



The Food Safety Consortium Newsletter

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To Block the Carcinogens, Put Rosemary on the Line

Rosemary, a member of the mint family and a popular seasoning on its own, also has benefits as a cancer prevention agent. Apply it to hamburgers, and it can break up the potentially cancer-causing compounds that can form when the meat is cooked.

J. Scott Smith found out about rosemary's strength against the compounds while researching ways to reduce them as part of a long-term Food Safety Consortium project at Kansas State University. Smith, a KSU food science professor, has been looking into the carcinogenic compounds known as HCAs (heterocyclic amines).

"Put a little bit on the surface," Smith advised grillers. "Rosemary extracts shouldn't have much of an

aroma to them. Most people don't want a rosemary-flavored burger. So if you get the extract you don't really know it's there."

Smith's findings began with research into commercial rosemary extracts' effect on stopping HCAs from forming in cooked beef patties. His research group found that the HCAs were reduced in levels ranging from 30 to 100 percent.

The presence of HCAs is a potential problem in cooked beef. The likelihood of their presence is influenced by cooking time and temperature. Previous



J. Scott Smith

studies showed that meat products cooked below 352 degrees Fahrenheit for less than four minutes had low or undetectable levels of HCAs. The HCAs would increase as temperature and cooking time increased.

Although lower temperatures and shorter cooking times can reduce the risk of HCA formation, those alternatives have their own problems. Lower temperatures can affect the taste adversely, Smith explained, noting that commercial steak houses cook at temperatures above 400 degrees F.

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Foodborne Pathogen Finds Resistance to Antibiotic

Recent studies have shown a connection between people who became infected with *Campylobacter jejuni*, a pathogen found in poultry, and their contact with certain chicken products that contained the pathogen. It also turned out that the *Campylobacter jejuni* from those products was becoming resistant to ciprofloxacin, a synthetic antibiotic used by humans to fight bacterial infections.

The prevalence of *Campylobacter* — a major cause of foodborne illness — is common on raw poultry. Of these bacteria only *Campylobacter jejuni* is predominantly pathogenic to humans.

The situation prompted Food Safety Consortium scientists at the University

of Arkansas to examine raw chicken carcasses purchased in two Fayetteville, Ark., grocery stores each week for nearly a year.

After examining the 392 chicken carcasses, they found that 85 percent of the chickens purchased from one store had countable levels of *Campylobacter*, with 27 percent of it resistant to ciprofloxacin. At the other store, 46 percent of the carcasses had detectable *Campylobacter* and 6 percent of that was resistant to ciprofloxacin.

Ramakrishna Nannapaneni, who



Ramakrishna
Nannapaneni

conducted the research while at Arkansas as a food science post-doctoral associate, said that ciprofloxacin has never been used in animals. However, it is closely related to two other antibiotics, enrofloxacin and sarafloxacin, which were previously approved for usage in poultry between 1995 and 2000 before they were banned on Sept. 12, 2005.

"When *Campylobacter* became resistant to enrofloxacin or sarafloxacin, it also showed cross-resistance

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To Block the Carcinogens... continued

“Some use real high temperatures quick on the surface, then they pull it out and put it in an oven to finish it,” he said.

The better way may be to use rosemary extracts so temperatures can be still be kept high. Rosemary’s antioxidant content makes this method possible thanks to the presence of phenolic compounds. Those compounds — rosmarinic acid, carnosol and carnosic acid — block the HCAs before they can form

The presence of HCAs is a potential problem in cooked beef, with the likelihood influenced by cooking time and temperature.

spices also reduces HCAs. Rosemary is among those herbs and spices with basil, mint, sage, savory, marjoram, oregano and thyme, all rich in antioxidants.

Marinating with any of these store shelf spices adds a healthy boost to

during heating.

The results of the rosemary research tie in with previous findings from Smith’s group. Those studies showed that marinating steaks with certain herbs and

grilling steaks, just as rubbing rosemary extracts onto burger patties is beneficial. Smith said rosemary extracts are for sale on the Internet. “The industry is moving toward an extract that you can rub onto the surface, or a rub that you can mix into the power to get better flavor to the hamburger,” Smith said.

