

EPIDEMIOLOGY

INFECTIONS ASSOCIATED WITH CANTALOUPE CONSUMPTION: A PUBLIC HEALTH CONCERN

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Fresh produce has been implicated in outbreaks of foodborne illness in the U.S. with increased frequency in the past two decades. Several factors may be contributing to this trend. Produce is now available year round as a result of global marketing and trade, and international travel and restaurant dining may enhance the likelihood of exposure of consumers to contaminated produce. In addition, fresh fruits and vegetables have been promoted to consumers as an important part of a healthy lifestyle. Numerous campaigns have highlighted the nutritional value of produce, resulting in an increase in per capita consumption. Cantaloupe is among the fresh fruits that are being consumed in larger quantities in recent years, which may be a contributing factor to the increased frequency of cantaloupe-associated outbreaks. Recently, several large outbreaks of *Salmonella enterica* serotype Poona infections have been associated with consuming cantaloupes, highlighting the need for enhancing cantaloupe safety and resulting in importation restrictions for offending producers. We reviewed the CDC reports of foodborne outbreaks of infections from 50 states and four territories, as well as the global literature, with the goal of summarizing information on cantaloupe-associated outbreaks, etiologic agents of disease, potential sources of contamination, conditions affecting survival and growth of foodborne pathogens on whole and fresh-cut melons, and procedures for sanitization. Twenty-three outbreaks occurred between 1984 and 2002; 1434 people became ill, 42 were hospitalized, and 2 died in these outbreaks. Etiologic agents in the outbreaks included five serotypes of *Salmonella enterica*, *Campylobacter jejuni*, *Escherichia coli* O157:H7, and norovirus. We reviewed processes contributing to cantaloupe contamination, conditions affecting survival and growth of bacterial pathogens on melons, and potential methods for sanitization. For maximum safety, industry, federal, and international partners must collaborate to ensure that appropriate interventions are in place to minimize the risk of contamination and prevent the growth of pathogens during cantaloupe production, processing, storage, and preparation.

SAFETY OF IMPORTED FOODS: MICROBIOLOGICAL ISSUES AND CHALLENGES

(M.P. Doyle)

The United States has become in 2004 a net importer of food based on product value, and this trend continues at an unprecedented rate. Agriculture products driving this U.S. import surge during the past two decades have been largely horticulture products. For 2005, approximately 44% of fruits, 16% of vegetables and more than 50% of nuts are imports. In addition, more than 80% of fresh and frozen fish and shellfish is imported. Most imported fruits are from Central and South America, imported vegetables from Mexico, and tree nuts from India, Vietnam, Brazil and Mexico. Primary U.S. importers of fish and shellfish are Canada, Thailand, China, Indonesia, Vietnam and Chile. Microbiological food safety issues associated with imported foods include inadequate sanitary practices used for food production and preparation in many countries providing food to the U.S. and movement of pathogens from areas where pathogens are indigenous to the U.S. where such pathogens seldom or do not exist. Fresh produce and fresh and frozen seafood which are often consumed without a pathogen kill step such as heating prior to eating are of particular concern. Pathogen contamination of produce can occur through a variety of sources including sewage/manure used as a soil amendment or through environmental contamination, contaminated irrigation or processing water, and poor hygienic practices of infected food handlers. Many countries such as many parts of China and Vietnam practice the centuries old tradition of using human excreta (fresh or partially composted) to fertilize farmlands or gardens. Irrigation water in parts of countries like Mexico and India is derived from untreated waste water from large cities. For example, less than 10% of waste water from Mexico City, with a population of greater than 25 million is treated, hence more than 90% of the city's untreated waste water is sent into rivers that irrigate farmland to the north. Furthermore, insanitary harvesting practices have been observed in countries with endemic carriage of foodborne pathogens such as hepatitis A virus and norovirus and import fresh produce to the U.S. Several outbreaks of hepatitis A virus infection associated with green onions imported from Mexico, causing more than 1000 cases resulted from insanitary harvesting practices. Although baseline data of pathogens in domestically grown and imported fresh produce are not available, a 1999-2002 study by the U.S. FDA revealed 1.1% vs. 4.4% of domestic vs. imported produce, respectively, was contaminated with specific foodborne enteric pathogens. Aquaculture practices in seafood and fish production in many U.S. importing countries are conducive to foodborne pathogen contamination. *Salmonella* is the most common contaminant of fish and fishery

