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## Next-Level Strategies in Meat and Poultry: E. coli O157:H7 Intervention at the Retail Level

By Robin Forgey and Christine Summers

It has been 10 years since hundreds of people were sickened by and four people died from eating hamburgers contaminated with E. coli O157:H7. Four years later, a recall was issued on 25 million pounds of ground beef that was also linked to consumer foodborne illness associated with E. coli O157:H7, which eventually led to one well-established U.S. company going out of business. These unfortunate events have had a huge impact on the meat industry and how it does business. Since then, there have been many changes made to the way things are done and how meat is produced and handled at all levels of the food supply chain, from the farm through the processor to the local grocery store.

As E. coli O157:H7 emerged as a significant foodborne illness-causing pathogen, the government stepped up efforts to measure the incidence of this microorganism in raw ground beef and trimmings. In 1994, the U.S. Department of Agriculture (USDA) instituted both production and retail level testing programs for E. coli O157:H7. Each year, USDA personnel collect approximately 7,000 samples in both production facilities and retail facilities and test them for E. coli O157:H7. In 2002, the USDA tested 1,241 samples at the retail level, 13 (0.2%) of which were positive for E. coli O157:H7, and 5,785 samples were collected at beef grinding plants, 42 (0.6%) of which were found to be positive for E. coli O157:H7. All beef from positive lots was removed from commerce.

The meat industry continues to make strides in improving its pathogen-reduction arsenal to reduce the incidence of this pathogen even further. In the past several years, the introduction of food safety programs, innovative new technologies and intervention strategies throughout the meat industry has truly upheld the spirit of the "farm-to-fork" concept, bringing forward new science-based solutions further downstream in the manufacturing supply chain. The many advances in preventing, controlling and reducing the incidence of microbial hazards in meat products on the farm and in the production facility are well documented. Grocery meat cutters and butchers, however, have not had available a practicable retail-level intervention technology at their disposal. Recently, Costco Wholesale, in conjunction with Grovac Systems, introduced such a technology to the retail industry that can assist operations that grind and cut beef in achieving a higher level of confidence in product safety at point-of-sale to consumers.

### Advances Upstream: From Farm to Processor

E. coli O157:H7 is a pathogenic organism that has been associated with many different food types but is generally linked with beef. It has been isolated from both dairy cows and beef cattle. The rate of shedding of E. coli O157:H7 in bovine feces varies with the time of year, and it will not only vary from herd to herd but it will vary within the herd itself. As such, food safety strategies and technological developments have been emphasized at the farm and meat processing levels of the manufacturing supply chain.

Many studies have been conducted at leading agricultural universities searching for ways to reduce the infection rate of E. coli O157:H7 within the beef supply. Some of the most significant of these cover the use of cattle feed, microbiological competition, quality of silage and composting methods at the farm level of production. Such scientific findings have engendered the development of and improvements in many on-farm practices.

Regulatory agencies also have placed emphasis on the creation of food safety enhancing protocols for farm use. For example, in 1998, the U.S. Food and Drug Administration (FDA) in conjunction with the USDA and the Centers for Disease Control and Prevention

(CDC), issued an industry guidance document that instructed the farming industry in Good Agricultural Practices (GAPs). This guidance provides farmers with information on how to properly produce, handle, apply and store animal manure.

Many new regulations have been enacted that affect beef manufacturing facilities, as well. The most significant is The Pathogen Reduction; Hazard Analysis and Critical Control Point (HACCP) Systems Rule (also known as the MegaReg.), the USDA regulation enacted in 1996 that requires everything from the implementation of sanitation standard operating procedures (SSOPs) and HACCP plans to the testing of the beef itself for generic E. coli and Salmonella. This regulation caused much concern when it was first introduced but as the bugs were worked out, the beef industry experienced some significant benefits of compliance with the rule.

As HACCP implementation and prerequisite programs took hold on the beef manufacturing side, meat processors began to voluntarily install and implement a variety of pathogen reduction intervention strategies in their facilities. A microbial intervention strategy is a process that when applied to a food will lower the microbial load of the food. Intervention strategies typically involve the use of heat, an organic acid or some type of food preservative. For example, the first USDA-approved intervention strategy available to meat processors was steam pasteurization, a system that involves passing a beef carcass through a cabinet, which engulfs the carcass in steam, killing off surface bacteria. The steam vacuum, which appeared in beef production facilities shortly after steam pasteurization, is a handheld unit that is used to vacuum contamination off the surface of the carcass. Hot water washes and organic acid washes also are common intervention strategies used in beef production facilities. The latest intervention strategy to come onto the scene is the surfactant lactoferrin, which is a natural protein that occurs in beef that when applied can "detach" pathogenic bacteria from meat surfaces. With the increased use of such antimicrobial agents and pathogen reduction technologies, bacterial counts in meat processing facilities have come down significantly and beef has never been safer or cleaner.

Unfortunately, to date there is not a single intervention strategy that can completely eliminate all bacteria on a piece of meat other than thorough cooking. Each intervention strategy, however, has an additive effect to create what the industry calls a "multi-hurdle" approach. For example, at a slaughter plant, the first hurdle that might be applied is a hide wash system in which the live animal goes through a wash system to remove as much debris as possible from its hide before slaughter. The next hurdle might be a steam vacuum of the hide after evisceration followed by passing the de-hided carcass through a steam cabinet and an acid wash cabinet. Each one of these intervention strategies could lower the total bacterial load by 1 log for a total cumulative reduction of 4 logs prior to manufacturing of primal cuts.

