

Outbreaks of Foodborne Illness Associated with Common Berries, 1983 through May 2013¹

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Introduction

Fresh and frozen common berries (i.e., blackberries, blueberries, raspberries, and strawberries) are popular and healthy foods. When berries are picked for fresh consumption, they are either placed directly in retail containers in the field or packed in a packinghouse without washing because they are highly perishable. Berries may be washed before freezing, but they are not usually blanched or heat-treated unless they are used in preserves or other processed products. Thus, there is typically no “kill step” that would eliminate pathogens in fresh or frozen berries.

Berries may be served mixed with other foods such as in salads or desserts, and these may contain more than one kind of berry or other fruit. Epidemiologists have more difficulty accurately determining the food vehicle during a foodborne illness outbreak when the outbreak is associated with mixed foods, such as mixed berries. The viral and parasitic pathogens that have caused outbreaks associated with consumption of berries are difficult to detect in foods. The laboratory methods used to detect these pathogens have only recently been developed or are still under development.

This publication serves as a reference for anyone concerned about the safety of fresh and frozen berry products.

Providing information for those who grow, harvest, process, transport, and serve berries to consumers is important for improving science-based food safety programs for the entire supply chain. Table 1 lists the reported outbreaks of foodborne illness from 1983 through May 2013 in which specific berries and mixed berries have been identified as the food vehicle. Table 2 lists the reported outbreaks in which berries were *likely* the food vehicle.



Figure 1. Credits: © Peter Close (iStock)

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Table 1. Foodborne illness outbreaks associated with common berries as the food vehicle, 1983 through May 2013

Berry	Form	Country of origin	Pathogen ¹	Year	Outbreak location	Number of cases (deaths ²)	Isolated/detected in product	Comments	References
Blueberry	Fresh	New Zealand	Hepatitis A	2002	New Zealand	43 (1)	Yes	Mode of contamination was likely infected food handlers or contaminated groundwater (pit latrines were located in and near orchard, with no hand-washing facilities).	Calder et al. 2003
Blueberry	NR ³	NR	<i>Salmonella</i> Muenchen	2009	United States, multiple states	14 (0)	NR	Consumed in private home(s)	CDC 2013a
Blueberry	Fresh	United States (Georgia)	<i>Salmonella</i> Newport	2010	United States, Minnesota	6 (0)	NR	Traced to single grower	CDC 2013a; Miller et al. 2013
Raspberry	Fresh	Guatemala	<i>C. cayetanensis</i>	1996	United States (multiple states), Canada (Ontario)	850	No	Source of contamination unknown	CDC 1996; Herwaldt and Ackers 1997
Raspberry	Fresh	Guatemala	<i>C. cayetanensis</i>	1997	United States (multiple states), Canada (Ontario)	1,012 (0)	No	Source of contamination unknown	CDC 1997b; CDC 1997c; Herwaldt and Beach 1999
Raspberry	Fresh	Guatemala	<i>C. cayetanensis</i>	1998	Canada (Ontario)	192	No	Source of contamination unknown	CDC 1998
Raspberry	Fresh	Guatemala likely	<i>C. cayetanensis</i>	2000	United States (Georgia, Pennsylvania)	54	Yes (PCR ⁴)	Source of contamination unknown	Ho et al. 2002; Murrow, Blake, and Kreckman 2002
Raspberry	Frozen	East Europe	Calicivirus	1988	Finland	509	No	Source of contamination unknown	Pönkä et al. 1999a; Pönkä et al. 1999b
Raspberry	Frozen	Scotland	Hepatitis A	1983	Scotland	24	No	Pickers were believed to be the source of contamination; cases were reported in the area at the time of picking.	Reid and Robison 1987
Raspberry	Purchased fresh, then frozen	Scotland	Hepatitis A	1988	Scotland	5	No	Infection was confirmed in a picker at the farm; other pickers had been ill, some with jaundice.	Ramsay and Upton 1989

Berry	Form	Country of origin	Pathogen ¹	Year	Outbreak location	Number of cases (deaths ²)	Isolated/detected in product	Comments	References
Raspberry	Frozen pieces	Poland	Norovirus	2005	Denmark	973	No	Six point source outbreaks occurred between June and September; five of these linked to the same large batch of frozen raspberries, which came from several small farms in Poland.	Falkenhorst et al. 2005; Korsager et al. 2005
Raspberry	Frozen, imported	NR	Norovirus	2005	France	75	No	Raspberries blended with fromage blanc, and a frozen raspberry placed on each dessert by hand; kitchen staff did not report GI illness before the outbreak.	Cotterelle et al. 2005
Raspberry	Frozen	China	Norovirus	2006	Sweden	43	NR	Four outbreaks between end of June and end of August in southwestern part of country; raspberries were same brand in each outbreak; lab results on leftover product were pending at time of report.	Hjertqvist et al. 2006
Raspberry	Frozen	Poland (some batches)	Norovirus	2009	Finland	900	Yes	Thirteen outbreaks linked to consumption of imported raspberries; two positive batches, one of which traced back to 62 different farms; source of contamination not known.	Maunula et al. 2009; Sarvikivi et al. 2012
Strawberry	Frozen	United States (California)	Hepatitis A	1990	United States (Georgia, Montana)	28	No	Outbreaks in elementary school in Georgia and institution for disabled in Montana; molecular analysis of HAV from patients showed viral genomes genetically identical and distinct from other known U.S. strains; strawberries implicated in both outbreaks processed at same plant on same night; infected picker was believed to be the likely source.	Niu et al. 1992

