Bacterial Standards for Retail Meats

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ABSTRACT

Unsuccessful efforts of the Oregon retail meat industry to comply with the subsequently revoked Oregon bacterial standards for raw meats are reviewed. The satisfactory role of bacterial standards in regulation of pasteurized milk in contrast to their unsatisfactory role in retail raw meats is discussed. It is concluded that bacterial counts on raw meats cannot serve as indicators of: (a) health hazards, (b) insanitary conditions, (c) product spoilage, or (d) an aesthetic value of the food. Bacterial standards on raw meats, as applied in Oregon for 4 years, are considered as unjustifiable because they: (a) could not accomplish what they purported to do, i.e., reduce public health hazards, (b) were not administratively feasible. (c) were not technically feasible, i.e., were unattainable under the conditions of current good manufacturing practice in the industry, and (c) were not administratively feasible.

This discussion will deal primarily with bacterial standards on raw ground beef at retail. Lest there be any misunderstanding, I shall use the term “bacterial standards” solely to denote bacterial limits which may serve as the sole basis for legal action against a food product wherein bacterial counts exceed the specified standard limits. This differs from “bacterial guidelines” the application of which, may not serve as justification for legal action against the product in which the specified guideline limits were exceeded.

From subsequent comments I think you will understand why I do not consider “quality standards” and “bacterial standards” as synonymous terms when applied to raw meats. You will see I am not convinced that bacterial counts necessarily denote quality of raw foodstuffs.

OREGON BACTERIAL REGULATIONS

In May, 1973, the Oregon regulations established as a criminal act the offering for sale of (a) raw meats with Aerobic Plate Counts (APC) exceeding 5 million per gram or Escherichia coli (MPN) counts exceeding 50 per gram or (b) of processed meats with Aerobic Plate Counts exceeding 1,000,000 per gram or E. coli (MPN) counts exceeding 10 per gram. Within an 18-month period (September '73 thru February '75), the Oregon compliance program had led to the filing of criminal charges against 24 different Oregon store managers (including four from Safeway) for violation of this regulation.

MEAT DISTRIBUTION SYSTEM

Safeway’s meat distribution system in Oregon involved supplying retail stores with bulk ground beef and with primal and sub-primal cuts of beef that had been pre-fabricated at our Clackamas, Oregon USDA-inspected meat breaking plant from USDA-inspected choice beef quarters trucked in primarily from Oregon, Washington and Idaho packers. Some fresh domestic boneless beef was purchased from nearby boners to supplement cow meat that was also boned out in the Safeway breaking plant. The bulk ground beef was prepared at the breaking plant using the USDA Choice trim from the pre-fabrication line together with the boneless cow beef boned out at this plant and/or additional boneless beef purchased from outside sources. The meat was distributed from the breaking-plant to the retail stores in Safeway trucks.

Approximately three-fourths of the ground beef distributed to Safeway’s Oregon stores was ground under controlled conditions in the breaking plant in approximately 5,000-lb. batches which were chilled to about 32-34 F with dry ice during blending. It was packaged into 20-lb. “keeper casings” for shipment to the stores. At the stores the product was re-packaged into consumer-sized retail packages. Regular ground beef was re-packaged directly from keeper casings into retail packages, whereas lean ground beef was passed once through the store grinder before final packaging. Trim resulting from breaking of beef primals and sub-primals into retail cuts at the stores, was ground and packaged separately from the warehouse-produced bulk ground beef. From the time the truckloads of beef quarters (or boneless beef) were received at the dock of the breaking plant until finished packages were picked out of the display cases by customers, the meat and its environment were constantly under the control of Safeway personnel. It was felt that better control of temperatures, equipment cleanliness, and sanitation could be maintained in the centralized operation than in approximately 200 individual stores.

