

Good Management Practices in Harvest, Hulling, and Drying

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Introduction

- Walnuts
 - Part of a healthy diet
 - Not linked to foodborne illness
- Outline of Presentation
 - Food Safety Background
 - Risk Reduction Strategies
 - Growers, hullers, dryers



Food Safety Hazards

- A
 - chemical
 - physical or
 - biological property

that is reasonably likely to cause

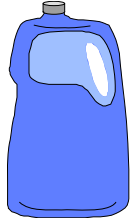
 - cause injury or illness

in the absence of its control

Chemical Hazards

- If not controlled will cause illness

- Natural toxins
 - Mycotoxins
 - E.g., Aflatoxin
- Chemicals
 - Pesticides
 - Sanitizers
- Allergens
 - Undeclared ingredients
 - Cross contaminants
- Unapproved additives



Physical Hazards

- Foreign objects **capable of injuring** the consumer

- Metal
- Glass
- Wood
- Hard plastic



Biological Hazards

- If not controlled will cause illness

- Pathogenic bacteria, e.g., *Salmonella*
- Viruses, e.g., hepatitis A
- Parasites, e.g., protozoa
 - *Cryptosporidium parvum*



Biological Hazards

- Microbial pathogens
- Estimated 250 foodborne pathogens
 - Bacteria most common cause
 - Viruses, parasites

1995-2006 Produce Outbreaks by Commodity (Fresh Cut)

Tomatoes	12 (3)	Green onions	3
Cantaloupe	7	Mango	2
Melons	2 (1)	Almonds	2
Honeydew melon	2	Parsley	2
Raspberries	5	Basil	4
Romaine lettuce	4 (2)	Green grapes	1
Lettuce	14 (6)	Snow Peas	1
Mixed lettuce	1 (1)	Basil or Mesclun	2
Cabbage	1	Squash	1
Spinach	2 (2)	Unknown	3



Examples of Harmful Microorganisms Associated with Produce

Bacteria

- *Salmonella* spp.
- *E. coli* O157:H7
- Pathogenic *E. coli*
- *Shigella* spp.
- *Aeromonas* spp.
- *L. monocytogenes*
- *Klebsiella* spp.
- *Enterobacter sakazakii*
- *Citrobacter freundii*
- *Campylobacter* spp.

Viruses

- Hepatitis A virus
- Norovirus
- Assorted Enteric viruses

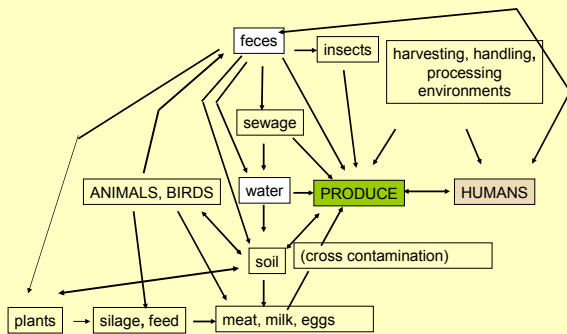
Parasites

- *Cyclospora*
- *Cryptosporidium*
- *Giardia*
- *Toxoplasma*
- Helminths - *Ascaris*

Enteric (Fecal) Pathogens (partial list)

	Pathogen Multiply in Foods	Enteric Source	Infectious Dose	Sequelae
Bacteria	<i>Salmonella</i> spp. YES	human animals	10 - 100,000	Reactive arthritis
	<i>E. coli</i> O157:H7 YES	human animals	10 - 1,000	HUS
	<i>Shigella</i> YES	Human	10 - 100	Dysentery
Protozoa	<i>Cryptosporidium</i> NO	human animals	<20	Severe diarrhea
Virus	Hepatitis A NO	human	10 - 100	Jaundice

Contamination of Produce



Beuchat, 1996

Almond Outbreaks 01,04,06

- Raw almonds from California
- 10/2000 - 7/2001
 - *Salmonella* Enteritidis Phage Type (PT) 30
 - 168 cases Canada and U.S.
- 9/2003 – 6/2004
 - *Salmonella* Enteritidis PT 9c
 - 47 cases in U.S. and Canada
 - Handler (processor) unrelated to 2001 outbreak
- 12/2005 – 8/2006 (raw almond-link suspected)
 - *Salmonella* Enteritidis PT 30
 - 15 cases Sweden