products resulting in detention of imported foods by FDA. In 2001, of 6,405 total violations of imported foods, 28.6% were for adulteration by *Salmonella*. More than half of the violations were for contaminated shrimp and prawns. Future gains in seafood production will come from farmed fish. Aquaculture accounted for 12% of fish and seafood in 1984 and for 37% in 2003. Tilapia imports are predicted to exceed salmon imports by 2014. Current and future trends of federal inspection of U.S. imported foods are not reassuring. During the past decade, food imports have increased at an unprecedented rate. In 1998, there were about 3 million food entries under FDA jurisdiction and in 2007 more than 11.7 million imported food entries are predicted. Furthermore, the type of foods has shifted from largely raw or bulk ingredients for further processing in the 1990's to largely finished, value-added foods such as cooked, RTE quick frozen shrimp in 2005. Today, less than 0.5% of imported foods under FDA jurisdiction is physically inspected. Predicted future trends in U.S. food importation include a transition of U.S. food production to developing countries, such as California produce production shifting to Mexico, and more outbreaks of foodborne illnesses attributed to imported foods, especially foods not receiving heat treatment prior to consumption.

OUTBREAK INVESTIGATION OF CYCLOSPORIASIS IN NAVAL RECRUITS IN LIMA, PERU

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Cyclospora cayetanensis has been responsible for several epidemics in the last decade. In March 2005, an outbreak of diarrhea was identified in recruits at the Ancon Naval Base in Lima, Peru. A case-control study was carried out. Enrolled individuals in the study completed an epidemiological questionnaire including demographic data, eating habits, food items consumed, and symptoms. Complete data from 52 recruits was available for the analysis. 37 met the criteria for case and 15 for control. The epidemic curve indicated a point source transmission, with cases occurring over 9 days with a peak on the fifth day. There was no association between diarrhea and consumption of tap water or with water stored in plastic containers in the dormitories. PCR for *C. cayetanensis* detected 20/35 (57.1%) cases and 3/15 (20%) controls, demonstrating the improved diagnostic yield of this technique. This is the second report to characterize an outbreak of diarrhea due to *C. cayetanensis* in Peru among recruits. The epidemiology and clinical course are similar to other reported outbreaks in developed regions.

DETECTION OF OOCYSTS OF *CYCLOSPORA CAYETANENSIS* IN HUMANS, DOGS AND SEWER SAMPLES

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Infections with *Cyclospora* have been primarily associated with foodborne transmission. In endemic areas, *Cyclospora* shows a defined seasonal pattern, and it is estimated that 7-15 days are required for it to sporulate and become infectious. We studied two other potential sources of *Cyclospora* oocysts in Pampas de San Juan, a location where we had a pediatric longitudinal cohort for endemic cyclosporiasis. Fecal specimens from local dogs and sewer samples from 10 different locations were examined for the presence of *Cyclospora* oocysts. Three *Cyclospora*-infected participants from three different households also had dogs with *Cyclospora* in their stools, with concurrent detection of parasites in all three episodes. The histo-pathological examination of tissues from one dog did not reveal infections in this animal and sequencing information demonstrated that the human and dog isolates were similar, suggesting a spurious infection. The sewer samples were collected on December 2005, January and March, 2006. Microscopy examination of the sewer pellets detected pathogenic parasites such as *Giardia*, *Ascaris*, *Trichuris* and *Ancylostoma* and the commensal parasites *Chilomastix mesnili*, *Endolimax nana*, and *Escherichia coli*. PCR testing identified *Cyclospora* in two sites, six other sites were positive at least once, and two sites were always negative. GPS mapping of the *Cyclospora*-negative sewer sites correlated with areas of low prevalence of *Cyclospora*, however several positive sites corresponded to areas where *Cyclospora* was not frequently detected in the study population. Our findings suggest that sewer samples can be used to determine the endemicity of *Cyclospora* in a community, that PCR detection is a more reliable method when testing sewer samples, that in endemic settings *Cyclospora* infections may not be restricted to young children, and that the observation of *Cyclospora* oocysts in animal stools is the result of spurious infections.