Effect of Cooking on Bacteriological Populations of "Soul Foods"

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ABSTRACT

Effect of typical cooking procedures on viable bacteria present in "soul foods" was determined. Time and temperature used were those determined to give a satisfactory product. Except for an aerobic plate count of 60 CFU/g in puddings (liver) and 10 CFU/g in jaws and neckbones, survival of vegetative bacterial cells in the cooked foods was nil.

A time-temperature survey of Hawaiian-style food has been done (2). The temperatures attained at the geometric center of these foods during cooking were such that vegetative pathogenic foodborne bacteria would have been killed had such organisms been present. Time-temperature conditions of Gyros (a meat dish of either beef or lamb seasoned with onions, garlic and parsley) have also been determined. After Gyros had been cooked and cooled, as many as $10^4$ Clostridium perfringens per gram were recovered from samples taken immediately under the surface (1).

Most of the foods used in the present study require relatively long cooking times before they are ready for human consumption. Since some bacteria have been known to survive high temperatures for long periods (5,6), and "soul foods" contain many bacteria (9), the intent of this study was to determine the bacterial populations of "soul foods" as influenced by time-temperature.

MATERIALS AND METHODS

Foods

Foods cooked in this investigation were pig offals, such as chitterlings (washed intestines), fatback, hamhocks, jaws, maws (stomach of swine), neckbones, pigears, pigfeet, pigtails, puddings (liver), sausage (loose) and sausage (encased). They were purchased from local supermarkets and cooked in quantities of 0.9 kg.

Time and temperature determinations

All foods were prepared for cooking by washing, placing in the appropriate container and cooking by the methods of Jackson and Wishart (4) and Roberts (7). Cooking temperatures were measured with a thermometer (Fairgrove) and times recorded in minutes. A taste panel of five persons determined when the foods were thoroughly cooked and ready for human consumption.

RESULTS AND DISCUSSION

Soul foods cooked for human consumption require long periods at high temperatures (Table 1). Cooking times were highest for hamhocks and pigfeet, 195 min at 95.7 and 98.3°C, respectively. Times and temperatures were identical for chitterlings and maws, 180 min at 98.5°C. Liver pudding, a precooked food, required 10 min to reheat at 72.3°C. Pigears and pigtails required relatively long cooking times and at high temperatures, 147 and 118 min at 99.0 and 99.6°C, respectively. Fatback fried within 15 min at 150°C, whereas jaws needed 75 min at 92.8°C to be thoroughly cooked. Fifteen minutes were needed to cook sausage (loose) at 72.5°C and 18 min for sausage (encased) at 81.4°C. All of the foods were described as delicious before being examined for the bacteriological content. Bacteriological analyses indicated that survival of bacteria was almost nil (Table 2). Aerobic plate counts were CFU/g in precooked, preheated liver pudding and 10 CFU/g in jaws and neckbones. There were less than 10 CFU/g in all other samples.
TABLE 2. Comparison of bacteriological content of “soul foods” before and after cooking.

<table>
<thead>
<tr>
<th>Foods</th>
<th>Aerobic plate count (CFU/g) Before cooking</th>
<th>After cooking</th>
<th>S. aureus (CFU/g) Before cooking</th>
<th>After cooking</th>
<th>C. perfringens (CFU/g) Before cooking</th>
<th>After cooking</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chitterlings</td>
<td>$8.3 \times 10^7$</td>
<td>&lt;10</td>
<td>$1.5 \times 10^5$</td>
<td>&lt;10</td>
<td>$2.0 \times 10^5$</td>
<td>&lt;10</td>
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<tr>
<td>Fatback</td>
<td>$2.8 \times 10^4$</td>
<td>&lt;10</td>
<td>$4.2 \times 10^2$</td>
<td>&lt;10</td>
<td>&lt;10</td>
<td>&lt;10</td>
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<tr>
<td>Hamhocks</td>
<td>$3.2 \times 10^6$</td>
<td>&lt;10</td>
<td>$8.4 \times 10^6$</td>
<td>&lt;10</td>
<td>&lt;10</td>
<td>&lt;10</td>
</tr>
<tr>
<td>Jaws</td>
<td>$4.9 \times 10^5$</td>
<td>$1 \times 10^3$</td>
<td>$4.3 \times 10^5$</td>
<td>&lt;10</td>
<td>&lt;10</td>
<td>&lt;10</td>
</tr>
<tr>
<td>Maws</td>
<td>$3.2 \times 10^7$</td>
<td>&lt;10</td>
<td>$1.4 \times 10^5$</td>
<td>&lt;10</td>
<td>&lt;10</td>
<td>&lt;10</td>
</tr>
<tr>
<td>Neckbones</td>
<td>$2.4 \times 10^6$</td>
<td>$1 \times 10^3$</td>
<td>$2.5 \times 10^5$</td>
<td>&lt;10</td>
<td>&lt;10</td>
<td>&lt;10</td>
</tr>
<tr>
<td>Pigeons</td>
<td>$8.1 \times 10^6$</td>
<td>&lt;10</td>
<td>$2.6 \times 10^5$</td>
<td>&lt;10</td>
<td>&lt;10</td>
<td>&lt;10</td>
</tr>
<tr>
<td>Pigfeet</td>
<td>$7.9 \times 10^7$</td>
<td>&lt;10</td>
<td>$1.3 \times 10^6$</td>
<td>&lt;10</td>
<td>&lt;10</td>
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<tr>
<td>Pigtail</td>
<td>$2.8 \times 10^5$</td>
<td>$6 \times 10^3$</td>
<td>$1.4 \times 10^5$</td>
<td>&lt;10</td>
<td>&lt;10</td>
<td>&lt;10</td>
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<tr>
<td>Puddings (Liver)</td>
<td>$2.1 \times 10^7$</td>
<td>&lt;10</td>
<td>$2.8 \times 10^4$</td>
<td>&lt;10</td>
<td>&lt;10</td>
<td>&lt;10</td>
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<tr>
<td>Sausage (Loose)</td>
<td>$1.0 \times 10^7$</td>
<td>&lt;10</td>
<td>$2.0 \times 10^3$</td>
<td>&lt;10</td>
<td>&lt;10</td>
<td>&lt;10</td>
</tr>
<tr>
<td>Sausage (Encased)</td>
<td>$1.6 \times 10^6$</td>
<td>&lt;10</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Geometric means of 30 samples.

*Geometric means of 24 cookings and 9 samples.

It is apparent that these “soul foods” attained temperatures during cooking which caused destruction of the bacteria (Table 2). *Clostridium perfringens*, found in chitterlings at a concentration of $2.0 \times 10^7$ before cooking, did not survive cooking at 98.5°C for 180 min. Although bacteria can be destroyed in these foods during cooking, if exposed to temperature-time abuse and recontamination during preparation before consumption, these foods can be a source of foodborne illness.

In conclusion, these studies show that cooking at the time-temperatures evaluated kills many of the bacteria that contaminate “soul foods.”

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REFERENCES