That may not be all. Antioxidants can have other benefits besides curtailing HCAs, Smith said. “There is some indication that they protect the pancreas. If you can get that from burgers, then that’s great.” ■

Foodborne Pathogen... continued

to other fluoroquinolones (a group of antibiotics), such as in human medicine against ciprofloxacin,” said Nannapaneni, now an assistant professor of food science at Mississippi State University.

The results showed a variance in the levels of *Campylobacter* between the two stores and also the levels of resistance to ciprofloxacin, with one store having

The Campylobacter jejuni from the poultry products was becoming resistant to ciprofloxacin, a synthetic antibiotic.

in management of the poultry before harvesting.

“There is a clear need for monitoring the persistence and quantitative

markedly lower numbers in each category. Nannapaneni said the difference could be because of variations in packing and storage conditions at the two stores or differences

reduction of the total antibiotic-resistant *Campylobacter* loads in the food chain, particularly on raw animal food products, in efforts to control human campylobacteriosis,” Nannapaneni said. ■

Rapid Methods Workshop Set for June 13-20

Kansas State University will host the 28th International Workshop and Symposium on Rapid Methods and Automation in Microbiology on June 13-20, 2008, in Manhattan, Kan. Activities will take place at the Clarion Hotel and at the KSU campus.

A mini-symposium is included June 13 and 14 for those unable to attend the full week of programs.

Daniel Fung, KSU professor of food science, is the conference director and is assisted by Beth Ann Crozier-Dodson. Program registration information will be posted on the conference Web site at <http://www.dce.ksu.edu/conf/rapidmethods> or can be obtained by contacting Debbie Hagenmaier at debbieh@ksu.edu.

Hurd Leaves ISU for USDA Food Safety Post

Agriculture Secretary Ed Schafer announced in February the appointment of H. Scott Hurd as deputy undersecretary for food safety at the U.S. Department of Agriculture.

“We are pleased to welcome Scott Hurd back to USDA as a senior member of the nation’s food safety team,” Schafer said. “He has extensive experience in a wide range of food safety and animal health issues that will greatly serve the Food Safety and Inspection Service’s mission to protect public health.”

Hurd comes to FSIS from Iowa State University where he served as an epidemiologist in the College of Veterinary Medicine for the past three years. At ISU, Hurd led important research of epide-



Scott Hurd

miology and food risks affecting human health. Hurd specializes in *Salmonella*, *Campylobacter* and antibiotic resistance risk assessments. Hurd was selected in 2007 as a U.S. delegate to the Codex Alimentarius Intergovernmental Task Force on Antimicrobial Resistance.

Prior to becoming an associate professor at ISU, Hurd served in the USDA’s Agricultural Research Service and the Animal and Plant Health Inspection Service from 1989 to 2004. At ARS, Hurd managed research programs and laboratory initiatives focusing on *Salmonella* in turkeys and swine.

At APHIS Hurd provided assistance

to the USDA chief veterinary officer and other officials to develop animal health programs to protect against *Salmonella*, tuberculosis and avian influenza infections. He led the design and analysis of APHIS’ National Animal Health Monitoring System, which today still conducts national studies on the health and health management of domestic livestock and poultry populations.

Hurd is a native of Pensacola, Fla., He received his bachelor of science degree in biology from the Virginia Polytechnic Institute where he played football as a defensive tackle. He received his doctor of veterinary medicine degree from ISU and completed his Ph.D. degree in epidemiology from Michigan State University. ■

Food Processors Find That Sustainability Cuts Costs

Sustainability is more than just a new environmental buzz word. It’s becoming a popular way for businesses to have a positive impact on their financial statements as well as on the world around them, speakers told the Ozark Food Processors Association in March during its 102nd annual convention in Springdale, Ark.

“Sustainability involves the reduction of operating costs,” said Earl Wells, vice president for science and technology at Allens, Inc., and OFPA president. “We’re dependent on the environment and we’re trying to protect it and grow in it.”

Transportation services, on which food processors depend, have a difficult time achieving sustainability, said

Gary Whicker, senior vice president of engineering services at J.B. Hunt Transportation Services. That makes the industry’s effort aimed largely at trying “to be less non-sustainable.”

That’s a challenge for an industry that “is nearly 100 percent petroleum based,” Whicker said, but he had a list of ways around it.

