Mitigate Listeria risks: precautions at the processing level can go a long way when liability comes into question.(food safety SOLUTIONS)

Magazine

Refrigerated & Frozen Foods
January 1, 2007 | Kramer, Melvin N.; Coto, Daniel; McNeela, Peter

"Listeria monocytogenes (Lm) is an organism which can cause serious and sometimes fatal infections in young children, frail or elderly people, and others with weakened immune systems. Healthy individuals may suffer only short-term symptoms such as high fever, severe headache, stiffness, nausea, abdominal pain and diarrhea. Listeria infection can cause miscarriages and stillbirths among pregnant women."

How often do we see this statement on recall notices from the U.S. Department of Agriculture (USDA) or the U.S. Food and Drug Administration (FDA)? We have become accustomed to Lm being associated with ready-to-eat (RTE) foods such as luncheon meats, cheeses and pate; however, this year also has seen Lm-related recalls of products ranging from raw mushrooms to frozen strawberries.

Lm is an organism that is ubiquitous in nature and grows very well in a refrigerated environment. Because of Lm's pathogenicity and ability to grow in refrigerated RTE foods, it is a major concern for processors, retailers and sensitive segments of the general population.

The Centers for Disease Control and Prevention (CDC) estimates foodborne diseases cause 76 million illnesses, 325,000 hospitalizations and 5,000 deaths in the United States each year. Listeriosis accounts for approximately 2,500 cases and 500 deaths, with a fatality rate of 20 percent. In comparison, there are an estimated 1,412,498 cases of salmonellosis each year, with a case fatality rate of 0.78 percent. Despite Lm's low incidence, the case fatality rate is one of the highest of all foodborne disease-related illnesses.

For this reason, the FDA adopted a "zero-tolerance" policy in the 1980s that prohibited the sale of RTE products containing any Lm organisms, regardless of concentration. Although this regulatory goal would surely eliminate the risk of foodborne listeriosis, the policy is unachievable because of the ubiquitous nature of Lm.

[ILLUSTRATION OMITTED]

A study by Chen et al. collected over 31,000 samples of RTE food products to quantify the prevalence and concentration of Lm in these food items. (1) The researchers then developed a mathematical model to determine dose-response curves for Lm. This study estimated that the probability of illness after ingesting a single Lm organism is less than one in a billion for high-susceptibility groups and roughly one in a hundred million if an individual were to ingest 100 Lm organisms.

Because of the extremely low probability of illness at low concentrations, the impossibility for food processing plants to completely eliminate this pathogen, and the high financial cost of recalling all RTE products that might be contaminated with Lm, Canada and several European countries adopted policies that set a maximum Lm concentration of 100 colony-forming units/gram (CFU/g) for foods that do not support the growth of this pathogen. (2) Despite differing policies, the incidence of listeriosis in these countries, compared to the United States and its zero-tolerance policy, is not significantly different.

There has been much debate within the government and industry as to which standard is best for the public's health. Scientifically, not all Lm are created equal. A variety of bio-types can and do cause disease, and other bio-types do not. It is known that three serotypes (4b, 1/2a, 1/2b) account for the majority of clinical cases, but are not routinely isolated in the processing environment. The reason for this is not clear; serotypes such as 4b might not adhere to equipment as well as other types and require specific niche environments for colonization. (3) The variability in virulence and ability to colonize the processing environment between serotypes might explain the low

number of cases, even though federal and state surveillance programs routinely find Lm in processing plants and in processed products at the retail level.

Surveillance conducted by the federal government has shown a decrease in sample positives for Lm in RTE foods--from 3.02 percent in 1995 to 0.75 percent in 2003. Further reductions are expected as objectives from the government's "2003 L. monocytogenes Risk Assessment" are initiated to achieve the Healthy People 2010 goals for national health promotion and disease prevention. Although processors are well aware of progress as an industry in reducing the presence of Lm in RTE products, do they know--and should they be interested in--surveillance data collected at the retail level?

As with Lm, not all state departments of agriculture are equal. Active surveillance for Lm at the retail level by state departments of agriculture varies; for the purpose of this article, we would like to highlight, review and discuss the implications of data collected by the New York State Department of Agriculture and Markets (NYDA & M). The NYDA & M has an active surveillance program for Lm at the retail level. Under NYDA & M jurisdiction, inspectors sample RTE foods in refrigerated cases and walk-in refrigerators, as well as take environmental samples from refrigeration equipment.

The table above shows both product and environmental sampling data collected for the years 2004 and 2005. Both years had similar product prevalence rates for Lm of 3.7 percent and 3.1 percent for 2004 (783 samples) and 2005 (1,213 samples), respectively.

The prevalence data collected by NYDA & M for Lm in RTE foods are similar to rates observed by Gombas et al. in 2002, in which the researchers concluded that the overall prevalence rates for Lm in RTE foods at the retail level was generally low. (2) Environmental samples collected by the NYDA & M had a higher prevalence of Lm for 2004 (2 samples) and 2005 (74 samples) at 13.3 percent and 13.1 percent, respectively. These data show that, while the levels of contamination in RTE foods are generally low, the environments in which they are stored have a much higher prevalence of Lm.

The table on p. 42 shows the number of implicated products for 2004 and 2005. In 2004, store-made salads were the highest implicated 18 times; in 2005, sandwiches were implicated seven times. These findings also are similar to results discussed in Gombas et al., in which store-made products were found to have a higher prevalence of Lm. (2)

Defending the plant

What does this mean, and what potential problems could this cause for a food processor? Food processors have little control over the sanitary conditions in which their products are stored and displayed. The potential for cross-contamination from an in-store-made RTE product or the storage environment to a branded processor's RTE product is very high. For instance, during routine inspections by departments of agriculture, samples of RTE luncheon meat could be collected from intact product.