SOURCE OF E. COLI

By April, 1974 after about a year’s experience with the standards, our Portland Retail Division had recognized that consistent compliance with the 50 maximum E. coli per gram level in the ground beef was beyond the
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capability of our individual store managers (who were being held legally liable for compliance) and that technical assistance was needed. In May, 1974 Safeway Stores, Inc. established a corporate level Quality Assurance Department with the initial assignment of learning how the corporation could meet these and similar bacterial criteria on meats. By September a bacteriological laboratory had been built and equipped in our Portland Division meat breaking plant. This laboratory was staffed by three graduate food technologists, one of whom had earned a Master of Science degree through a study of microbiological aspects of ground beef irradiation before working for about 4 years as Quality Control Supervisor in two of Safeway’s milk plants.

Since Safeway had control of the product from time of receipt at the breaking plant, either as quartered beef or as boneless beef, until time of pick-up of the finished package of meat at the store by the customer, it was possible to develop a bacterial monitoring system which pointed up the major source of high E. coli counts in the retail packages of ground beef. It was soon found that approximately 30-50% of the lots of bulk ground beef exceeded 50 E. coli (MPN) as they were packaged from the breaking plant grinder even before shipping to the stores. Since this incidence was not higher in samples obtained from the retail counters, it was apparent that sanitation and temperature control at the retail stores and during trucking from the breaking plant to the stores were not significant contributors to excessive E. coli counts in the retail ground beef.

Our bacteriologists became convinced that the crux of the problem rested with the incidence of E. coli on the carcasses as received from the packers. This was indicated by the results of routine equipment sanitation swabbing in the breaking plant, swabbing for E. coli on carcasses as unloaded at the receiving dock, and as a result of several special studies.

Based on knowledge gained from the E. coli monitoring of carcasses from each supplier, it was found possible to select a very limited number of quarters from select suppliers from which could be prepared ground beef that had about a 95% chance of meeting the Oregon regulations. However, the amount of available beef suitable for this purpose would supply only a very small percentage of our total demand.

BACTERIAL CONTROL MEASURES

Since store managers were being charged with criminal offenses, our bacteriologists recognized that, although the primary source of the problem was beyond our control, all feasible steps must be taken to be certain that our people and our operations were not increasing the problem. At the breaking plant the effectiveness of plant clean-up procedures was regularly checked both visually and bacteriologically (by swabbing of equipment after sanitation) with revisions made in clean-up procedures as indicated by the bacterial checks. A personal hygiene guide developed for guidance of workers was enforced. Every employee of the plant attended a special sanitation seminar designed to give insight into the practical aspects of food bacteriology. Temperature controls were carefully monitored and maintained. To more quickly reduce the heat generated by grinding of the beef, dry-ice was added to the freshly ground product in the blender just before it was packed. Routine bacterial monitoring of the product included swabbing of carcasses and boneless beef on receipt and testing for E. coli, APC and E. coli counts of freshly packaged bulk packages of ground beef and samples of retail-packaged ground beef from retail meat display cases.

Temperatures of trucks in which meat was delivered to the stores were carefully checked and controlled. Truck scheduling was reviewed and modified as needed to give best possible control during delivery.

At the retail store level a day-long sanitation seminar was held for all Meat Department Managers, Store Managers, District Managers, and Meat Merchandisers. It was presented by the bacteriologists from the laboratory at the breaking plant, the Sanitation Coordinator, an Industrial Engineer, a Meat Merchandiser, and the Retail Operations Manager — all from the Portland Retail Division with the assistance of the Corporate Sanitation Coordinator. Designed as a training course to instruct all operating management personnel in bacterial control of meats at the retail level, the seminar included practical “how to” instructions as well as simplified explanations of food bacteriology and departmental clean-up. Interest at the seminar was very good and management follow-up was excellent with a resultant improvement in bacterial control of the meat at store level.

In an effort to decrease the E. coli incidence on incoming carcasses, our bacteriologist made a series of visits to each of our suppliers’ packing plants, observing their operations and suggesting ways whereby he felt that each might reduce the E. coli on beef quarters being shipped to our breaking plant from their packing plants. This effort met with only very limited success.