Isaacs et al. 2005. JFP 68:191-198

Dried Food Outbreaks

- **Salmonella outbreaks have occurred with nuts, seeds, legumes:**
 - Almond (2000-01, 2003-04, 2006)
 - Coconut (dried) (1999)
 - Peanut (1994-95, 2001, 2005)
 - peanut butter (1996, 2006, 2009)
 - Sesame seed
 - Halva (2001)
 - Tahini (2002, 2003)
- **Other dried foods and other ingredients**
 - Chocolate (2001-02, 2006)
 - Skim milk powder, dried eggs (1993, 2005, 2008)
 - Spices: Pepper, paprika (1995, 2009)
 - "Veggie Bootie" seasoning (2007)
 - Cereal (1998, 2008)
 - Dry pet food/pet treats (2004-05, 2006-07, 2008)

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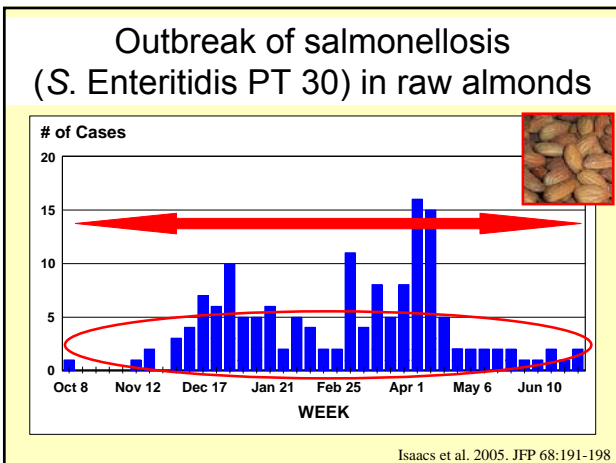
Long shelf life

Consumed without further kill step

May be ingredients in foods

Low infectious dose

- Skim milk powder, dried eggs (1993, 2005, 2008)
- Spices: Pepper, paprika (1995, 2009)
- "Veggie Bootie" seasoning (2007)
- Cereal (1998, 2008)
- Dry pet food/pet treats (2004-05, 2006-07, 2008)



Peanut Butter 2008-2009



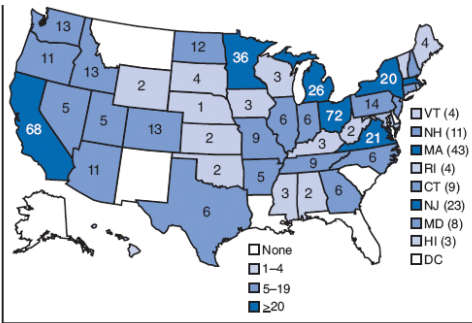
Salmonella Typhimurium, rare fingerprint

Salmonella Serotype	DNA Fingerprint ID (PFGE Pattern*)	PFGE Image	Source in Which Strain was Found
Typhimurium	JPXX01.1818		Ill humans
Typhimurium	JPXX01.1825		Ill humans
Typhimurium	JPXX01.0459		Ill humans
Typhimurium	JPXX01.0459		closed container of King Nut brand peanut butter
Typhimurium	JPXX01.1818		open container of King Nut brand creamy peanut butter
Typhimurium	JPXX01.1825		open container of King Nut brand creamy peanut butter
Typhimurium	JPXX01.0459		unopened container of King Nut brand peanut butter
Typhimurium	JPXX01.1818		Austin brand Toasty Peanut Butter Crackers purchased in the United States

CDC, 2009

666* (691) cases in 45 (46) states and Canada (1)

>119 hospitalizations, 9 deaths



*Cases reported as of February 24, 2009. Cases reported in the previous 3 weeks might not yet be reported. CDC, 2009

Peanut Butter 2008-2009

- Recall of 3182 products over 2 years – 2007 to 2008
- Product used as an ingredient – Peanut paste
- Items as diverse as pet food, ice cream and energy bars

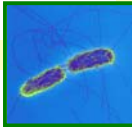


Pistachio Recall 2009

- Monday April 6, 2009
 - Setton Farms: all roasted, shelled pistachios, roasted in-shell pistachios and raw shelled pistachios from its 2008 crop
- www.pistachiorecall.org
 - List of brands not involved in recall

