MICROBIOLOGICAL STANDARDS FOR CANNED MEAT

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The question of microbial standards for meat products has been debated for many years. The main problem seems to be lack of agreement by microbiologists on methodology, incubation temperatures, significance of numbers vs types, statistical sampling procedures, etc. According to Hobbs (1969) agreement on safety measures by means of microbiological standards on an international basis is being studied by a number of groups (e.g. Codex Alimentarius, International Standards Organization and the International Committee on Microbiological Specifications for Foods). Standards for international use must be simple with as small a number of parameters as possible.

Ingram (1961) discussed the problem of incubation and the fact we often incubate at temperatures at which the organisms causing the quality decrease do not grow simply because we do not have time to wait for visible growth at low temperatures. With meat canning line speeds between 10 - 600 cans per minute we must have rapid methods for use in plant microbiological control programs. The best current plant procedure appears to be environmental control and careful control of raw materials. Microbiological standards imposed on canned meats must be consistent with the ability of the plant operating under good manufacturing practices to meet the specification a high percentage of the time.

Another problem still to be resolved by the meat canning industry is the question of the microbiology of additives such as starches, sugar, salt, hydrolyzed vegetable protein, etc. used in product preparation. The National Canners Association (1968) states "In general, there are no microbial standards by which the suitability of ingredients for use in canning may be measured".

One significant recent paper by Baltzer (1970) summarizes the subject of bacterial standards in Western Europe. Yugoslavia standards given in this paper are summarized for canned meats in Table 1.

Table 1

<table>
<thead>
<tr>
<th>Microbiological Standards in Yugoslavia</th>
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<tbody>
<tr>
<td><strong>Product</strong></td>
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<tr>
<td>---------------------------------------</td>
</tr>
<tr>
<td>Pasteurized Canned Meats</td>
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<tr>
<td>Heat Sterilized Canned Meats</td>
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Germany has a standard for canned meats which states: In a smear from the sample of canned meat, there should be less than 30 stained bacteria in 20 areas by microscopic examination. If this is not met, further samples will be examined.

Greece has governmental standards for imported canned meats demanding: less than 2 harmless and no pathogenic organisms per gram in sterilized products.

Spain has official standards demanding less than 10,000 as the total count limit and less than 200 spores per gram in imported canned meats.

Denmark has rejected canned meats with high counts of Bacillus and will not accept the presence of significant numbers of Clostridium in canned meats.

Baltzer (1970) also discusses the Danish Meat Research Institute private microbiological standards "and shows a marked improvement in the bacterial level of product in Danish canning factories since 1964. The viable spore count in sterilized products has been reduced by 50% and the percentage of pasteurized canned meats containing viable streptococci reduced by 50%.

Some canned meats are processed to a "commercially safe or sterile" level with a heat process calculated to kill all vegetative bacteria and most spores in the product. However, the process is not calculated to kill the spores of clostridia and stability is obtained by curing salts preventing the germination and growth of the remaining spores. Brown and Vinton (1964) summarized twenty years data on bacterial spores in luncheon meat and canned hams. They concluded that the spore load has markedly decreased during recent years and most samples contained less than 1 anaerobic spore/gram of meat. Tompkin (1970) furnished additional information on the product load in Table 2.

Table 2

<table>
<thead>
<tr>
<th>Product Category</th>
<th>Samples Analyzed</th>
<th>Range of PA Spores/gm</th>
<th>Samples in Which PA Spores not Detected</th>
<th>% Negative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perishable Luncheon Meat</td>
<td>66 17</td>
<td>0.03-0.36</td>
<td>49</td>
<td>74</td>
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These data again show a product with extremely low levels of viable anaerobic spores.

Recent papers by Canadian Workers (Johnson et al. 1969; Pivnick et al. 1969 and Pivnick and Thacker 1970) discussed the inhibition of Clostridium...
botulinum by nitrite in a bacteriological medium and in meat. These workers also discussed in detail the factors affecting the safety of canned, cured, shelf-stable luncheon meat inoculated with Clostridium botulinum. Factors which affected toxinogenesis were the number of spores, concentration of salt (sodium chloride) sodium nitrite and the amount of thermal processing. Meat inoculated with 1 spore per gram and processed to $F_0 = 0.6$ became toxic if salt and nitrite were omitted. In contrast, meat inoculated with $10^8$ spores per gram remained non-toxic after the same thermal process provided sufficient salt and nitrite were present ie with a brine of 6.1% and no added nitrite, with a brine of 4.6% and 300 ppm of added nitrite, or with intermediate concentrations of salt and nitrite.

Ingram and Kitchell (1970) emphasized that microbiological standards serve several quite distinct purposes and it is not likely that a single standard will effectively serve more than one.

Summary

Microbiological standards do not appear to be possible for canned meats at the present time. Not enough information is available on the bacteriology of various types of products produced by industry.

The meat bacteriologist in industry must be concerned with the safety and shelf life of the product his plant produces. He must know the numbers and types of organisms likely to be present at the time of production and how these organisms are likely to multiply during subsequent storage. Complete elimination of the normal flora in some types of canned meat products can create a hazard by permitting growth of potential pathogenic microorganisms.

As discussed in this paper the amount of heat processing, sodium chloride content, sodium nitrite level, additives incorporated and storage condition each has an effect on the safety and shelf life of canned meat products.

Statistical sampling difficulties are a real problem because of the heterogeneity of most canned meats and the obvious impossibility of examining all the food.

"Freedom from pathogenic microorganisms" is a favorite phrase of public health authorities but for commercial samples absolute absence is a condition which can neither be attained or verified by any practical microbiological method.

In line production control based on reasonable statistical tolerances represents the most obvious practical approach to develop microbiological data on canned meat products and study the relationship between the many variables that influence product quality.


