



# Preliminary Study of Bacterial Contamination of Pre-Cooked Luncheon Meats in Retail Stores of North Central Louisiana

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## Introduction

The quality of food at the time of purchase is important to the consumer. The microbiological contamination of meat products which are pre-cooked, and may be served without further preparation, is of particular significance. A high level of bacterial contamination may shorten the period of time that luncheon meats can remain on the shelf for consumer purchase and may also adversely affect the flavor and appearance of these products.

The purpose of this study was to determine the numbers of bacteria found in luncheon meats, at the time of purchase, obtained at different types of retail stores. These stores were urban chain, small urban, and rural stores. Two types of media were used in the analysis, one for total enumeration of bacteria present and the other for detection of potentially dangerous staphylococci.

## Literature Review

The microflora of food may affect the health of the consumer according to evidence presented by Tanner (1946), Jenson (1949), and the American Meat Institute (1960). Evidence has been presented by Tanner (1933), Jensen (1964), and Thornton (1960), that the number and kinds of organisms affect the keeping quality of meat.

The presence of large numbers of bacteria in frozen foods has been reported by many investigators. Proctor and Phillips (1948) reported that in 124 different kinds of commercially prepared pre-cooked foods examined by them, bacterial plate counts ranged from fifty thousand to one million per gram. Their samples included both meat and vegetable products.

Microorganisms present in frozen meats are not always significant epidemiologically since non-pathogenic organisms form a large portion of the bacterial flora present. Yet these non-pathogenic bacteria may significantly reduce the storage life of these products. The occurrence of a large number of bacteria in meat may be related to the method in which meat was handled prior to freezing, such as improper handling during slaughter or improper aging of the meat. Borgstrom (1955) reported data from bacterial studies made throughout the United States on a variety of foods containing chopped meats in which the average colony count was: for pork, sixteen thousand per gram; for beef, two hundred sixty three thousand per gram; for lamb, sixty three thousand per gram.

Brewer (1925) analyzed a variety of meats. His data showed average counts, obtained from bologna, to be slightly less than forty million per gram at an incubation temperature of 20°C, and almost one hundred-fifty million per gram at an incubation temperature of 37°C.

In a review of the microbiological aspects of meat spoilage, Ayres (1951), pointed out that bacterial counts were found to vary with the type of meat product, handling procedure, and sanitary conditions. Meats that required special processing such as chopping or slicing, were found to be most heavily contaminated. Initial studies of packaging materials and procedures indicated that characteristics favorable for one type of meat were not always favorable for other types of meat.

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Favorable conditions for the growth of *Samonella* spp. and *Staphylococci* ssp. exist in pork and beef at temperatures of 15.6° C to 32.2° C. In the ordinary household refrigerator, a temperature of 4.4° C to 10° C inhibits the growth of "food poisoning" organisms for at least twenty-four (Gomutputra and Fabian, 1953).

Sixteen kinds of non-frozen fresh meats were analyzed for the presence of coagulase-positive staphylococci by Jay (1962). Five of the six meats in which no *Staphylococci aureus* was found were precooked luncheon meats which apparently indicated that precooking reduced the number of staphylococci in these meats (Jay, 1962).

As a result of the selective bacteriostatic activity of curing salts, cured meats have a different bacterial flora than do fresh meats. Apparently the major selective agent is sodium chloride, although not all groups are inhibited. Certain stphylococci, capable of growth in the presence of sodium chloride, were inhibited by the addition of nitrite and additional inhibition was obtained with an unfavorable pH (Lechowich et al. 1956).

A major problem for producers of certain meat products is the maintenance of quality during the time between production and consumption. Extra preparation of meat items, such as slicing, small unit packaging, or cooking, always presents problems. Urbain and Ramsbotton (1948), presented information on preparation of such products as sliced bacon, sliced dried beef, and frankfurters.

Miller (1960), stated that the slicing and packaging of various meat products for self-service marketing may increase the possibility of surface contamination with spoilage organisms. From his investigations, Miller concluded that the predominant contaminating organisms under these circumstances were micrococci. Similarly, Thornton (1960), reported that foods most likely to become contaminated are those that require some handling prior to sale. He further reported that seventy-five per cent of the cases of bacterial food poisoning occur in such "made up" foods.