### **New Developments Downstream**

Food retailers know that intervention strategies implemented throughout the food chain, rather than solely on the farm or in the food processing plant, raises consumer confidence that the risk of illness associated with consuming ground beef is very small indeed. While the use of multi-hurdle microbial intervention strategies on the farm and in the beef production facility has been widely—and successfully—adopted, the food retail end of the supply chain is just beginning to develop such strategies that can be adapted to these operations' unique requirements.

In the past, retail groceries and butcher shops have not had the resources to utilize a microbial intervention strategy in their facilities. These operators typically have had to rely on the processor to provide "clean" meat. The most that retailers have been able to do is to conduct inspections and audits to ensure that their suppliers have applied one or more microbial interventions to the purchased meat prior to shipment of the product. The logic is that if the supplier uses appropriate intervention strategies and if all temperature requirements are met, the meat will have a relatively low bacterial load upon arrival at the retail establishment.

Once the sub-primal cuts arrive in the butcher shop or grocery meat department, they are cut into smaller center-of-the-plate cuts such as steaks, chops and roasts. The excess fat and meat that is cut off is referred to as trim. Generally, this trim either is used to produce ground beef or is sent out for rendering. By the time the trim is ready to be ground, it has been handled many times and the potential for microbial cross-contamination is quite high. This isn't a problem for whole meat cuts because the bacteria stays on the outside of the muscle and is killed during the cooking process. Unfortunately, the grinding process mixes all that bacteria on the outside of the trim throughout the ground beef. If the consumer cooks the ground beef properly, this bacteria will be killed. Unfortunately, the retailer cannot guarantee that this will happen, even with the best safe handling/cooking instruction labeling and consumer education program in place.

So what is happening at the retail level? According to the USDA, approximately 100,000 retail outlets grind beef on a regular basis. These retailers have a very complicated process to control. Traditionally, retailers employed meat cutters in each store who would use day-old cuts of beef and trim from cutting steaks and roasts and grind it to make fresh ground beef. This involves a high level of hands-on labor and a highly skilled workforce. Of course, these highly skilled personnel come with a high price tag. Have you noticed that seeing a meat cutter at the grocery store has become a rare sight? Many stores have eliminated their meat-cutting operations for various reasons, including the cost of labor and the increase in liability and risk due to possible E. coli O157:H7 incidence in product, particularly ground beef. These operators are buying their meat in a case-ready state, thus eliminating the need for a meat cutter (and transferring the liability for E. coli O157:H7 and other pathogens back to the meat producer).

Even so, retailers and butcher shops continue to search out strategies to reduce the risk of E. coli contamination of ground beef products. For example, a few operators have taken an additional step to reduce their risk and are selling ground beef that has been irradiated. So far, irradiated ground meat is being met with mixed reviews in the marketplace. In addition, retailers have been very active in educating their consumers about proper cooking techniques for beef and other meats. It is not uncommon to see pamphlets on proper cooking temperatures and various thermometers on display around the meat cases. Safe handling and cooking instructions can now be found on meat packages throughout the nation.

Recently, new technology has been tested in the retail industry that can help the retailer produce a safer product with a longer shelf life. This microbial intervention system is called the Costco/Grovac Intervention System. The system utilizes an organic acid wash under vacuum to lower the bacterial load on trim prior to grinding. Current research shows that the system can lower total plate count (TPC) numbers by up to 1.5 logs, effectively reducing the total bacterial load on the product by more than 90%. It has also been shown to reduce the level of Salmonella spp. and E. coli O157:H7 by up to 1 log. A potential benefit of the system is that the organic acid in the system acts as an antioxidant and delays the conversion of oxymyoglobin into metmyoglobin for up to four days. This keeps the ground beef from turning brown, which is a benefit to the consumer. The system is simple and inexpensive to use. It does not take up much space and comes in both tabletop and floor models, making it suitable for both small- and high-volume users. As of the writing of this article, the Costco/Grovac Intervention System is the only intervention system available to the retail industry.

So what are the drawbacks of this type of system? Like any acid-based intervention system, it does cause a very slight lightening of the protein on the outside of the trim. However, this effect will be minimized after the trim is ground and the muscle from the inside of the trim blooms out. After six months of use in a large warehouse club, there have been no customer complaints regarding the color or flavor of the meat and the sales have been consistent with expectations for that market.

### **A Huge Leap Forward**

Is it possible to prevent E. coli O157:H7 from getting to consumers? Even though many things have been done to minimize E. coli O157:H7 contamination at all levels of the food chain, it is impossible to prevent beef contaminated with E. coli O157:H7 from leaving the production facility without testing 100% of the beef, which is cost prohibitive. As mentioned, this has prompted meat production facilities to develop and apply the multi-hurdle intervention strategy. Though this strategy has lowered the number of outbreaks in recent years, they still occur. Retailers, on the other hand, have had few choices in the way of intervention strategies that they can use at their facilities to minimize microbial risks, and as a result, many of them have stopped grinding beef altogether.

The use of an intervention strategy in the retail setting presents a huge leap forward for consumer safety. The addition of this type of hurdle prior to the consumer's final cooking hurdle should greatly improve consumer confidence in fresh ground beef. A retail intervention strategy is an idea whose day has come and in the future, more intervention strategies will become available for use at the retail level.

Retailers who would like more information on the Costco/Grovac Intervention System may contact Grovac Systems in Pine Bluff, AR at (870) 534-1167 or visit [www.grovac.com](http://www.grovac.com).

**For more information on meat and poultry food safety services and technologies.**

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