Transporters can eliminate miles by realigning their networks and can be more energy efficient by increasing their payloads. Intermodal transportation options should also be explored, Whicker said, noting that water is most energy efficient followed by rail, truck and air. Whicker said one Arkansas company reduced its carbon emissions by 31 percent after switching from all-truck

transportation to intermodal systems.

Whicker said food processors and other industries can determine the energy efficiency levels of transportation providers that participate in the Environmental Protection Agency’s SmartWay Transport Partnership. EPA describes SmartWay (<http://www.epa.gov/smartway>) as a voluntary partnership between various freight industry sectors and EPA that establishes incentives for fuel efficiency improvements and greenhouse gas emissions reductions. By 2012, the initiative aims to reduce between 33 million and 66 million metric tons of carbon dioxide emissions and up to 200,000 tons of nitrogen oxide emissions per year.

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Getting It Said for Food Safety

To get the word out to the general public about food safety, a dose of fear can do the job along with some humor and a bit of guilt.

And it's a jungle of messages out there, explained Monique Turner, director of the Center for Risk Communication Research at the University of Maryland. Turner discussed how to reach target populations with food safety messages at the 2007 Institute of Food Technologists convention in Chicago.

About 15 years ago, communications researchers estimated that the average person is presented with about 5,000 messages a day, a figure that Turner suspects has risen since then. There are television commercials, radio commercials, posters and billboards in the public arena. Then there are messages coming from family members, teachers and colleagues.

"We get many messages to start doing something, stop doing something, change your behavior," Turner said. "So the question is why do you think they're going to pay attention to your message? Why is 'wash your cutting board' more important than the 4,999 other messages they receive that day?"

Getting their attention is just the start. If people do pay attention to the message, it's essential that they understand it. If the people delivering the message are successful at that, that's where they often stop. That's a mistake.

"They also have to believe it," Turner said. "They have to remember it. And then they have to decide that they're going to be changed." Believability, she said, requires the use of emotion in the message.

That's why, she continued, about 25 percent of all public service announce-

ments use fear tactics. Fear can be effective if it communicates that the issue is severe and that the audience is susceptible.

With regard to food safety, a viewer could see a message and think, "That won't happen to me. I've been undercooking meat all my life without a problem." To overcome that reaction, a message using fear must tell people how to empower themselves. That's done in two steps: letting people know that they can easily accomplish the message's key point and that doing so will be effective.

Otherwise, the use of fear in the message can defeat its purpose. If it raises people's anxiety, research has shown that comprehension of the

message can suffer. "They'll actually recall things that you never said," Turner said.

Humor is considered by researchers to be a good way to initially attract attention for a message and

then serve as a gateway into the more serious aspects.

Empathy is listed as a best practice that's much preferable to avoiding blame, Turner said. "So when people approach a food crisis or food risk by saying, 'I understand you're afraid. I understand that this is a concerning issue to you,' even if you admit you were wrong and that your organization was truly at fault, your credibility will increase by admitting it. We've seen companies and organizations actually go into a whirlwind of trouble because they put blame on somebody else or avoided blame, when in fact by just saying we're sorry could have actually helped their organization."

Finally, there is guilt, which Turner advises to use in messages carefully when encouraging people in use appropriate

food safety practices. "It is actually in the pre-crisis stage very effective at persuading people to engage in preventive behavior," she said. "Even anticipating that you would feel guilty if you didn't do the right thing would motivate people to do the correct thing." ■

Food Processors... continued

While industry looks for ways to incorporate sustainable practices, consumers continue to embrace them. Half the population reports that it engages in some sustainability-linked behavior, said Jay Billings, marketing manager of Ball Corp. Thirty-four percent are more involved in sustainability than they were a year earlier.

Billings said consumers who were interviewed by Ball expressed "a heightened level of concern regarding the environment."

Recycling is the "most engaging behavior" that consumers reported, Billings said. "Consumers want to recycle. Practicing it is easy."

Consumer reaction to food cans is mixed because of misinformation, he said. Consumers want to recycle the cans, but many believe that the labels must be peeled off first, which inhibits them.

"Limited knowledge translates into suspicion," Billings noted, adding that steel cans still have the highest recycling rate of all food packaging with 63.4 percent of them being recycled in 2006. ■

Why is 'wash your cutting board' more important than the 4,999 other messages they receive that day?

