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Why don't we irradiate all germ-carrying food?
Technology exists that destroys disease-causing bacteria in food. We use it more--and in some cases, less--than you might think

By Jordan Lite

The four-month-long, nationwide salmonella outbreak from peanut butter—coming on the heels of other, widespread food-borne illnesses—raises the question: Why not just zap all of our food with radiation to destroy contaminants?

The U.S. Food and Drug Administration (FDA) last summer okayed irradiation to destroy pathogens in fresh iceberg lettuce and spinach in the wake of an *Escherichia coli* (*E. coli*) outbreak traced to the latter in 2006. Since the early 1980s, irradiation has also been approved for that same purpose in meats as well as to both extend the shelf life of and kill insects in fruits, veggies and spices.

But radiation isn't commonly used to treat most foodstuffs in the U.S. because of cost, consumer wariness and the worries of some about its long-term safety. Food & Water Watch (FWW), a Washington, D.C.–based advocacy group, frowns on the process, which it says degrades the nutritional value of foods and has the potential to mask but not remedy unsanitary conditions at plants that led to it in the first place.

We asked Sam Beattie, a food safety extension specialist at Iowa State University in Ames, to fill us in on the controversial process and why it hasn't been used more often, especially in light of the recent deadly outbreaks. There is an irradiation facility at the university, but it's used only for studies and Beattie, a microbiologist, has no affiliation with companies that make irradiation devices or zap their food.

[*An edited transcript of the interview follows.*]

What is food irradiation, and how does it work?
Irradiation is done by exposing food or bacterium to a dose of ionizing radiation, which disrupts the DNA or protein of pathogenic bacteria that make people ill.

When we talk about the sources for irradiation, we're looking at two major ones: radioactive elements—like cobalt 60—and the electron beam, or e-beam. Cobalt 60 is an isotope, or a traceable radioactive version of the element, that emits the type of radiation called gamma rays, whereas the e-beam is an electron-based radiation source. We also are experimenting now with x-rays, which are generated from an electron beam hitting a piece of metal, as a potentially new technology for irradiating food

The potential problems of the irradiation processes are fairly limited. As cobalt decays, it becomes less effective, so you have to monitor that. E-beams don't penetrate as deeply as cobalt, so you have to irradiate less of a food at a time. And generating x-rays takes an extra step, so it may not be as efficient as e-beam.

Cobalt 60 has historical precedence with food. It's been used for a long time with meats, fruits and vegetables. It is a safe source: When it decays, it becomes a stable, less radioactive element — in this case nickel, so disposing of it is less of a problem than with isotopes used at, say, nuclear plants. And there is no direct contact between the cobalt and the food or its packaging.

How long does it take to zap bugs in food?
It depends on the kind of radiation you're using. Cobalt 60 is a lower dose rate, so it takes longer—a minutes type of exposure. E-beam is a more intense, higher dose rate and we're looking at seconds.

Which foods is irradiation most used on?
Among fresh produce, the FDA has only approved irradiation to reduce food-borne illness in leaf spinach and iceberg lettuce. We're not exactly sure why only those two, because there's very little difference between cut greens when it comes to whether or not they turn to mush under an e-beam at the approved levels.

Irradiation is approved for other purposes on a whole variety of foods—everything from strawberries and other fresh fruits to meats and spices. On bananas or something like that coming into the country, it would be used to knock out pests, or to control sprouting and ripening. With meat, it's approved as pasteurization to kill illness-causing organisms such as *E. Coli* or salmonella.

Across the world, there are many countries, including the Netherlands, Belgium, France, South Africa, Japan and Thailand that allow irradiation. You can argue that for some countries, having the ability to prevent spoilage is an important contributor to enhancing food security. Spoilage takes a lot of product off the shelves or makes it nutritionally unacceptable.

Does irradiation affect taste or nutritional quality?
There's no difference in taste. I have had irradiated spinach and it doesn't taste any different.

Some nutrients are impacted. Among vitamins B, C, B6, B2, E and precursors for vitamins A and K, the loss that we see is comparable with the loss from other food processes that we might use (like thermal processing for canning or pasteurization), if not less.

Some irradiated products, mainly meat, do develop an aroma—it's not a bad thing. If you vacuum package a raw pork cut and then irradiate it, it develops a unique aroma that dissipates as soon as you open the package.

How much does irradiating food cut down on germs that make us sick?
What we're trying to affect is a 99.9999 percent, or 100,000-fold reduction in germs.

We irradiate for the pathogen that is most risky and most likely to be there. We would not necessarily be irradiating meat to, say, kill *Clostridium botulinum* spores, because there's a fairly

low risk of them growing and creating the toxin that causes botulism, which may result in paralysis and death. But we would adjust the dosage to kill *E. coli O157*, which is more likely to be there and to grow if the product is not stored at the right temperature. We can actually count how long and at what dosage it takes to kill a particular number of microorganisms per minute. It might take a lot higher dosage to knock out *C. botulinum* than *O157*. (*E. coli O157* can cause severe stomach cramps, bloody diarrhea and vomiting.)

Does irradiation work against viruses?
It doesn't work as well against viruses. We're not sure why. But in processed food, viruses don't typically cause problems. Where we do see them is in food-service food. There are an estimated 76 million cases of food-borne illness each year, and about half are caused by *norovirus*, or Norwalk-like virus. (*Norovirus* causes nausea, vomiting, diarrhea and some stomach cramping.) They come from someone failing to wash their hands; fecal material there then can be transferred into food.

Could radiation be used to kill salmonella in peanut butter?
Products high in fat may not be very amenable to radiation. When fats break down they produce off-flavors.

