Microbial Control of Meat - A Retailers Approach

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ABSTRACT

Fresh meats and poultry contain bacteria at the time the retailer receives them from the supplier. To protect customers from foodborne illness, control product loss and improve shelf life, the retailer strives to minimize further contamination and growth of these bacteria. With no bactericidal processing of the meats approved for use by the retailer, microbial control is achieved through the control of (a) market cleanliness and sanitation, (b) temperature and (c) product movement and rotation by concerned market employees. These bacterial control techniques are not new to the non-technically trained butcher or meat cutter who has been thoroughly schooled in the adage that to control meat losses you must "(a) keep it clean, (b) keep it cold and (c) keep it moving." The effectiveness of the retailer's meat microbial control program is largely dependent upon the thoroughness of each individual market employee's adherence to details of these principles.

From a career in dairy microbiology, I was asked by my company in 1974 to help our Oregon meat operations to comply with the meat microbiological standards which had been adopted in Oregon the previous year. We found that with no approved process (comparable to milk pasteurization) for destroying various bacterial loads in or on the carcasses as received at our breaking plant from various suppliers, we were unable to control bacterial levels and types of bacteria closely enough to supply our retail markets with ground beef that would consistently comply with the Oregon standards at the time the product was packaged in bulk at the meat breaking plant (5, 6, 7). (Oregon regulators subsequently reduced their mandatory standards to guidelines.) Thus the retail market, at the consumer end of the meat industry chain, was at that time -- and still is -- subject to the presence of bacteria in the fresh meat as received at the market.

Another of our efforts was an attempt to consistently produce Salmonella-free ground beef in a meat breaking plant where microbiological controls of the operation were considered to be far above the industry average. Reasons for failure of this effort were subsequently understood when Silliker reported isolations of Salmonella from surfaces of carcasses as unloaded at the dock of a meat breaking plant and also their isolation from lymph glands excised from within the carcasses (4). [Later work in Australia reported by Moo, et al. (2) and by Samuel, et al. (3) has also demonstrated the presence of Salmonella in lymph glands of several species of animals, including beef.]. Thus, with Salmonella indigenous to the live animal and no approved and practical method available for destruction of the organism in or on the meat, it is impossible for the retailer to guarantee a Salmonella-free product, as specified in several regulatory microbial criteria for raw meat.

With bacteria indigenous to the live animal (even as bacteria are indigenous to the human body), with the meat slaughtering and cutting operations by their very nature open to bacterial contamination and with no available bactericidal process for the raw product, the level of bacteria on the raw meat as it arrives at the retail market is the culmination of the cooperative bacterial control efforts of all segments of the meat industry. The retailer's responsibility is to handle the product in a way that will minimize both multiplication of bacteria already present and introduction of additional bacteria.

SPOILAGE

Since most meat spoilage is the direct result of bacterial growth, the retailer has a direct financial concern about the bacterial control of all the meat which he handles. Short shelf life; loss of bright, fresh color; development of gassiness, off-odors, and off-flavors all result in monetary loss to the retailer. Loss of customers due to unappealing meat displays, or customer dissatisfaction with purchased meats are a major concern of the meat retailer.

Meat spoilage bacteria in general are psychrotrophic mesophiles. Therefore, their growth tends to be slowest at temperatures near the freezing point of meat, increasing markedly as refrigeration temperatures approach abuse ranges of 50°F and above. At 45°F and below most common meat pathogens are unable to grow, although the spoilage organisms grow fairly rapidly at this temperature. At 45 to 50°F pathogens grow only very
slowly, whereas spoilage bacteria grow quite rapidly, so that obvious spoilage occurs before significant pathogenic growth takes place, as pointed out by Goepfert and Kim (1) on the basis of controlled studies of pathogen-inoculated ground beef. Thus by maintaining meat temperature at near freezing to retard spoilage the retailer prevents multiplication of the pathogens.

