Microbiological Safety of Meat and Meat Products: Challenges and Opportunities

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Abstract: Meat and meat products are consumed extensively throughout the world. Meat is a nutritious and a nutritionally well balanced component of a meal, with a per capita consumption of meat is about 8.7 kg a year. In recent years, some of the high profile outbreaks and recalls of meat have resulted from meatborne pathogens such as *Escherichia coli* O157:H7, *Salmonella* spp., *Listeria monocytogenes*. Some of the pathogens are associated with specific products, such as *E. coli* O157:H7 with beef and beef products, *L. monocytogenes* with cooked, ready-to-eat meat and poultry products, while *Salmonella* spp. has been an issue for a variety of products, mostly fresh meats.

The USDA-FSIS has declared six additional serotypes of Shiga toxin-producing *E. coli* (STEC; O26, O45, O103, O111, O121, O145) as adulterants in beef and beef products in addition to *E. coli* O157:H7. The CDC (US Centers for Disease Control and Prevention) data indicates increasing prevalence of these six Shiga toxigenic serotypes causing over 70%-83% of the confirmed, non-O157 STEC illnesses. The methodology for detection and identification of all the serotypes in addition to O157 within a sample is complex and the beef industry, academia and research community is currently developing and evaluating systems to detect these pathogens within a reasonable timeframe to allow the industry take action based on the results (hold-and-test). Further, the research community is actively seeking antimicrobial interventions to minimize the risk from farm through the fork. Current evidence indicates that these organisms have similar characteristics as *E. coli* O157:H7 in terms of thermal, acid, and osmotic resistance, and hence the antimicrobial interventions that have been adopted for controlling *E. coli* O157:H7 will be reasonably effective in minimizing the risk of the other six STECs in the beef supply. The current interventions for control of *E. coli* O157:H7 and the STECs are basically through antimicrobial interventions on the fresh meat, during harvest and post-harvest. HPP (While High Pressure Processing) has been evaluated and being used by a ground beef processor, it is not widely used by the industry due to denaturation of the myoglobin and the associated color changes.

Another pathogen of practical significance for the meat industry, *L. monocytogenes* is specifically an issue for the processed meat and poultry processors. The risk reduction strategy for control of *L. monocytogenes* includes minimizing the growth of the organism to very high numbers through the use of antimicrobial agents (ingredients) or antimicrobial processes (freezing, dehydration, pH reduction, water activity, etc.) or lethality processed that reduce the populations in the final product. Other pathogens of significance include *Clostridium perfringens* and *Clostridium difficile* (CD), an emerging pathogen that could be of significance for the processed meat industry. The meat and poultry industry is currently evaluating several antimicrobial technologies to control these and other emerging pathogens that could threaten the safety of the products.

Key words: Microbial safety, meat and meat products, emerging pathogens, intervention technologies.