#### Materials and Methods

Responses obtained from a questionnaire given to certain students enrolled at Louisiana Polytechnic Institute, Ruston, Louisiana, indicated that they often use precooked luncheon meats without further preparation. Ten per cent of the student body was used as a test group. Over ninety-five per cent of the students surveyed, at one time or the other, did eat precooked luncheon meats. Of those questioned, 64.1 per cent

frequently ate those meats without further cooking; 32.8 per cent rarely ate those foods without further preparation, and 3.1 per cent never ate those foods without further cooking. The results of this survey indicated that these foods were usually eaten at home, but that they were popular for lunches while at work, for meals while on fishing trips, and for midnight snacks in the dormitories. When these luncheon meats were taken on outdoor excursions, only 32.2 per cent always refrigerated them, and 8.2 per cent never attempted to refrigerate these meats.

This study was limited to luncheon meats that were found to have a widespread usage in picnic type lunches. Precooked luncheon meats were purchased at random in retail stores located within a thirty-five mile radius of the Louisiana Polytechnic Institute campus. The stores sampled varied in size from large chain stores to small individually operated stores. Both urban and rural stores were tested.

The samples were refrigerated within ten minutes after collection. When distance necessitated it, a portable ice chest was used to provide refrigeration. The samples were always analyzed for bacterial content within twenty-four hours after they were purchased and most were analyzed within three to six hours after purchase.

At the time of purchase, observations were made of the over-all appearance of the store. The general sanitary condition of the facilities in the meat market, and the personnel were closely observed. Special notes were made regarding the methods by which the meat was handled.

For microbiological analysis a sterile cutting instrument was used to remove a small portion of the outer slice of meat. A one-gram sample was placed in a sterile mortar. The weighed sample was flooded with twenty milliliters of sterile saline and was mascerated with a sterile pestle. Dilutions were made ranging from 10 through multiples of ten to one million.

#### Results and Discussion

Generally, the plate counts obtained from the stores sampled did indicate that the consumer in the north central Louisiana area is receiving a good quality luncheon meat. When a comparison of these results is made with those obtained by Brewer (1925), it would seem that considerable progress in meat sanitation has been achieved. The average number of bacteria found in bologna by Brewer was approximately one and one-half times that found in the most highly contaminated

TABLE I.

RESULTS FROM COLONY COUNTS ON TWO MEDIA INCUBATED AT 12° C AND 37° C. ALL SAMPLES WERE OF BOLOGNA SECURED FROM THREE GENERAL TYPES OF RETAIL MARKETS. TABULATIONS ARE AVERAGE COLONY COUNTS OF ALL SAMPLES FROM EACH STORE AND ARE EXPRESSED IN 1000's PER GRAM.

Type Store	Nutrient Agar		Chapman-Stone Agar	
	12° C	12° C	12° C	37° C
Urban Chain				
1	11	370	7,000	1,340
2	53	43	0	0
3	3	5	0	0
Small Urban				
1	24	540	3	0
2	1	1	0	0
3	400	850	170	200
4	300	500	130	37
5	8,300	8,500	0	260
6	1,800	23	0	0
Rural Stores				
1	15	30	0	0
2	55	10	30	7
3	3	10	0	0
4	1,000	180	500	0
5	450	185	50	5
6	1,000	1,000	1	0
7	65	45	1	0
8	1	10	1	0
9	530	1,000	1,000	1,000
10	30	1,000	1,000	1,000
11	14	10	0	0
12	1	10	0	0

sample in this study. Many factors have contributed to this improvement: for example, increased sanitary measures at the packing plants; improved methods of bacteriological detection; and use of prepackaging materials. Furthermore, the separation of the meat processing areas from the rest of the store has evidently resulted in lower bacterial contamination. This was true in samples 2 and 3 where the meat packaging was separated from other areas and was completely excluded from the main store area. Examination of Table I shows that these two stores consistently yielded good samples. Other factors cannot be overlooked, because store Number 1 had such a meat packaging area, yet samples from this store were strikingly inconsistent as can be seen from Table I. The small urban and rural stores did not have as complete a separation of the meat packaging area as did the chain stores. In the small urban stores in particular this was, perhaps, one factor that resulted in samples that yielded higher counts (Table I).