Salmonella – factoids

- *Salmonella enterica*
 - Intestinal track of humans/animals
 - Approximately 2,500 serovars (outer-membrane component antibody typing)
 - Serovars can be typed by many different methods
 - Enteritidis is one serovar
 - Phage typing
 - determined by sensitivity to bacterial viruses – bacteriophage
 - *Salmonella* Enteritidis PT 8, 13a, 4, are common
 - *Salmonella* Enteritidis PT 30, 9c are rare
 - Fingerprinting (PFGE)
 - Used to further distinguish foodborne pathogens



Salmonellosis factoids

- Associated with many foods
 - Animal origin (meat, poultry, eggs, dairy)
 - Fruits and vegetables
 - Dried foods
- Symptoms range:
 - None to severe (septicemia infection of blood)
 - Most common: diarrhea, fever, vomiting, dehydration, cramps
- Long-term impact: reactive arthritis
- Infective dose:
 - As few as 15 to 20 cells
 - May be lower in dried foods
 - Depends on age, health and type



Salmonella - misconceptions

- *Salmonella* has a high infectious dose
- *Salmonella* doesn't survive in dry foods
- *Salmonella* doesn't survive at cold temperatures
- *Salmonella* is easily killed by heat (in dry foods)

Examples of salmonellosis outbreaks with known low infectious doses

Food	<i>Salmonella</i>	Infectious Dose (cells per serving)
Cheddar cheese (1976)	Heidelberg	100
Cheddar cheese (1984)	Typhimurium	1 to 10
Chocolate (1973-74)	Eastbourne	100
Chocolate (1982)	Napoli	10 to 100
Chocolate (1987)	Typhimurium	≤10
Paprika coated potato chips (1993)	Saint-paul, Javiana, Rubislaw	≤45
Ice cream (1994)	Enteritidis	≤28
Almonds (2001)	Enteritidis PT30	<10 to 200+

Can *Salmonella* be isolated from Almonds? Survey of Almonds from Huller/Sheller (100 g)

Year	Number Positive	% Positive	MPN/100 g	Number MPN >1.2 /100 g
2001	12 of 2003	0.60	Not done	Not done
2002	24 of 2012	1.2	<1.2 - 2.9	1 of 24
2003	15 of 1764	0.80	<1.2 - 1.4	3 of 15
2004	12 of 1643	0.73	<1.2 - 1.4	1 of 12
2005	18 of 1852	0.97	<1.2 - 1.4	1 of 18
2006	30 of 1899	1.6	<1.2 - 15.5	10 of 30

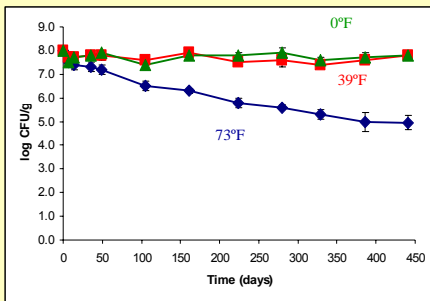
Average 0.99% positive samples per year

Levels less than 3 to 15.5 MPN/100 g



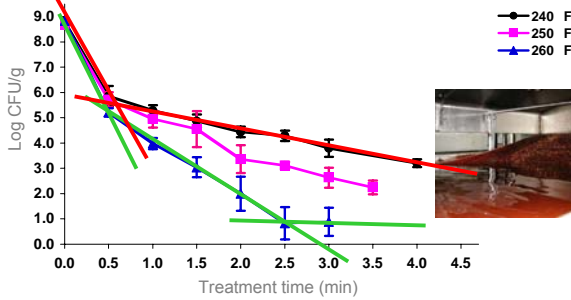
Uesugi, Danyluk and Harris, 2007 JFP 70:820-827

How well does *Salmonella* survive on almonds?



