A Foodborne Outbreak of Cyclosporiasis Caused by Imported Raspberries

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BACKGROUND. *Cyclospora cayetanensis* is a recently recognized parasite that causes prolonged diarrheal illness. Its modes of transmission have not been fully determined, although some investigations before 1996 implicated water. Outbreaks of cyclosporiasis in the United States in 1996 and 1997 are evidence of the increasing incidence of this disease. This report describes an outbreak of cyclosporiasis in persons who attended a luncheon on May 23, 1996, near Charleston, South Carolina.

METHODS. In this retrospective cohort study, we interviewed all 64 luncheon attendees and the chef regarding food and beverage exposures. A case of cyclosporiasis was defined as diarrhea (≥3 loose stools per day, or ≥2 loose stools per day if using antimotility drugs) after attending the luncheon. We identified sporadic cases of cyclosporiasis and traced the implicated food.

RESULTS. Of 64 luncheon attendees, 38 (59%) met the case definition. Persons who ate raspberries (relative risk [RR]=5.4; 95% confidence interval [CI], 2.2 - 13.2) or potato salad (RR=1.8; 95% CI, 1.2 - 2.6) were at significantly increased risk for illness. The population attributable risk percentages were 73% for raspberries and 20% for potato salad. *Cyclospora* oocysts were found in stools from 11 (85%) of the 13 case patients submitting specimens for testing. Implicated raspberries originated in Guatemala.

CONCLUSIONS. Our investigation is one of the first studies to implicate a specific food (raspberries) as a vehicle for transmission of *Cyclospora*. Because of the apparent increasing incidence of cyclosporiasis in the United States, family physicians should consider testing for *Cyclospora* in any patient with prolonged, unexplained diarrhea.

KEY WORDS. Cyclosporins; diarrhea; food; parasites. *(J Fam Pract 1998; 47:231-234)*

Cyclospora cayetanensis is a recently recognized coccidian parasite that causes cyclosporiasis, an illness associated with prolonged diarrhea, fatigue, and weight loss.[1-5] Medical attention is often sought for this illness because its symptoms are frequently remittent and severe. Effective treatment consists of a 7-day course of trimethoprim-sulfamethoxazole.[6] Before 1996, cyclosporiasis had been largely described from studies of patients in developing countries.[5,7,8] Most cases in the United States were reported to have occurred in immunocompromised persons or in persons who had traveled to other countries.[4,9] The modes of transmission for this parasite are not well understood; some outbreak investigations implicated waterborne transmission.[10-12] Although previous reports have raised the possibility of foodborne transmission,[13,14] this study is among the first to implicate a specific food as a vehicle for transmission of *Cyclospora*.[15]

On June 14, 1996, the South Carolina Department of Health and Environmental Control (SCDHEC) was notified of a cluster of cases of diarrheal illness among those who had attended a women's golf tournament luncheon at a country club on May 23. This cluster was unusual because the illnesses were prolonged and no pathogens were identified by routine stool examinations. The SCDHEC initiated an investigation to identify the cause of the outbreak.

Methods

The SCDHEC conducted a retrospective cohort study of all 64 luncheon attendees by administering a standard questionnaire by telephone. A clinical case of cyclosporiasis was defined as onset of diarrhea (≥3 loose stools per day, or ≥2 loose stools per day if using antimotility agents) after attending the luncheon. Laboratory-confirmed case-patients had *Cyclospora* oocysts identified in their stool specimens.

Stool specimens were collected from ill and well luncheon attendees and placed in both Cary-Blair medium for routine bacterial pathogens and kits containing 10% for-

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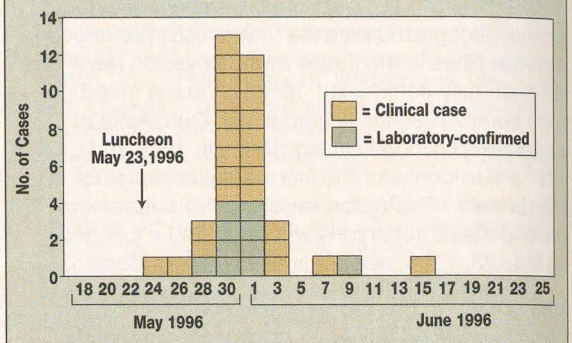
malin solution for ova and parasites (O&P). Stools were examined for *Cyclospora* oocysts at both the SCDHEC laboratory and the Centers for Disease Control and Prevention (CDC) using a modified Kinyoun acid-fast stain (not usually part of routine O&P analyses, but done in most laboratories if requested).[16]

Data were analyzed using the Epi Info software package.[17] Univariate relative risks (RRs) and Taylor series 95% confidence intervals (CIs) were calculated for each potential risk factor. Stratified analyses were performed using the method of Greenland and Robins to compute adjusted RRs to control for confounding.[18] Interactions between potential risk factors were evaluated by the method of Breslow and Day.[19]

The SCDHEC alerted community physicians to the recent *Cyclospora*-related illnesses and distributed information on diagnostic evaluation and treatment. Physicians and laboratories were asked to report all suspected or confirmed illnesses to the SCDHEC. A sporadic case was defined as a laboratory-confirmed *Cyclospora* infection in a person from the community who had not attended the luncheon. All sporadic case-patients were asked questions regarding raspberry consumption. The origin of raspberries associated with the luncheon and the sporadic cases was determined by reviewing sales invoices.