RESULTS

In spite of the very considerable efforts of all involved, Safeway was able to routinely accomplish an E. coli compliance rate for its bulk packed ground beef of no better than about 60% to 70%. Thus we felt that despite our best efforts, we were unable to attain satisfactory compliance with the Oregon bacterial standards on meats.

In January 1976 a newly appointed State Director of Agriculture in Oregon appointed a blue ribbon meat bacterial standards review committee to review the standards and recommend whether they should be: (a) continued as promulgated, (b) modified, or (c) rescinded. After a year’s very thorough study, this committee of consumers, educators, scientists, lawyers, a legislator,
regulators, and industry representatives concluded the standards should be dropped and the bacterial criteria be applied as guidelines. The committee made eight specific recommendations for use in place of the bacterial standards. In the summer of 1977 the Oregon State Department of Agriculture adopted the recommendations of this committee, including the repeal of their bacterial standards on meat at retail.

**PERSPECTIVE**

As a food bacteriologist with extensive training and experience in the limited field of dairy bacteriology, I had looked forward to helping develop a program that would bring Safeway’s ground beef into compliance with the Oregon standards. I was disappointed that we did not achieve a higher compliance rating.

Our Oregon experience has prompted me to consider why bacterial standards should have proved ineffective on meats in contrast to their extremely important role in the sanitary control of fluid milk products. Suspecting that, like me, many of you have had rather extensive experience with bacterial regulation of milk, I should like to share first my conclusions and then my reasoning with you.

I question the value to the consuming public of such bacterial standards on raw meats as those enforced at the retail store level by the State of Oregon on the grounds that this approach: (a) will not increase protection of the consumer against health hazards, (b) will not indicate the level of sanitation of the environment to which the meat has been subjected, (c) will not indicate either actual or potential spoilage of the meat, and (d) can indicate only a falsely-assumed aesthetic property of the meat. Our experience with these Oregon regulations on meats caused us to question: (a) the effectiveness of such an approach in accomplishing any of the aforementioned objectives, (b) the technical feasibility of the standards in relation to existing practices of the entire meat industry (including feeder, packer, breaker, and distributor), and (c) the feasibility of administering such a regulation in an effective compliance program. Apparently, Oregon’s “meat bacterial review committee” arrived at similar or related conclusions.

**Bacterial counts as health hazard indicators**

In considering bacterial counts as health hazard indicators, we are aware that the application of bacterial standards, in combination with certain other techniques, has changed milk from one of our most hazardous agents of foodborne illnesses to one of our safest foods. However, bacteriological regulation of the meat industry cannot be expected to achieve so dramatic a benefit. Thus, diseases originating in the cow as well as those coming from human handlers of milk were often transmitted to the consumer through raw milk. To halt transmission of pathogenic organisms through milk, public health officials required (a) sanitary inspection (by regulatory officials) of farms and processing plants, (b) pasteurization to destroy any pathogens in the raw milk, (c) bacterial monitoring of the pasteurized product to ascertain that it is practically free of coliforms which should be readily destroyed by pasteurization and whose presence indicates probable post-pasteurization contamination of the milk (with the assumption that any post-pasteurization contamination could have introduced pathogenic organisms into the pasteurized milk), and (d) processing of the product through readily-cleanable, enclosed systems.

In contrast to the former higher rate of disease transmission through raw milk, the U.S. Center for Disease Control indicates that few instances of foodborne illness directly attributable to pathogens on raw meats have been reported. Rather, most foodborne illnesses transmitted by meats have been the result of mishandling meats (and/or gravies) that had become contaminated by the pathogen after cooking. This is probably true because most food pathogens are normally unable to grow well in or on raw meats in competition with other bacteria normally present and also, perhaps more important, to the fact that cooking of the meat destroys the pathogenic organisms that may be present. (Few Americans consume raw meat which has not at least been seared on the surfaces - an operation that would destroy the pathogens on most cuts of raw meat.)

Furthermore, at present there is no process available to the meat industry (aside from the consumers’ cooking of the product immediately before consumption) comparable to pasteurization to guarantee destruction of all pathogens on carcasses, quarters, cuts, or ground meats. Also, it is impossible to cut up meats in an enclosed system and relatively little meat equipment has as yet been designed for easy and automated cleaning.