E. coli Also a Presence Among Swine

E. *coli* O157:H7, an organism that causes gastrointestinal disease in humans, is generally associated with cattle. But it can also be recovered from swine to a lesser extent. Recent research at Iowa State University revealed that the pathogen can be transmitted through the air among swine, even when there is no direct contact between them.

Nancy Cornick, an ISU associate professor of veterinary microbiology who has researched the issue for the Food Safety Consortium, has previously shown that uninfected pigs sharing pens with infected pigs could also become infected. In the more recent research, it appeared that transmission of the organism could be accomplished through the air even when infected pigs were separated from uninfected pigs.

‘If the organism is in the environment with the pig, it’s very easily transmitted.’

“In this study, some of the aerosols could be from hosing the pen, although we scrape the pens first before we hose them,” Cornick explained. “One of the air samples was taken 24 hours after the pens had been cleaned.” That suggests infectious aerosols may remain suspended for at least that long or that the pigs themselves may be creating aerosolized *E. coli*.

“What it says to me is that if the organism is in the environment with the pig, it’s very easily transmitted and the infectious dose is very low,” Cornick said.

Cornick had also performed a similar experiment



Nancy Cornick

with sheep and found that *E. coli* wasn’t transmitted as easily as in pigs. Other experiments have also shown that *E. coli* O157:H7 can establish and maintain a population in some pigs’ intestinal tracts for at least two months, indicating that the bacterium can colonize swine. The incidence of the pathogen in swine remains small but worthy of notice.

Cornick noted that one U.S. slaughter facility recovered *E. coli* O157:H7 in 2 percent of its pigs, and the bacterium has also been recovered from healthy swine in Japan, Chile, the Netherlands, Norway and Sweden.

Cornick seeks to follow up the swine research by performing the same experiments with cattle, which are considered the major reservoir of *E. coli* O157:H7. ■

Technology Uses Live Cells To Detect Foodborne Pathogens, Toxins

Researchers have developed a new technology that can simultaneously screen thousands of samples of food or water for several dangerous foodborne pathogens in one to two hours.

The technique, which has potential biosecurity and food safety applications, also can estimate the amount of microbes present and whether they pose an active health risk. This could help neutralize potential threats and improve food processing techniques, said Arun Bhunia, a professor of food science at Purdue University.

“For food safety and biosecurity purposes, you need a quick test — a first line of defense — to be able to tell if there is something pathogenic in the food or water,” Bhunia said.

The technology utilizes live mammalian cells that release a measurable amount of a signaling chemical when harmed. Optical equipment and computer software can then analyze this quantity to estimate the amount of harmful microbes present, Bhunia said.

“This is very important,” he said. “With many toxins or pathogens, there is an effective dose or threshold you

must pass before you have to worry. By providing information on quantity, this technology gives you a higher degree of confidence in the test and what steps must be taken to alleviate the problem.”

The technology can recognize very small amounts of *Listeria monocytogenes*, a bacterium that kills one in five infected and is the leading cause of foodborne illness. It also recognizes several species of *Bacillus*, a non-fatal but common cause of food-poisoning, said Pratik Banerjee, a Purdue researcher and first author of a study detailing the technology that is

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'Stark Differences' Between Countries Regarding Beef Risk Perceptions

The saying goes “You are what you eat,” but perceptions about what you’re eating when it comes to beef can vary widely from one country to another.

Using data from more than 4,000 consumers surveyed across four countries, agricultural economists from Kansas State University, Michigan State University and Maastricht University (Netherlands) found that consumers in Japan and Mexico have more concerns about beef food safety than do consumers in the United States and Canada.

“Food safety concerns have created havoc in global beef markets in recent years,” said Ted Schroeder, a KSU agricultural economist and one of the study’s authors. “Most noteworthy in North America was a loss of major export markets following the discovery of cattle in the United States and Canada infected with BSE (bovine spongiform encephalopathy) in 2003.”

Agricultural economics researchers involved in the study included Schroeder, James Mintert of Kansas State, Glynn Tonsor of Michigan State and Joost Penning of Maastricht University.

The four countries studied represent major markets for U.S. beef.

In addition to finding that Japanese consumers are more “risk averse” with respect to beef food safety, the economists found that relative to U.S. and Canadian consumers, Japanese and Mexican consumers perceive beef to be less safe and consider eating beef to involve greater food safety risk.

