



*Where the subject may be perishable
but the insight isn't.*

Building A Better Understanding Of Salmonella In Pistachios

Jim Prevor's Perishable Pundit, May 1, 2009

In the course of our coverage of the Salmonella/pistachio [recall](#), we've confirmed what we have found in previous outbreaks: The FDA has no one with deep expertise in these commodities.

Sometimes the failure shows up in terms of not understanding the industry and distribution systems; sometimes it shows up in terms of not really understanding the commodity itself.

Because the recent pistachio recall has left so many open questions, we turned to Linda Harris at the University of California at Davis. We spoke to many experts and all identified her as the person to speak to when it came to tree nuts. She is understandably busy just now, but was kind enough to work with Pundit Investigator and Special Projects Editor Mira Slott to fill in some of the gaps in industry understanding of the intersection between Salmonella and pistachios:



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Q: Where do pistachios rank in terms of risk for contamination of Salmonella in comparison to other produce items? Are pistachios a common or uncommon host for Salmonella? Why or why not? Do different nuts, such as peanuts or almonds, pose higher or lower risks of Salmonella contamination?

A. There is relatively little information available on Salmonella in nuts. The largest body of work relates to almonds, with some early work about 30 years ago on pecans, a little recently on peanut butter and a few, relatively limited international prevalence studies. And that is it. So your questions simply cannot be answered. There is no data to compare risks among nuts.

Q: What is required in the processing stages to provide a kill step and eliminate any potential

pathogens in pistachios? Does roasting act as a kill step? What needs to occur, i.e., reach a certain temperature for a particular time period, for example? What other methods would work as kill steps? What types of research is being done in this area?

A. Thermal (heat) processes are the most common applied to foods. Typically we think of a heat process in terms of a given time at a certain temperature. The basis of validated thermal processes is that this time and temperature combination will result in a certain predictable reduction of target microorganisms. In general, the greater the time at a given temperature, the more microbes you kill AND less time is required at a higher temperature to kill the same number of microorganisms. Most processes that are designed to kill pathogens target the most heat resistant pathogen that would be important for that food.

A reduction goal is also set (for example: 10,000-, 100,000-, 10,000,000-fold reduction — these are 4-, 5- and 7-log reductions). "Eliminate" is not a term used by regulators or microbiologists — we say "reduce to an acceptable level". That acceptable level often can be considered "virtually eliminate," but it isn't scientifically correct to say eliminate.

Thermal processes for nuts include oil roasting, dry roasting, and blanching as more traditional practices, but heat can also be applied through steam, infrared heat, etc. Each nut type has different handling after harvest, and there is variability in the type and amount of heat that is/can be applied. There are also other treatments such as gas (propylene oxide).

*We are all pretty familiar with temperatures that are given for cooking poultry and other meats. The USDA recommends cooking turkey to **165 degrees F**. This guidance is designed to reduce Salmonella by 10 million-fold (7 log). The meat industry must follow validated guidelines for cooking roast beef. In this case, achieving a temperature of 158 degrees F is sufficient to reduce Salmonella by 10-million fold — the target set for this **product**. The time (or the time/temperature combination) is zero seconds for these two examples. For the roast, if you look at the USDA chart you can see that an equivalent reduction is achieved at lower temperatures in combination with longer times.*

I understand why people might assume that these types of times/temperatures should be adequate for other types of foods such as nuts. However, this is one of the most common misconceptions about Salmonella. Meat and poultry are moist. Once Salmonella dries as it would be on a nut it becomes remarkably heat resistant. If we look at some of the validated processes for almonds — oil roasting requires 2 minutes at 260 degrees F to achieve a 100,000-fold reduction of Salmonella (5 log) — 100-fold less reduction than in the roast beef or turkey examples — yet we had to use 100 degrees F higher temperature and 2 extra minutes to achieve this. Even blanched nuts need to be exposed to hot water for 2 minutes at 190 degrees F to achieve a 100,000-fold reduction, which is much longer time and higher temperature than for turkey or beef.

[Note: Domestic almonds must be treated using a process validated to achieve at least 10,000-fold reduction].

(Editor's note: you can read the Pundit's coverage of the almond situation [here](#) and [here](#).)

A second complication is that not all heating methods are equal. That is clear in my example above — there is a very large difference between heating in hot oil (260 degrees F) and hot water (190degrees F) to achieve the same reduction of Salmonella in 2 minutes. We do not currently know if the data for almonds and oil roasting or blanching apply to other nuts.