Thus, whereas the use of bacterial standards has been a very effective aid in the assurance of a safe milk supply for United States consumers, similar standards cannot be expected to guarantee safety of a food such as raw meat which has not been subjected to a bactericial process that will guarantee destruction of pathogens. Bacterial numbers per se do not — indeed cannot — reflect the degree of hazard involved in consumption of the meat, and therefore their application cannot actually increase the protection of the consumer against a health hazard. Assuming the meat to be palatable, I would have no more concern for consumption of meat which had been properly cooked from product having an Aerobic Plate Count of 100,000,000 per gram with more than 1100 E. coli per gram than I would for meat having an Aerobic Plate Count of 10,000 per gram with less than 3 E. coli per gram regardless of whether the consumption was to be by myself, by one of my grandsons, or by their great-grandmother!

**Bacterial counts as indicators of sanitation**

The sanitary conditions of the environment to which a given sample of meat has been subjected cannot be ascertained on the basis of bacterial counts on a specific meat sample obtained from the meat display case of a
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Bacterial counts as spoilage indicators

Neither actual nor incipient spoilage can be deduced from the bacterial count of a specific package of raw meat obtained from the display case of a retail store. Bacteria which grow in foods are of many types. Some, the pathogenic, may cause us to become ill if they are present in or have grown in the food which we eat. Others may cause the food to spoil as they grow in it. In other instances such as cheeses, certain fermented sausages, buttermilk, yogurt, and sour cream the growth of millions to billions of bacterial cells of certain types is essential for production of the desired food. Still other types of bacteria may grow to high numbers in a food without producing any change whatsoever in the palatability or safety of that food. Frequently growth of the desired types of bacteria or of those that cause no apparent change in the food will tend to inhibit growth of the pathogenic and spoilage bacteria.

When bacterial growth in a food is predominantly or virtually exclusively of the spoilage type, the food may become unpalatable by the time the count is hundreds of thousands of bacteria per gram. However, if the growth has been predominantly of desirable or benign types of bacteria, the count may reach hundreds of millions to billions without loss of palatability. In this latter instance, the danger of spoilage or illness may actually be reduced due to inhibition of undesirable bacteria by relatively high numbers of the harmless bacteria!

In dairy bacteriology a relative indication of potential shelf-life of pasteurized milk is obtained by checking bacterial counts on many samples of milk that have been held at 45°F for 5 days to a week before determining the counts. When this is done over a period of weeks and months, establishment of trends of results gives an indication which is valuable to the dairy. However, the approach is not one which has generally proved to be valuable for regulatory purposes and it is unlikely that it would be as valuable for a food such as raw meat which has not been subjected to a bactericidal processing step.

Bacterial counts and aesthetic property of food

In raw meats there is no relationship between bacterial counts and inherent goodness, wholesomeness, or aesthetic value. Publicity in the common news media and from some regulatory agencies would seem to impute some special desirability to low bacterial counts per se — some aesthetic value, if you will. If high bacterial counts actually indicated adulteration of the food with gross amounts of filth there might be some justification for this inference. However, as has already been pointed out, this is not true. It is suggested by many that presence
of *E. coli* in meats denotes fecal contamination, with a frequent inference that it may denote human fecal contamination. There is no arguing the fact that animal feces, both human and non-human, are a very common source of this organism. However, the organism becomes so widespread that its presence in food frequently represents contamination of food with bacteria growing on incompletely cleaned food-contact equipment. Another very plausible source of this organism on meat would be contamination during the skinning operation, where knives used for cutting and skinning the hide would carry the organism from the outside of the hide onto the freshly exposed surface meat of the carcass.

