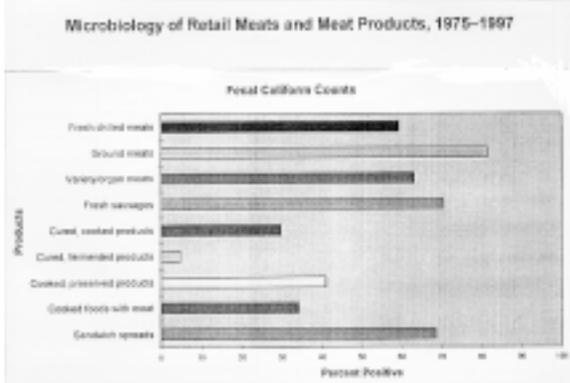
The culturing of meats and meat products has covered the period September 1975-June 1997. Figures 2a-c show percentages of positive cultures as much as possible by 5-year periods. Total APC counts by time periods varied between 81.2 and 92.1% positive. Coliform counts varied between 53.5 and 76%. *Staphylococcus* counts varied between 55.9 and 69%. Of importance is that no trends in prevalence of any of the test bacteria over time could be discerned and no statistically significant differences were found related to time periods.

Titers in log₁₀ mean colony forming units per gram of raw pork are shown by time periods in Figures 3a-c. Total APC counts for raw pork varied by time periods between $10^{6.2}$ and $10^{7.2}$, of FC between $10^{3.1}$ and $10^{4.0}$, and of Sa between $10^{2.9}$ and $10^{3.9}$. Of importance is that APC counts were in a range of 1–10 million CFU/g whereas fecal coliform and *S. aureus* counts were in a 1,000C10,000 CFU range per gram. No trends in levels of contamination by the test bacteria were identified by time periods; in other words, no progress in microbial reduction on raw pork was found from 1973–1997 at retail level.

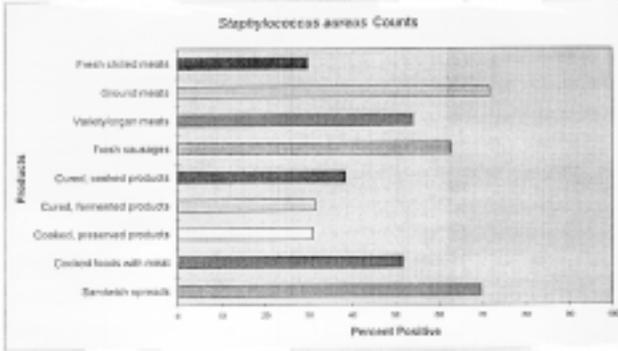
Titers in log₁₀ mean CFU/g of processed ready to eat pork products are shown by time periods in Figures 4a-c. Total APC counts showed APC counts generally increasing over the time period from a low of $10^{5.2}$ in 1975–1977 to $10^{6.6}$ in 1988–1992 and $10^{6.4}$ in 1993–1997. The FC counts were between $10^{1.6}$ and $10^{2.8}$ and Sa counts were between $10^{1.7}$ and $10^{3.4}$, both significantly lower than the APC counts and with much greater variation by time periods. Of importance is that bacterial contamination levels were similar in ready to eat pork products to those raw pork, and that no progress was evident in reduction of the test organisms over the study period.

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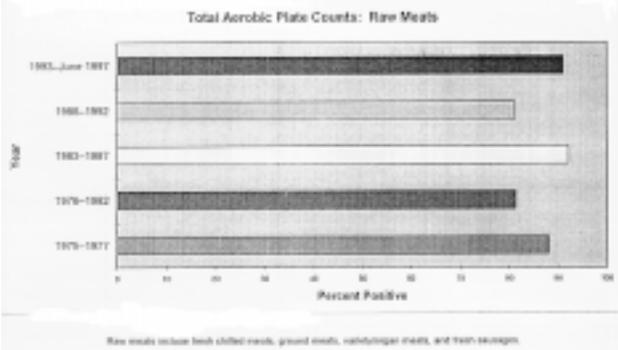
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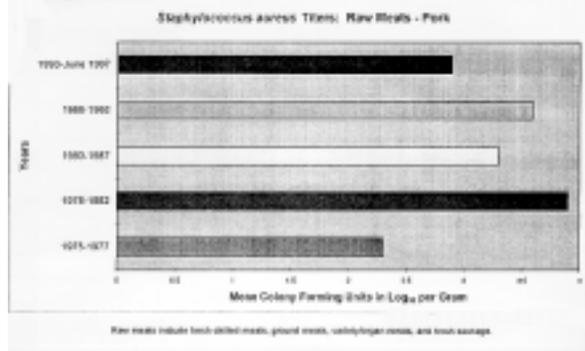
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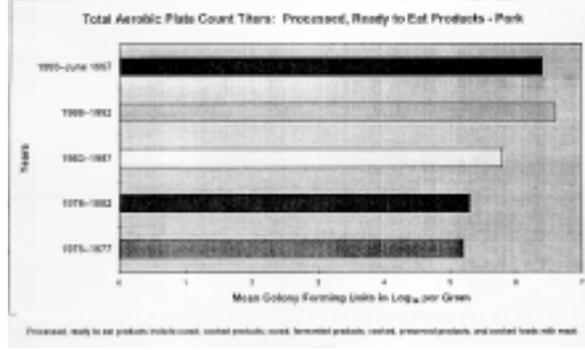
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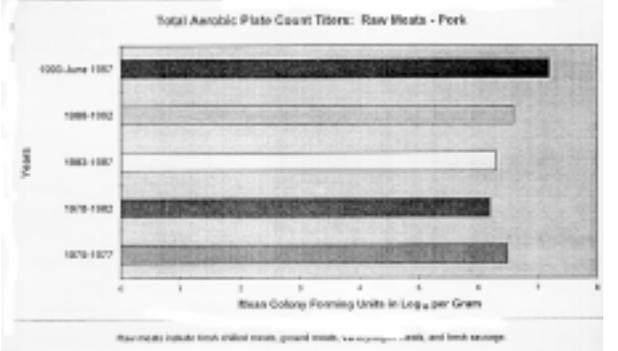
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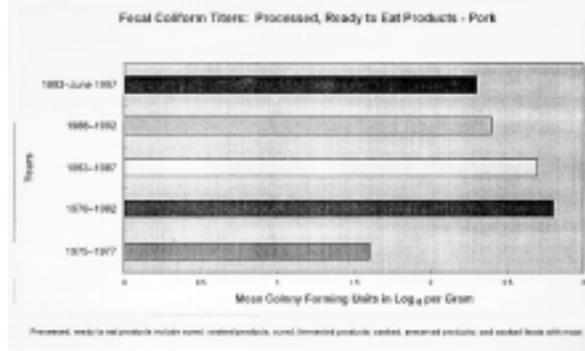
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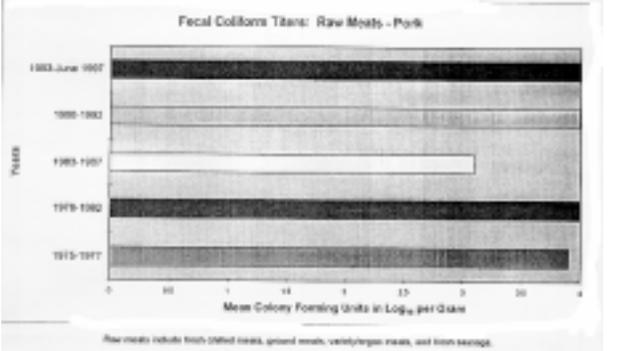
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