FIGURE 1

Epidemiologic curve of luncheon-associated cases of cyclosporiasis by date of symptom onset (n=35). Note: Date of onset assigned by 2-day intervals; 3 cases excluded because of uncertainty about date of onset.



RESULTS

Of the 64 luncheon attendees, 38 (59%) had an illness meeting the case definition. The median age of case patients was 62 years (range: 33 to 78 years). The median incubation period was 7 days (range: 1 to 23 days) (Figure 1). Common symptoms among the 38 case patients included diarrhea (38, 100%), fatigue (30, 79%), weight loss (23, 61%), and abdominal pain (21, 55%). Duration of illness was ≥2 weeks in 28 (80%) of the 35 case patients who could recall their date of symptom onset. The illness was often described as remitting and relapsing with symptom-free intervals lasting several days.

Food- and beverage-specific attack rates are shown in the Table. The risk for illness was significantly increased in persons who had eaten fresh raspberries ($P < .001$), fresh strawberries ($P = .03$), and potato salad ($P = .02$). None of the other salads, meats, or beverages were significantly associated with illness. When controlling for exposure to raspberries, the risk for illness associated with having eaten potato salad diminished but remained significant (RR=1.5; 95% CI, 1.1 - 2.0), and the consumption of strawberries was no longer significantly associated with illness (RR=1.8; 95% CI, 0.9 - 3.8). Consumption of raspberries remained significantly associated with illness after controlling separately for consumption of strawberries and potato salad. Of 37 case patients who could recall whether they had eaten raspberries, 33 (89%) reported eating raspberries. Based on univariate RRs, the population attributable risk percentages for exposures to raspberries, strawberries, and potato salad were 73%, 50%, and 20%, respectively. One woman who had laboratory-confirmed *Cyclospora* infection had not attended the luncheon but had eaten left-

TABLE

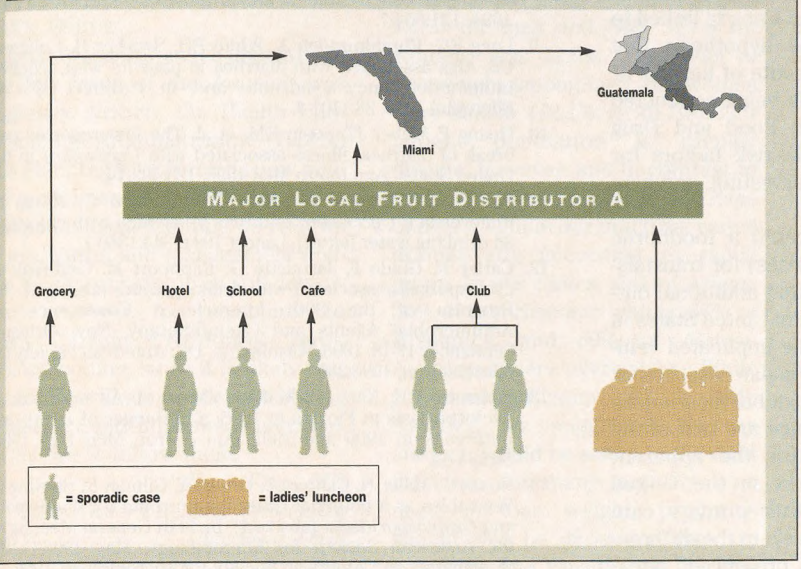
Attack Rates and Relative Risks Associated with Exposures to Various Foods and Beverages Served at the Luncheon

Item	Exposed ill/total (%)	Unexposed ill/total (%)	RR (95% CI)
Ham	11/25 (44)	26/37 (70)	0.6 (0.4-1.0)
Turkey	19/34 (56)	16/26 (62)	0.9 (0.6-1.4)
Roast beef	16/22 (73)	20/39 (51)	1.4 (1.0-2.1)
Potato salad	16/19 (84)	20/42 (48)	1.8 (1.2-2.6)
Carrot and raisin salad	12/21 (57)	24/39 (62)	0.9 (0.6-1.5)
Pasta salad	10/29 (69)	17/34 (50)	1.4 (0.9-2.1)
Raspberries	33/37 (89)	4/24 (17)	5.4 (2.2-13.2)
Strawberries	34/49 (69)	4/13 (31)	2.3 (1.0-5.2)
Tea	17/31 (55)	21/33 (64)	0.9 (0.6-1.3)
Open bar	11/14 (79)	27/50 (54)	1.5 (1.0-2.1)

RR denotes relative risk.