Normally the factors that affect the aesthetic properties of food without affecting its safety and nutritive value would include such things as presence of animal hairs, insect fragments, stems, etc. These substances do not increase in numbers after entry into the food, whereas a single *E. coli* organism contaminating a warm carcass could quite conceivably increase to very sizable numbers before the meat was cooled to below 41°F (at which temperature *E. coli* reportedly can multiply in certain foods). Thus neither the presence nor the numbers of these or any other organisms would be indicative of the aesthetic value of the product. No person who savors any fermented food such as cheese, wine, sauerkraut, yogurt, buttermilk, sour cream, or fermented sausages containing billions of microorganisms (bacteria or yeasts) should have any qualms about the consumption of bacterial cells per se.

**CONCLUDING COMMENTS**

I have shared with you some of our efforts and frustrations in our unsuccessful attempts at satisfactory compliance with Oregon's meat bacterial standards—standards which the state has since seen fit to revoke. Although not reflected in our regulatory compliance rating, we feel that our in-house bacterial monitoring and control programs are of value in improving appearance, shelf life, and loss of raw meats. These experiences have led us to a re-evaluation of the potential role of bacterial standards for raw meats in the regulation of the food industry, leading to our conclusions that bacterial counts on raw meats could not serve as indicators of: (a) health hazards, (b) insanitary conditions, (c) product spoilage, or (d) aesthetic value of the food. Based on our Oregon experience we have concluded that bacterial standards on raw meats are not justified because they: (a) cannot accomplish what they purport to do, i.e., reduce public health hazards; (b) are not technically feasible, i.e., are unattainable under conditions of current good manufacturing practice; and (c) are not administratively feasible.

We consider the Oregon State Department of Agriculture's revocation of its bacterial standards for meats, in accordance with the recommendation of its meat bacterial standards review committee, to be a prime example of the consumer benefiting through the cooperative efforts and careful study of a question by affected regulatory agencies, industry, and consumers aided by appropriate legal and scientific guidance.

**ACKNOWLEDGMENT**


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**Coming Events con’d from p. 437**

Aug. 13-17.--WORKSHOP ON EDUCATIVE PROCESSES IN FOOD MICROBIOLOGY. Sponsored by the Joint American Society for Microbiology/Institute for Food Technologists Committee on Food Microbiology Education. Quadna Resort, Hill City, MN. Contact: E. A. Zottola, Dept. of Food Science and Nutrition, 1334 Eckles Ave., University of Minnesota, St. Paul, MN 55108.

Aug. 29-31.--FOURTH INTERNATIONAL IUPAC SYMPOSIUM ON MYCOTOXINS AND PHYCOTOXINS. Co-sponsored by World Health Organization and Swiss Society for Analytical and Applied Chemistry. Lausanne, Switzerland. For participation and poster presentation, contact: Prof. P. Krog, Dept. of Veterinary Microbiology, School of Veterinary Medicine, Purdue University, West Lafayette, IN 47907 or Prof. D. Raymond, IUPAC, Case postale 88, 1814 La Tour de Peilz, Switzerland.

Sept. 10-14.--FOOD PROCESSORS ADVANCED MICROBIOLOGY SHORT COURSE. University of California, Davis. Fee $200. Contact: John C. Bruntn, Dept. of Food Science and Technology, University of California, Davis, CA 95616, 916-752-2192.

Sept. 13-14.--INTERNATIONAL SYMPOSIUM ON ANIMAL AND HUMAN INFLUENZA. Ecole Nationale Veterinaire D'Alfort, 7, avenue du General de Gaulle, 97-704 Maisons-Alfort cedex, France. Contact: Ch. Pilet, Secretariat of the Dept. of Microbiology, Ecole Nationale Veterinaire D'Alfort.


Sept. 23-26.--SOUTH DAKOTA STATE DAIRY CONVENTION. Downtown Holiday Inn, Sioux Falls, South Dakota 57100. Contact: Shirley W. Sees, Secretary, Dairy Science Department, South Dakota State University, Brookings, South Dakota 57007, 605-688-5420.

Nov. 3-6, 1979 AMERICAN MEAT INSTITUTE CONVENTION. McCormick Place and The Conrad Hilton, Chicago. Contact: Judi Winslow, American Meat Institute, P.O. Box 3556, Washington, D.C. 20007, 703-841-2431.