CONTROL

For the average retailer who accepts seriously the responsibility for minimizing bacterial contamination and growth on meat while in his establishment but who has no microbiological expertise available on his staff is there a practical approach to the microbial control of meat, short of hiring a microbiologist, retaining a consultant in microbiology or having much work performed by an outside microbiology laboratory? I believe there is. The more I have worked with our meat people, the greater has become my respect for their practical approaches to bacterial control. Stemming from the necessity to control meat disappearance losses, these approaches have been developed largely from the meat cutters' old adage to "keep it clean, keep it cold and keep it moving." The effectiveness of the bacterial control program in any given market is dependent upon the thoroughness with which this adage is carried out by all employees of that market.

The key to such a practical program lies in a market manager who (a) is personally committed to meat bacterial control, (b) is able to motivate all his/her employees to a similar commitment, (c) conducts daily critical inspections of meat contact equipment using a strong flashlight, critical pair of eyes, and finger tips and fingernails to "feel out" soil in areas that can't be seen, (d) frequently each day monitors temperatures of all meat storage and display areas and of product and (e) maintains practically constant surveillance of the appearance of all meat contact surfaces including the hands and clothing (aprons, coats) of employees contacting the unwrapped meat, as well as of such equipment as table tops and cutting boards, knives, scabbards, saws, slicers, grinders, cubers, pans, trays, cooler doors and door handles. Walls, ceilings, floors, and other environmental areas which do not directly contact the meat are generally of only secondary concern in bacterial control of the meat although they are of concern from the aesthetic standpoint.

No day's production should be considered complete in any meat department until all meat contact surfaces have been thoroughly cleaned and sanitized. At the completion of the cleaning and sanitizing cycle no meat, blood or other soil should remain on a single piece of equipment where it can be contacted by unwrapped product at some later time. Often only USDA-approved cleaners and sanitizers are accepted for the cleaning of meat departments. Beyond this, selection of the specific cleaner and sanitizer and of specific cleaning procedures are of little bacteriological concern as long as all soil is removed by the chemicals and procedures used. It should be noted that chemical sanitizers are generally effective only on thoroughly cleaned surfaces; they will not destroy bacteria which they cannot reach when the bacteria are embedded in soil.

For routine evaluation of adequacy of cleaning, most retailers rely upon a thorough inspection of equipment. As a practical approach this is probably adequate if conducted daily by a person with very critical eyes, a bright flashlight and sensitive fingertips and fingernails used to check for dried residual product soil left on equipment surfaces. In addition, some retailers may use

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occasional bacteriological monitoring such as swabbing or contact plates for spot checking, educational purposes, trouble shooting, or special investigations. Generally, if conducted by a sufficiently critical individual, I feel the daily inspection, if followed by management insistence on adequate cleaning, has greater potential effectiveness than does sporadic-bacteriological monitoring. The latter approach is probably of greatest value only if it stimulates more critical inspections or more adequate follow-up in the form of better cleaning.

To avoid cross-contamination with pathogens from one species of raw meat to another or from raw meat to ready-to-eat (processed) meats, it is necessary that involved product contact surfaces (including employees' hands) be cleaned when changing from one species of meat to another or from any raw meat to any ready-to-eat product.

As one step in minimizing addition of bacteria from retail sources to meat products, the market trim used in production of ground beef or stew meat should be only fresh trim with no trim from darkening cuts of meat (indicative of bacterial growth) used as an ingredient.

**Keep it cold.** Keep meat as cold as possible without freezing. As a meat department manager once told me, "If, when I check my meat display the first thing each morning, the meat packages nearest the incoming refrigerated air have a very slight crust of frozen product, I know my refrigeration is correct regardless of any thermometer readings." Thus the retailer's goal is to keep unfrozen, fresh meat as near freezing as possible without actually freezing it.