FIGURE 2

Schematic representation of the traceback investigation of a foodborne route for the transmission of *Cyclospora*.



over raspberries at the country club the evening of May 23; she had not eaten strawberries or potato salad.

No bacterial pathogens were found in specimens from case patients. *Cyclospora* oocysts were found in stools from 11 (85%) of the 13 case patients, but in none of the six healthy luncheon attendees who submitted specimens for testing.

The chef for the luncheon reported having prepared raspberries, strawberries, and potato salad on the same counter within a 2-hour period before the luncheon. He prepared the potato salad first and then used his bare hands and the same strainer for washing the berries. The chef remembered washing strawberries and raspberries separately, but he did not remember the order in which he washed them. The berries were placed in separate bowls next to each other on the buffet table; each bowl had a separate spoon. The chef stated that after he prepared the berries, he probably handled the potato salad again for taste-testing.

Community Surveillance and Raspberry Traceback

Through enhanced community surveillance, the SCDHEC identified six sporadic cases of *Cyclospora* infection, including the woman described above who ate leftover raspberries at the club. These sporadic case patients became ill from May 28, 1996, through June 3, 1996, and had eaten raspberries in the 2 weeks before onset of illness.

Raspberries served at the ladies' luncheon were bought from the major local fruit distributor, distributor A (Figure 2). Five of the sporadic case patients had eaten raspberries at establishments that had obtained raspberries from distributor A. Sales invoices indicated that distributor A had received only Guatemalan raspberries obtained through a Miami importer during the time the implicated raspberries were purchased. The remaining sporadic case patient had purchased a pint of raspberries labeled "Guatemala" from a grocery. This grocery identified a Miami importer (different from that associated with distributor A) as the source of its raspberries.

Discussion

This investigation implicated *Cyclospora* as the pathogen responsible for the luncheon outbreak and raspberries as the vehicle for transmission. Several lines of evidence support these conclusions. Laboratory analyses of stool specimens from luncheon-associated and sporadic cases identified the same causative organism: *Cyclospora*. Among luncheon attendees, eating raspberries was the strongest risk factor and could account for almost all cases; the apparent increased risk associated with strawberries and potato salad might have resulted from cross-contamination during preparation. In addition, all the sporadic cases (non-luncheon associated) occurred in persons who had recently eaten raspberries. We traced raspberries eaten at the luncheon and those eaten by all sporadic case patients to a common country of origin (Guatemala). Finally, the luncheon-associated and sporadic cases of cyclosporiasis we described were included in a larger outbreak investigation that occurred in the United States and Canada during the spring and summer of 1996; the investigation of the larger outbreak also implicated Guatemalan raspberries.[15,20,21]

Our study had certain limitations. The luncheon outbreak occurred in the context of media reports of other clusters of cyclosporiasis in the United States being linked to fresh fruit. Case patients may have been more likely than well persons to recall exposure to berries. However, our study implicated exposure to raspberries despite extensive media reports that strawberries were the likely vehicle for *Cyclospora*. Another factor that may have decreased the accuracy of food histories is that surveys were administered 3 to 4 weeks after the luncheon.

We were unable to determine how the raspberries became contaminated. Contamination by food handlers in South Carolina is unlikely because *Cyclospora* oocysts are not infectious when they are excreted (ie,

the organism requires an extrinsic incubation period of days to weeks).[5] Both the presence of sporadic cases in the community (associated with more than one local distributor and importer) and other clusters of cases of cyclosporiasis in the United States and Canada linked to Guatemalan raspberries support the hypothesis that contamination occurred closer to the site of harvest or initial distribution. An investigation is being conducted in Guatemala by the CDC and the Food and Drug Administration to determine possible risk factors for contamination during the growing, harvesting, and handling of raspberries.[21]

Our investigation strongly implicated a foodborne route (ie, the consumption of raspberries) for transmission of *Cyclospora*. It is noteworthy that additional outbreaks of cyclosporiasis occurred in the United States in the spring and summer of 1997.[22,23] The implicated vehicles of infection included fresh Guatemalan raspberries, mesclun lettuce, and basil. Increasing global food importation as well as improving surveillance are two of the factors that may be responsible for the apparent increase in *Cyclospora*-related illness in the United States.[24,25] Family physicians and other primary care providers should consider cyclosporiasis in the differential diagnosis for any patient with prolonged, unexplained diarrhea and specifically request testing for *Cyclospora*.

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