Uesugi, Danyluk and Harris, 2006 JFP 69:1851-1857

Survival of *S. Enteritidis* PT30 on almonds exposed to hot oil 116, 121, 127°C

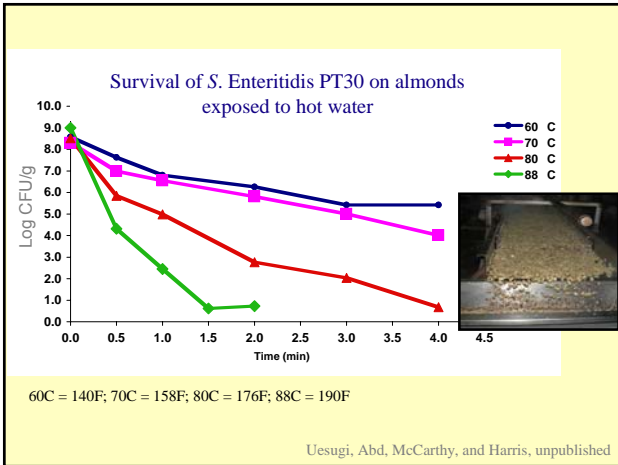


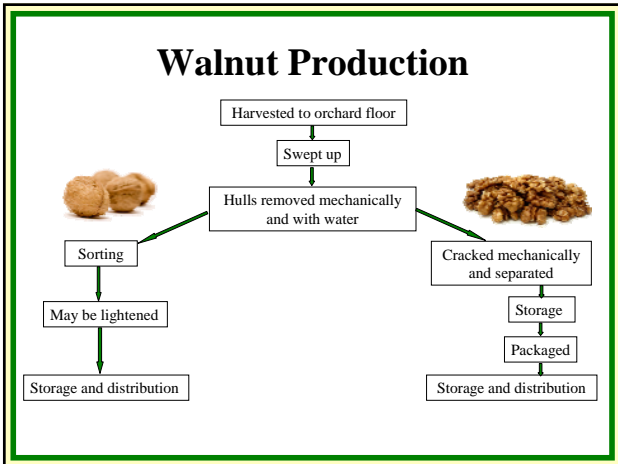
Du, Abd, McCarthy, and Harris, unpublished

Time to 4- or 5-log reduction of *Salmonella* Enteritidis PT 30 on almonds exposed to hot oil, according to the Weibull model

Temperature (°C/°F)	Time required for reduction (s)	
	10,000-fold	100,000-fold
116/240	125	255 2X
121/250	82	145 1.8X
127/260	44	76 1.7X







Role of Walnut Hullers/Dryers

- Assess Potential Sources of Contamination
 - Insects, birds, rodents, etc.
 - Contaminated water
 - Unsanitary equipment
 - Poor worker hygiene

Animal Sources

- Animal feces are a main source for pathogenic organisms like *Salmonella* and *E. coli* O157:H7 that can contaminate water sources and produce
- Since animals are in contact with soil, manure and water, they can easily pick up and spread contaminants from these sources

Pre-harvest

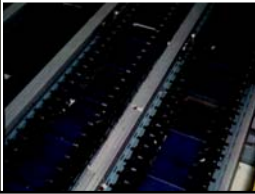
- The orchard floor potential source of contamination
 - Irrigation water
 - Compost/manure
 - Wildlife
 - Domestic animals
 - Grazing, proximity
 - Humans





Harvest and Postharvest

- Protect harvested product from animals and animal feces



Keeping Animals Out



- Dead or trapped animals such as birds, insects, rats, etc. should be disposed of promptly in order to avoid attracting other animals.
 - Proper disposal procedures are to bury or incinerate the animal.
- Place rodent traps around the perimeter of buildings and monitor them daily.
- Electronic insect repellants or traps can be used inside buildings.



Device to Deter Nesting

Keep Surrounding Areas Clean

- Keep grass & weeds short to avoid the presence of rats, reptiles and other pests.
- Keep all areas free of garbage.
- Remove all unnecessary equipment - old and broken equipment can provide protection for rats and insects.
- Maintain good records of your animal control program

Water

- Water source should be appropriate for application to a food product

Why is Sanitation Important?

- Unsanitary conditions promote contamination with microorganisms

Summary

- Where possible
 - Restrict animal access to hulling/drying facility
 - Where fecal contamination of walnut contact surfaces or walnuts themselves is evident
 - Correct the problem
 - Flush hull waste out of equipment on a daily basis

Summary

- Everyone in the food system has a responsibility for food safety
- Although walnuts have not been associated with foodborne illness
 - Prudent to evaluate potential sources of organisms like *Salmonella*
 - Reduce or eliminate where possible
 - Need not be complicated nor expensive