Since the significant spoilage bacteria in meats tend to be psychrotrophic, the lower the product temperature can be maintained, the longer the shelf-life will be. While walk-in coolers and display cases are generally set to operate as cold as possible without freezing the product, the cutting and wrapping areas are usually at air temperatures of 50-55°F. To minimize changes in product temperatures it is important that meat be moved with no delay from the truck in which it is received into the holding cooler, and that it be held in cutting and wrapping areas for the minimum time necessary. (Trimmings, should not be accumulated in cutting rooms for several hours nor should wrapped meats be accumulated at the weighing and wrapping area. Both should be returned to cold storage promptly.) It is also important that meat packages not be stacked above (or in front of) load lines for extended times in display cases and that walk-in cooler doors be kept closed.

As mentioned before, so long as product temperatures are kept as near freezing as possible (normally below 35°F) to control growth of spoilage organisms, there is only a very remote possibility of growth of the commonly recognized pathogens (most of which are unable to grow at temperatures below 45°F). Psychrotrophic spoilage organisms grow so much more rapidly than the pathogens that even at temperatures that would be considered abusive for raw meats, the product spoils before significant pathogenic growth can occur.

Since temperature control is a critical factor in limiting bacterial growth in meats, it is very important that the meat department manager keep informed regarding adequacy of operation of all meat refrigeration equipment by monitoring both air temperature and product temperature several times daily in all meat holding units.

**Keep it moving.** Since bacterial numbers are dependent not only on product temperature but also on the length of time held under any given growth temperature, it is important that the meat products be moved through the retail operation as quickly as possible. This is particularly true of the meat after it has been cut and packaged.

The first step in keeping the meat moving is in close ordering and inventory control so that some, but only a minimum, inventory of various meat products is left from one delivery to the next one. This depends upon knowledge of existing inventory at time of ordering and upon very accurate estimation of customer demand for the product ordered for the next delivery. While a store cannot afford to order so closely that it does not have sufficient product to meet customer demand, it also cannot afford to order so "long" that it has product still in storage or display two or three deliveries after its initial receipt at the store. Similarly, the "over-cutting" of specific cuts of meat should be avoided through carefully controlled "cutting lists" assigning those meat cuts to be cut and packaged at given times.

The second step in keeping meat moving is controlling the rotation of the product so that packages of meat on display are always from the oldest meat on hand. This is best controlled through a system of marking a received date on shipping boxes of meat as they come into the department and of marking a "pack date" or a "pull date" on each package of meat when it is wrapped before placing on display.

Finally, to keep the meat moving, at the earliest indication of darkening or discoloration of a package of meat or of the tearing of the film wrap, the package should be reworked or distress-priced to encourage immediate sale before spoilage occurs.

**Keep employees motivated.** In the final analysis, the effectiveness of microbiological control of meat at the retail level is strictly dependent upon the care with which all employees in any given meat department perform those aspects of their jobs that bear upon contamination and growth of bacteria in the product. Thus if bacterial numbers are to be controlled it is necessary that all employees be highly concerned about departmental cleanliness and sanitation, product temperature control and product rotation. Development in each worker of personal pride in the appearance of the meat display and in the reduction of number of packages requiring rework or distress pricing is a necessity for bacterial control.
Establishment of policies and procedures for meat department operation, providing of technical guidance, microbiological monitoring, and use of special training programs may all be effective tools to help a good bacterial control program for meats at retail. However, none is really effective unless the meat department employees are individually motivated to a concern for their own personal roles in keeping the meat clean, cold and moving.

While recognizing a responsibility to handle meat in a way to minimize both multiplication of bacteria already present and the introduction of additional bacteria to the product, the retailer really has little new available as an approach to bacterial control of meats. Rather than doing something new that we've not known about before, bacterial control is a matter of doing better those things which we've known for years that had to be done -- i.e. "keep the meat cold, keep it clean, and keep it moving" through the efforts of committed market personnel.

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REFERENCES