Other findings of the study included:

- Food safety perceptions and attitudes, and interaction between the two, contribute to reductions in beef consumption by at least some consumers in each of the four countries, with impacts most pronounced in Japan and Mexico.

- From policy and industry perspectives, a beef food safety event in the United States and Canada can be dealt with by quickly containing the hazard and informing consumers about the low probability of adverse health effects associated with consuming the product. For Japanese consumers, a beef food safety concern requires greater assurance that steps have been taken to eliminate a potential hazard.

- Canadian and American respondents generally believe that beef products are safe, though they perceive that *E. coli* 0157:H7 poses the highest risk, with about 50 percent of respondents indicating moderate risk or greater. About 60 percent of respondents in Canada and the U.S. rated BSE as low or very low risk.

- Japanese respondents generally perceived low risk levels for beef except for BSE, which more than 50 percent of the respondents rated “high” or “very high risk.”

- Overall, Mexican respondents have greater concerns about beef food safety than consumers in the other three countries.

“The high risk perceptions of Mexican respondents for food safety hazards that have low incidence rates suggest that Mexican consumers have a higher concern about food safety than consumers in the other three countries,” Schroeder said. “The reason for that is unknown. Perhaps they experience more food safety-related illnesses than do consumers in the other countries. Food safety concerns may also be influenced by other factors such as media and government announcements.”

“The lack of knowledge among consumers about some beef food safety concerns is noticeable,” Mintert said. “In particular, the most common response in Canada, the United States and Japan is that consumers don’t know the risk levels associated with *Listeria*, *Campylobacter* and *Staphylococcus aureus*. This could be because the incidence level of these foodborne pathogens is low, and generally receive little media attention. For that reason, consumers may simply be unfamiliar with them.”

The findings of this and future work indicate that a concerted industry effort to ensure that beef is free of any food safety concern is essential if beef is to regain market share because Japanese consumers, in particular, have a very low tolerance for even a small probability that beef contributes to food safety problems, Mintert said.

“Information reassuring consumers needs to be combined with a stringent, auditable set of changes in industry and government inspection standards to avoid large sustained losses in consumer demand,” Schroeder added.

Details about the study can be found on The Berkeley Electronic Journal of Economic Analysis and Policy’s Web site at <http://www.bepress.com/bejeap/vol7/iss1/art65>. ■

Technology Uses Live Cells... continued

published in the February issue of the journal *Laboratory Investigation*.

"This paper outlines two key accomplishments: one, we found a way to immobilize cells, which is a necessary and difficult prerequisite for further study. Two, we are able to simultaneously perform multiple tests on a large number of samples," Bhunia said.

The cells are suspended in collagen gel, a useful substance for capturing particles of a desired size, and put into small wells within multi-well plates. Each well can test one sample, so tests can be expanded to quickly analyze as many samples as desired.

By using live cells, called biosensors, this technology can identify actively harmful pathogens but ignore those that are inactive or harmless. Some analogous tests lack this capability, making them prone to false alarms and entailing a relatively lengthy incubation period to grow out any living microbes, Banerjee said. The new technology's discerning

power also could help optimize processes to kill harmful microbes or deactivate toxins, he said.

Another advantage to the technique is its mobility and versatility, Bhunia said. The multi-well plates and their contents of gel-suspended mammalian cells could be efficiently prepared in a central location. When desired, the plates could then be shipped to the test location, like a food processing plant, so that analysis could take place on-site, he said.

This technology tests for bacteria and toxins that attack cell membranes. For this reason, researchers employed cells with high amounts of alkaline phosphatase, the signaling chemical released upon damage to the cell membrane. Researchers could conceivably employ other types of cells within this framework to detect additional types of pathogens, Bhunia said.

Samples of food and water are added to biosensor wells before being incubated for one to two hours. To each well a chemical is added that reacts with the biosensor's alkaline phosphatase,

yielding a yellow product quantified by a special camera and a computer. A precise calculation may be unnecessary sometimes, however.

"When a large amount of pathogen is present, you can literally see the color change taking place before your eyes," Banerjee said.

The suspension of live mammalian cells within a collagen gel is unique, according to the researchers.

"This is the first time that anybody has trapped these kinds of cells alive in a collagen framework," Bhunia said.