The samples might be prepared by slicing on an improperly sanitized deli meat slicer or cut with an unclean knife. If the sample is confirmed positive, what happens then? In addition to closure of the display/deli case, a press release is routinely sent out informing the public that store or deli X has tested positive for Lm in Y product. On occasion, Y product is named, initiating an investigation by federal regulatory agencies.

This situation quickly becomes a finger-pointing contest--the store operator claims product was sent to him contaminated, while the processor claims the contamination resulted from in-store cross-contamination caused by unsanitary conditions. In such instances, what does the processor have to back up his claims of in-store cross-contamination? The answer lies in its in-plant HACCP, GMP and SSOP programs.

Microbiological testing is an important component to monitoring and validating the effectiveness of procedures used to control the presence of Lm in food processing plants. There are two methods of testing: product testing of RTE food samples at the completion of processing, and environmental testing of samples taken from various food plant surfaces (floors, walls, equipment).

Of course, for any product tested, the day's production must be held (in a test-and-hold program). Failure to hold

could result in a recall if any product sample is positive for Lm. A big disadvantage of product testing is that a positive sample provides no indication of how or where the contamination took place. A well-designed environmental testing protocol, on the other hand, can pinpoint niches that can be aggressively cleaned, sanitized, repaired or replaced--depending on the location of contamination along the production line.

Environmental testing for Lm at RTE food processing plants should be performed at least once weekly. An effective testing method is to collect two to 10 samples randomly selected from a list of as many as 20 strategic sites on each production line. (4) Sites that should be sampled include equipment close to floor drains (Lm contamination has been shown to occur via aerosols emitting from drains), surfaces that come in direct contact with the product and various niches or hard-to-reach areas that can be difficult to sanitize. Examples of niches include hollow rollers on conveyors, cracked tubular support rods, the space between close-fitting metal-to-metal or metal-to-plastic parts, worn or cracked rubber seals, on-off valves and switches for equipment, and saturated insulation. (4)

Long-term establishment of Lm in one of these niches can uncover a source of contamination during food processing, despite best efforts at sanitizing contact surfaces. Therefore, the most effective way to reduce product adulteration is to design an environmental testing protocol that pinpoints the source, followed by corrective measures that eliminate the pathogen.

Because of the ubiquitous nature of Lm, a positive sample should not be considered a failure in sanitation, but instead a success in the environmental testing protocol. The ultimate success in Lm control depends on the steps taken following a positive sample result.

The plant should dismantle, clean and sanitize equipment found to be the source of contamination. If these actions prove to be ineffective, it must take more extensive measures.

In today's regulatory and litigious climate, food processors are under tremendous pressure to produce products that are guaranteed 100 percent safe. With the U.S. population around 300 million and the global population over 6.5 billion, the demand for processed RTE foods is always increasing.

Over the past decade, food processors have made remarkable strides in increasing the safety of processed foods. Unfortunately, achieving 100 percent safety is impossible. Moreover, as the industry continues to grow to meet demand, new obstacles will arise. Pathogens once thought to be under control will evolve to survive current control methods and enter into new food processing environments.

In the face of ever-changing regulations and pathogen control, processors also must consider how their products will be handled after they leave the warehouse. The scenario with Lm described in this article demonstrates how a solid HACCP, GMP and SSOP program in plant is crucial to the survival of your brand--and possibly your company.

Kramer is president of and Coto and McNeela are experts with EHA Consulting Group, a global public health, epidemiology, and food safety consultantancy headquartered in Baltimore.

[ILLUSTRATION OMITTED]

Contact them at (410) 484-9133; e-mail: ehacorporate@ehagroup.com; Web site: www.ehagroup.com

References:

1. Chen Yuhuan, Ross William H., Scott Virginia N., and Gombas David E., 2003. "Listeria Monocytogenes: Low Levels Equals Low Risk," J. Food Protection. 66(4):570-577.

2. Gombas David E., Chen Yuhuan, Clavero Rocelle S., and Scott Virginia N., 2003. "Survey of Listeria Monocytogenes in Ready-to-Eat Foods," J. Food Protection. 66(4):559-569.

3. Kathariou Sophia. "2002 Listeria Monocytogenes Virulence and Pathogenicity, a Food Safety Perspective," J.

Food Protection. 65(11):1811-1829.

4. Tompkin R.B. 2002. "Control of Listeria Monocytogenes in the Food Processing Environment," J. Food Protection. 65(4):709-725.

By Melvin N. Kramer, Ph.D., MPH; Daniel Coto, MPH, REHS; and Peter McNeela, MD, MPH

2004 & 2005 Lm surveillance data, New York state

Year	No. of food samples tested	No. positive	% positive
2004	783	29	3.7
2005	1213	38	3.1

Year	No. of swab samples tested	No. positive	% positive
2004	15	2	13.3
2005	567	74	13.1

Source: New York Department of Agriculture & Markets

Number of Lm-implicated products

	2004	2005
Fish/seafood	6	5
Deli meat	6	2
Store-made salads	18	4
Hot dogs	1	0
Sausage	1	2
Sandwiches	4	7
Raw milk	2	0
Meat	0	7
Cheese	0	2

Source: New York Dept. of Agriculture & Markets
Series 1
Series 2