When the results from the large chain stores and the small urban stores are compared, there is an indication that samples with lower counts were obtained from the larger stores; however, store size is not a completely reliable criterion, since store Number 1 yielded some samples with very high counts. The general appearance of this store was very good.

The high counts could possibly have been attributed to carelessness of employees rather than to poor facilities. A striking example of the effort that handling procedure may have can be noted in store Number 2 of the small urban group. This store was small and one in which one person transacted all the business. This store had a very neat appearance, but in particular it was noted that the store owner carefully washed his hands before handling the meat. The samples obtained here yielded very low counts. Additional evidence that handling procedures are important can be noted in store Number 5 of the small urban group. The first sample yielded low counts, but all other samples were strikingly high. Between the collection of the first and second samples there was a change in butchers. During the slicing process, the second butcher allowed more contact of meat with his hand than the first in that the meat was sliced from the "stick" and was allowed to fall into the palm of his hand.

Among the small urban stores only store Number 2 sold pre-packaged luncheon meats. The prepackaging of this meat was done at the packing plant. The counts here were low. Among the rural stores, Numbers 1, 3, and 4 sold luncheon meats prepackaged at the packing plant. It may be noted that stores Number 1 and 3 gave low counts while a very high count was given at store Number 4. When this last sample was examined visually it had an old appearance and seemed to

be dry. The general impression was that the sample had been on hand for some time. Age, then, would seem to be an important factor.

The variation in counts from the rural stores is not surprising. The difference in external appearances, procedure in handling the meat, and the condition of the stores varied among the stores as much as did the bacterial counts. Stores Number 1, 2, 3, 7, 11, and 12, gave low counts which was probably merited by methods of handling the meat within these stores. The very high counts obtained from other rural stores could possibly be traced to the fact that crowded, dirty conditions prevail and slicing knives appeared dirty. Lack of proper screening of doors and windows was noted in each of these stores with very high counts. Possibly major factors contributing to the high counts obtained would be crowded conditions in the refrigerators and possibly the slow turn-over of the foods.

The variation in intensity of contamination by staphylococci was great. It was found that the majority of staphylococci were contaminants of the meats from the smaller stores. Only one sample from the larger stores showed the presence of staphylococci, and this count from a sample obtained at store 1, was extremely high. The method of handling the meat by the operators of the store was possibly a contributing factor to the high level of contamination.

## Summary

This study indicates that possibly lower bacterial counts can be obtained more consistently from the larger stores. Possibly the excellent facilities observed in these stores were partially responsible for these low counts, but results suggest that sanitary inconsistencies do occur even in the larger stores. It is apparent that sanitation procedures employed by the meat handler within the store whether the store is large or small, influence the quality of the meat as measured by bacterial contamination. There can be no substitute for cleanliness within the meat market. No matter how good the product is when delivered from the producer, it must be kept in the same condition by the operator of the store.

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# Progress Report on the Professional Improvement and Course Development Project

SUBMITTED TO  
THE NATIONAL SCIENCE FOUNDATION BY  
LOUISIANA TECH ON BEHALF OF THE  
NATIONAL ASSOCIATION OF COLLEGES  
AND TEACHERS OF AGRICULTURE

By F. E. Beckett

The National Association of Colleges and Teachers of Agriculture during its April 1963 meeting, at the suggestion of the Foundation Committee, instructed representatives from Louisiana Polytechnic Institute to submit a proposal to the National Science Foundation in its behalf for the purpose of improving teaching in college agriculture. This proposal has been prepared and submitted.

The fields to be covered are the first courses in plant and animal science as applied to agriculture. It is intended that 30 participants will be selected in each area to attend a 9-week seminar. These participants are to be qualified in teaching their subject matter. They must plan to remain in the teaching profession for a reasonable period of time in the future. The agenda for the summer includes two outstanding lecturers in each area.