The U.S. Department of Agriculture (USDA) now requires almonds to be pasteurized, because of *salmonella* outbreaks in 2001 and 2004. That same type of regulation will probably happen to peanuts also, and that would be a thermal process—roasting in dry heat or immersion in oil at a level that would kill disease-causing organisms.

To what extent do we use irradiation in the U.S. now?
A significant number of spices that enter this country are irradiated, but otherwise, it's not so common. The problem becomes one of public perception. People are not aware of the benefits compared with the minimal risk associated with it. Some groups adamantly oppose irradiation. It does cause changes, but these groups believe it causes negative health changes to humans and that hasn't been shown.

What kinds of changes does irradiation cause?
Anytime you break bonds in chemicals you're going to introduce changes in the molecules. The important part is that the changes don't impart any toxicological effects to the food, and irradiation does not appear to do that. You can see unique by-products formed, but there's been no evidence that these cause human illness at the levels that they are in the food. There was some thought that 2-alkylcyclobutanone, a by-product derived from fatty acid, could cause cell mutations that might lead to cancer. The most recent science evidence suggests otherwise: It was extensively tested and does not cause mutations.

Does radiation stay in the food?
No. The food is not radioactive by any means. In fact the food is probably safe, if not safer, than before it was irradiated. It's an entirely safe process with wide application that could reduce hunger in some countries through reduction of spoilage, and can certainly reduce food-borne illness in this country.

COMMENTS

- Urania at 02:35 PM on 02/06/09

I, for one, do NOT want my food irradiated. If we eat locally produced food that is raised with cleanliness this problem would not arise. We really don't know how irradiation will affect our health way down the line. Wanting to irradiate our foods for longer shelf life and because they don't want to clean up their act smacks of corporate greed once again.

- user659callifornia at 03:31 PM on 02/06/09

I see farmworkers harvesting in fields with nothing more than a moveable portapotty nearby. Handwashing facilities should be supplied and handwashing enforced by growers or people hired to supervise harvesting by hand. Washing in packing faciities can't aways remove fecal bacteria.

- Rogeregon at 04:07 PM on 02/06/09

user659callifornia, I agree! Here in Oregon, I picked strawberries as a kid and I noticed that most of the workers didn't have the best sanitary standards! If people knew that the guy that picked their fruit or vegetables had gone to the bathroom and not washed his hands, would they be fine knowing they just rinsed their fruit in a bit of cold water?

Irraditation would prevent many deaths and countless cases of sickness, but people have such an irrational fear of anything "radioactive" that they'd rather play Russian Roulette with their food than have it irradiated!

- joeldooris at 04:14 PM on 02/06/09

PLEASE IRRADIATE MY food! I have zero issue with this and I've been an advocate of this since I first heard about this in the 80's. People have died because of germs in the food supply. This would have already saved lives. If this were a clinical trial it would be unethical to not irradiate food at this point! I know radiation sounds like to boogie man but in this application, it's not.

- joeldooris at 04:18 PM on 02/06/09

Workers in the field are not the only issue. The last outbreak of salmonella was attributed to a water supply. I 100% agree that the best solution is a clean environment. However, realistically speaking that aint gona happen! So irradiation is a good answer to mass produced food,

- lamorpa at 04:47 PM on 02/06/09

Urania: You are living in an elitist fantasy world. Locally-grown food is impossible for the mass population. You didn't mention that you want to pay a LOT more for your food, which is what will happen if quality is increased (unless you hold a paranoid belief that 'other' people intentionally produce contaminated food because they don't care [like you, of course, do] or are just plain mean spirited). I've personally met this person Corp. Greed. Do you know where he lives?

- Caca at 09:42 PM on 02/07/09

Irradiate all of it...especially milk and ganges beef! Remember that irradiation never makes anything radioactive...unless the food is wound thru a neutron flux. Uhmm tasty!

- wfitz1964 at 10:06 PM on 02/08/09

I am also for food irradation. However I feel there should be lable showing the food was processed in this way. This has made Genticaly modified foods a problem because people do not understand the process involoved. For food irradation you use a radio active source to destroy all harmful parasite bactreria fungie etc. Nothing can survie the radation. The food is safe to eat and there is no lingering radioactivity. The food is much much safer to eat and is easer to handle. I used to work in the food processing environment and microbacterial buildup is always a issue in food processing equiptment. Souds like the people got sloppy in washing the equiptment and the inspections failed to catch it .
I am surprized there is no radom sampling done as part of a quality control. If random samples were pulled sooner or latter the bad batch would have shown up.

- kozowh at 11:41 PM on 02/08/09

While irradiation can reduce contamination by viable microbes, I am concerned that processors will rely on it and abandon the few contamination-mitigating practices that they currently use.

- DRHX at 01:59 PM on 02/11/09

I think irradiation is great. It is especially valuable for organicly grown foods, where disease carrying manures are used for fertilizer, where Pateurization is avoided, and where preservatives are left out. All three of these situation increase the danger of food poisonings. I support buying locally grown foods, but they aren't saintly when it comes to diseases.

- DRHX at 02:03 PM on 02/11/09

SCI-AM, I would appreciate better editing on your part when it comes to scientific names. Genera, such as Salmonella, should always be capitalized. Species, such as the coli of E. coli, should always be in lower case. Thank-you.

- Quinn the Eskimo at 02:09 AM on 02/15/09

I'm older, now 60, and am having trouble with my balance in the dark house at night. Please irradiate my food! I am very comfortable with the idea of being my own night-light!

- hampers at 01:59 AM on 06/08/09

This is the result of overdoing the processing of foods. Yore, no such sickness, how come it exist now? The answer is just simple...we tend to overdo everything and failed to see the possible negative output. But its not yet too late.