When we move to dry roasting, things get really complex. Each type of dry roaster has a different heating profile. In addition, many dry roasters do not achieve uniform heating across the roaster. Data generated for oil roasting is not at all applicable to dry roasters, and each dry roaster must be individually validated.

For pistachios, dry roasting is most commonly used. Different companies will not only have different pieces of equipment but they may also have different times/temperatures that they use to achieve a certain end product quality. Validation of dry roasters is ongoing in the pistachio industry at the moment. Each company will be generating their own data for each roaster or roaster type. Most will probably hire a "thermal process authority" to do this as it is not an easy task, and it requires someone with expertise and experience with these types of validations.

Q. If raw pistachios carrying Salmonella were entering the processing plant, how likely would it be

during periodic environmental testing within the plant where raw product was being handled during the processing stages for samples to test positive for Salmonella?

A. There is no answer to this question. There simply is no data.

Q: What is the significance of FDA discovering Salmonella in the Setton processing plant? Wouldn't it be important to know exactly where the samples testing positive were taken in terms of the processing flow to make a meaningful assessment?

A: This demonstrates the presence of Salmonella in the processing facility. [Editors note: more on its relevance below] It would be useful to know this information but not critical at this point.

Q. What is the statistical/scientific significance that the Montevideo variety of Salmonella was discovered at the Setton plant in April and also in Georgia Nut Company's testing of Setton product back in March? How scientifically significant is it that the same PFGE pattern of the Montevideo strain was discovered at both the Setton plant in April and also in the Georgia Nut Company's testing of Setton product?

A. There are many different serovars of Salmonella. Montevideo is not uncommon but there are multiple PFGE patterns for this serovar. Finding a PFGE match between isolates from a finished product and the facility that produced the product provide further evidence that the two are linked. The fact that the organism is still in the processing facility indicates that it has been there for some time. In the 2000/2001 raw almond outbreak, investigators found the outbreak strain in the processing facility several months after the outbreak-associated lot was processed. It was also found at the huller/sheller and in the orchard. So we know that Salmonella strains can "hang out" in processing facilities and other environments.

Q. FDA said that four different strains of Salmonella (including Montevideo) were discovered in the Georgia Nut Company's testing of Setton product in March. How common would it be to find four different strains of Salmonella in the same round of testing?

A. It depends. It would not be uncommon to find more than one type of Salmonella in a food product upon testing.

Q. Is it notable or inconsequential that the other three strains were not found during extensive testing at the Setton plant?

A. It is inconsequential.

Q. Is it notable or odd that Setton Pistachio had received excellent food safety ratings during regular audits from numerous reputable companies, and no one pointed out any violations of consequence?

A. There are a group of food microbiologists and food safety specialist that have been talking about the importance of Salmonella in dried foods for a long time. Unfortunately, the dogma has been that dried foods are not an issue for foodborne illness so not everyone paid attention to us.

Q: Why?

A: More misconceptions:

1. Salmonella can't grow in dried foods so they aren't a problem. Actually it is true that Salmonella cannot grow in a food that is dried below a certain moisture level. However, they do survive on dried foods for very, very long periods of time. When the dried food is cooled down to refrigerated or freezer temperatures Salmonella levels will remain constant for years (another difficult concept for many people).

2. High levels of Salmonella are needed to cause illness. Not true. There are a number of outbreaks in dry foods where levels of Salmonella were documented and very low levels (10 cells or less per serving) were sufficient to cause illness. Salmonella doesn't need to be able to multiply to cause illness.

If you couple these misconceptions with the "any kind of roasting will always eliminate Salmonella," you can imagine that inspections/views of processing facilities for these products might have been inadequate from the perspective of Salmonella contamination. They weren't looking for potential sources of Salmonella or for validated kill steps or for potential cross contamination points.

It is my hope that in 2009 we finally have enough evidence to convince the dried food industry that Salmonella IS an issue they should address – ALL DRIED FOODS - regardless of whether or not Salmonella has been isolated from the product and regardless of whether there has been a documented outbreak. RE-EVALUATE your safety programs with the view that Salmonella IS a potential hazard – that may just ensure it never is.

Q. This pistachio recall is massive. Does the size of the recall of Setton products seem weighted appropriately to the potential risk? What scientific methods can be employed to determine the size of a recall?