Berry	Form	Country of origin	Pathogen ¹	Year	Outbreak location	Number of cases (deaths ²)	Isolated/detected in product	Comments	References
Strawberry	Frozen	Mexico	Hepatitis A	1997	United States (Michigan, Maine)	242	No	Implicated strawberries were grown in Mexico, processed and frozen in California, and distributed through USDA school lunch programs and through distributors for commercial use; U.S. FDA conducted site visits of growing fields and found inadequate toilet and hand-washing facilities; workers did not wear gloves and removed berry calyx with fingernails.	CDC 1997a; Hutin et al. 1999
Strawberry	NR	NR	Norovirus	2005	United States (Georgia)	40 (0)	NR	Consumed at wedding reception	CDC 2013a
Strawberry	NR	NR	Norovirus	2007	United States (Georgia)	10 (0)	NR	Consumed in private home	CDC 2013a
Strawberry	Fresh	NR	Norovirus	2007	United States (California)	17 (0)	NR	Consumed with ice cream in restaurant	CDC 2013a
Strawberry	Fresh	United States	<i>E. coli</i> O157:H7	2011	United States (Oregon)	15 (2)	NR	Matching strain found by environmental sampling in field, including deer droppings	CDC 2013a; Oregon Public Health 2011; Terry 2011
Strawberry	Frozen	China	Norovirus	2012	Germany	11,200	NR	Berries delivered to almost 500 schools and day care centers in eastern Germany by catering firm	Associated Press 2012; Dweide 2012; Bourquin 2012; Food Safety News 2012
Berry mixture (pomegranate seeds, strawberry, blueberry, cherry)	Frozen	NR	Hepatitis A	2012	Canada (British Columbia)	8	NR	Five of 8 cases recalled eating this product	CFIA 2012; Marler-Clark 2012; Rothschild 2012
Berries, mixed	NR	NR	<i>C. cayetanensis</i>	2008	United States (California)	59 (0)	NR	Consumed at workplace cafeteria and banquet facility	CDC 2013a
Berries	NR	NR	<i>C. cayetanensis</i>	2008	United States (Tennessee)	3 (0)	NR	Type of berry not described, consumed at banquet facility; outbreak occurred in same month (July) as California outbreak	Marler-Clark 2012; CDC 2013b

Berry	Form	Country of origin	Pathogen ¹	Year	Outbreak location	Number of cases (deaths ²)	Isolated/detected in product	Comments	References
Berries	Frozen	NR	Hepatitis A	2012–2013	Denmark, Finland, Norway, Sweden	71 (as of April 17, 2013)	No	May be ongoing; type of berry not yet identified	ECDC-EFSA 2013a; Gillesberg Lassen et al. 2013
Berries, mixed	Frozen	NR	Hepatitis A	2013	Germany, the Netherlands, Poland	15	Yes, in package from case patient's home	All cases had traveled to northern Italy, provinces of Trento and Bolzano. Hepatitis A subgenotype IB	ECDC-EFSA 2013b
Berries, mixed (contained pomegranate seeds)	Frozen	Berries from United States, Chile, and Argentina; pomegranate seeds from Turkey	Hepatitis A	2013	United States (Arizona, California, Colorado, New Mexico, and Nevada)	162	No	Genotype 1B. Same genotype as outbreak in British Columbia (2012) and northern Europe (2012–2013). Genotype reported to be rare in the United States, but circulates in Middle East and North Africa. Pomegranate seeds imported from Turkey considered most likely source.	Colorado Department of Public Health and Environment 2013; CDC 2013b
Raspberry and blackberry	NR	NR	<i>C. cayentanensis</i>	2009	United States (Connecticut)	8	NR	Consumed in private home	CDC 2013a
Strawberry and/or blueberry	NR	NR	<i>E. coli</i> O26	2006	United States (Massachusetts)	5 (0)	NR		Luna and Mody 2010

Notes to Table 1:

¹ Pathogen abbreviated as *C.* denotes *Cyclospora*.

² Deaths are shown in parentheses (x) only if reported by literature sources. If no (x) appears, no information on deaths was reported.

³ NR, not reported

⁴ PCR, polymerase chain reaction

Table 2. Foodborne illness outbreaks suspected to be associated with common berries as the food vehicle, 1983 through May 2013

Berry	Form	Country of origin	Pathogen ¹	Year	Outbreak location	Number of cases (deaths ²)	Isolated/detected in product	Comments	References
Blackberry likely	Fresh	Guatemala	<i>C. cayetanensis</i>	1999	Canada (Ontario)	104	No	Implicated dessert contained blackberries, frozen Chilean raspberries, fresh U.S. strawberries	Herwaldt 2000
Blackberry likely	Frozen	NR ³	Norovirus	2005	Germany	241	No	[Article in German]	Fell, Boyens, and Baumgarde 2007
Raspberry most likely (strawberry possible)	Fresh	Guatemala	<i>C. cayetanensis</i>	1996	United States (20 states and Washington, DC), Canada (2 provinces)	1,465 (0)	No	Possible contamination due to fruit spraying with insecticides and fungicides mixed with contaminated water	Fleming et al. 1998; Herwaldt and Ackers 1997; Katz et al. 1999
Raspberry likely	NR	Guatemala likely	<i>C. cayetanensis</i>	1995	Florida	87	No	Two social events; berries purchased from separate sources	Koumans et al. 1998

Notes to Table 2:
¹ Pathogen abbreviated as *C.* denotes *Cyclospora*.
² Deaths are shown in parentheses (x) only if reported by literature sources. If no (x) appears, no information on deaths was reported.
³ NR, not reported

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