Researchers are trying to get these cells to live within the gel beyond four to six days, a current limitation. But Bhunia said this time-span could be expanded to two weeks, the shelf-life he deems necessary for the technique to have commercial value.

The study was funded by the U.S. Department of Agriculture and Purdue's Center for Food Safety Engineering. ■

Papers & Presentations

Curtis Kastner, Abbey Nutsch and **Justin Kastner**, Kansas State, delivered a presentation on "Leading Interdisciplinary Food Safety and Security Teams" during the Professional Development Brownbag Discussion in March at KSU. They described their efforts to create an interdisciplinary approach for university food safety and security initiatives as part of a project funded by the National Science Foundation.

Yun Wang, Arkansas, an M.S. student in biological and agricultural

engineering, won first place in the Institute of Biological Engineering graduate students poster competition in March in Chapel Hill, N.C.

Yanbin Li, Arkansas, received the 2008 John W. White Outstanding Research Award in January from the University of Arkansas Division of Agriculture. The holder of the Tyson Endowed Chair in Biosensing Engineering, Li developed a biosensor system for rapid, in-field detection of the H5N1 avian influenza "bird flu" virus. He is

also a leading scholar in detection of pathogenic bacteria in food products.

Li also delivered a presentation on "Biosensors Technologies and Their Applications in Biological Detection" in December at the Ningbo (China) University College of Biological Science. In November, he presented "Biosensors and their Applications in Biosystems Engineering" at the College of Biosystems Engineering and Food Science in Hangzhou, China. ■

Food Safety Digest

by Dave Edmark

Another senator has issued a call for consolidation of federal government agencies that oversee food safety into a single regulatory agency. That's nothing new in the U.S., but this particular story isn't about the U.S. It's happening in the Philippines.

Sen. Edgardo Angara said in March that six agencies were handling responsibilities that could be combined into one, the Philippine Information Agency reported. "There seems to be plenty of overlapping agencies that are concerned about food safety," Angara said. "However, what we really need is a single agency that could focus on this concern and harmonize all the policies for proper implementation in the local level."

The Philippine agencies that have food safety jurisdiction are the Bureau of Food and Drugs, the Department of Health, the National Food Authority, the Department of Agriculture, the National Meat Inspection Commission, the National Consumer Affairs Council Department of Trade and Industry and the Bureau of Fisheries and Aquatic Resources, Fertilizer and Pesticide Authority.

Angara, a former secretary of agriculture, advocated the consolidation when he held the post.

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If Chinese government officials provide final approval, the U.S. Food and Drug Administration will station eight people at diplomatic missions in China to work with Chinese food safety personnel in inspecting food production plants making products to be shipped to the U.S.

Food Navigator-USA.com reported in March that China and the U.S. reached an agreement in December after six months of talks after some poor quality food from China was exported to the U.S. Health and Human Services Secretary Mike Leavitt said the agreement satisfies the principle that any country producing goods for American consumers must follow American safety and quality standards.

"All Chinese producers of items covered under the agreement must register with Chinese authorities, who will share that data with HHS," Leavitt said. "Chinese regulators will certify that food and feed covered by the agreement meet our standards ... and to verify compliance, the Chinese are adopting quality assurance methods every step of the way."

■ ■ ■

The Canadian Food Inspection Agency commissioned a study to find out what level of confidence citizens

have the nation's food supply. After interviewing members of focus groups in four cities, the research team found that that consumers' view of food safety in Canada is "favorable, but fragile." *The Ottawa Citizen* reported on the study, conducted among focus groups in Calgary, Toronto, Halifax and Montreal by a public opinion research firm.

"While the safety of the food supply was thought to fall within acceptable limits, people indicated that anxiety was just below the surface, ready to emerge," the study said. It also revealed that consumers had low confidence in imported food and viewed it as a "major threat" to the safety of the food supply.

The respondents believe that meat and poultry contain "harmful and highly hazardous substances added by the food industry. The perceived health risks of meat and poultry were long-term, unknown and scary, while short-term risks were seen as acceptable, for now."

The study called on the government to be proactive in communications. "Not doing this and only communicating when there is a problem (i.e., a food alert or recall) gives the impression that the government is reacting and therefore consumer confidence is more at risk." ■

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