A. I have not seen the data that FDA and Setton Farms used to determine the scope of the recall. I will say that recalls can be more limited in scope if the company has data to support that the contamination is limited to one or more well-defined lots.

Q. Could recalled pistachio products be sent out for re-roasting and safely be sold in the market?

A. Products can be "reconditioned" if they are processed with a validated kill step and they are protected from re-contamination after that kill step.

Q. What additional actions can pistachio companies take to alleviate the risk of Salmonella contamination?

A. As I said earlier — this applies to all dried foods. The new GMA Salmonella control guidance and appendix should be mandatory reading for all in the dried food business. I have begun to compile nut-related information at this site including the GMA [documents](#).

There are many things that can be done. I think the GMA document covers the basics very well, and I have taken a section out of that document table of contents that covers all the points I would make:

SALMONELLA CONTROL ELEMENTS

- 1. Prevent ingress or spread of Salmonella in the processing facility*
- 2. Enhance the stringency of hygiene practices and controls in the Primary Salmonella Control Area*
- 3. Apply hygienic design principles to building and equipment design*
- 4. Prevent or minimize growth of Salmonella within the facility*
- 5. Establish a raw materials/ingredients control program*
- 6. Validate control measures to inactivate Salmonella*
- 7. Establish procedures for verification of Salmonella controls and corrective actions*

We really are in debt to Linda Harris. She has clarified issues that hundreds of articles and countless interactions with government authorities have been unable to clarify. Here are the seven big points we take from this:

1. There is insufficient data. We need to get the various tree nut producers to start funding studies. Perhaps The Center for Produce Safety, all set up and operating, could extend a hand of outreach to the tree nut communities and offer to facilitate the research if the tree nut folks will fund it. We need to understand baselines, comparative risk, to know when we are experiencing the norm and when it is an exception. We need good, hard, scientific data. Which means we need money.
2. If you are going to use roasting as a kill step then every type of roaster must be individually validated. We don't actually know if a particular type of roasting is a kill step or not unless it is validated.
3. Almonds have had more trouble and so have come to require a treatment validated to achieve a 10,000 log reduction. One possibility is that most of the roasters are already achieving this and so problems have been few on pistachios and we need a formal validation procedure to make sure no one errant roaster is causing a problem. More research in the field might tell us if Salmonella is more or less prevalent on the raw pistachios than it is on raw almonds.

4. We think it fascinating that Dr. Harris does not think, at this point, it is critical to know where in the processing plant Salmonella was found. The FDA and CDFA have not even attempted to trace the Salmonella back to the trees. They assume there is Salmonella on the raw nuts and count on the assumed kill step — roasting — to make the product acceptably safe. So the FDA and CDFA seem to be accepting that the plant will take in Salmonella laced product, which means they would expect to find Salmonella in intake areas and other parts of the plant prior to roasting. It seems Dr. Harris has different expectations.

We asked Dr. Harris if she thought the FDA and CDFA should go back to the fields as they did in the spinach crisis and she gave this answer:

I think you are trying to compare two very different things. In the case of the spinach outbreak — it was outbreak #20 associated with lettuce and leafy greens if I remember correctly. There was strong incentive to attempt to identify a source of the organism with the goal of potentially preventing future outbreaks. In addition, their traceback was able to narrow the investigation to 4 farms (I am going from memory on the number of farms) which helped improve the odds that they might actually find something.

In the almond outbreak in 2000/2001 they were able to identify the processor through microbial sampling, they narrowed the lot to 4 huller/shellers and then found the outbreak isolate at a single huller/sheller and were able to focus the "field" work on three farms (and they were able to isolate the organism from the orchards on those farms).

In both cases there was an outbreak. Both investigations involved huge input in terms of human resources and sample analysis even with the targeted analysis of a few farms. In many ways these types of investigations are needle in a hay stack and you really need to keep them as focused as possible so that you don't spend a lot of money for zero results.

In this case I am not sure it is good use of limited state or federal resources to push this back further. Also, it may not be possible to narrow the investigation to a small number of farms or orchards at this point in time or given the records available.

Obviously resource allocation is always an issue but we would point out that this is not what the FDA and CDFA claimed when we spoke to them. We were told that the distinction had to do with the fact that spinach is consumed raw, without going through a kill step — so no pathogen is acceptable. In the case of pistachios, we were specifically told that the government assumes there is Salmonella on raw nuts and so doing trace back would not yield any important information.
