2013-11-14-082 Campylobacteriosis - USA (12): 2012, uncooked chicken livers
To: (03) Food-borne, water-borne and air-borne diseases;

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CAMPYLOBACTERIOSIS - USA (12): 2012, UNCOOKED CHICKEN LIVERS
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In October 2012, the Vermont Department of Health (VDH) identified 3 cases of laboratory-confirmed _Campylobacter jejuni_ infection in Vermont residents; the isolates had indistinguishable pulsed-field gel electrophoresis (PFGE) patterns. A query of PulseNet, the national molecular subtyping network for foodborne disease surveillance, led to the identification of an additional case each from New Hampshire, New York, and Vermont that had been reported in the preceding 6 months.

An investigation led by VDH found that all 6 patients had been exposed to raw or lightly cooked chicken livers that had been produced at the same Vermont poultry establishment (establishment A). Livers collected from this establishment yielded the outbreak strain of _C. jejuni_. In response, establishment A voluntarily ceased the sale of chicken livers on 9 Nov 2012. A food safety assessment conducted by the US Department of Agriculture's Food Safety and Inspection Service (USDA-FSIS) found no major violations at the establishment.

This is the 1st reported multistate outbreak of campylobacteriosis associated with chicken liver in the USA. Public health professionals, members of the food industry, and consumers should be aware that chicken livers often are contaminated with _Campylobacter_ and that fully cooking products made with chicken liver is the only way to prepare them so they are safe to eat.

Epidemiologic Investigation

On 2 Oct 2012, VDH identified 2 laboratory-confirmed cases of _C. jejuni_ infection with indistinguishable SmaI and KpnI PFGE patterns (DBRS16.1508 and DBRK02.0049). Patient 1 became ill with diarrhea on 16 Sep 2012 and reported working at a Vermont poultry establishment (establishment A); his food history was unremarkable and did not include any products from establishment A. His work duties involved handling live and slaughtered chickens and turkeys. Patient 2 also became ill on 16 Sep 2012 and was hospitalized 4 days later. He reported eating a charcuterie (meat platter) appetizer and rabbit entree at a Vermont restaurant (restaurant A) 2 days before his illness onset. The charcuterie included a mousse made from chicken livers produced at establishment A.

Patient 3 became ill on 20 Sep 2012; she reported eating the same menu items at restaurant A 1 day after patient 2. The _C. jejuni_ isolate from her stool specimen yielded a PFGE pattern indistinguishable from the outbreak strain.

A retrospective cohort study of patrons who dined at restaurant A within 2 days of the patients with confirmed _C. jejuni_ infection was conducted. Contact information was obtained from the restaurant's reservation list. A total of 43 diners were contacted in addition to patients 1 and 2; one diner declined to participate in the study.
Diners were asked what they ate and whether they experienced any diarrhea in the subsequent 10 days. No additional diners reported diarrhea; therefore, no probable cases were identified.

19 menu items were analyzed for a statistical association with illness by calculating relative risks (RR). A value of 0.5 was added to all cells in 2x2 tables that contained a zero. Consumption of only 2 menu items showed a statistically significant relative risk of illness:
charcuterie that included chicken liver mousse (RR = 52.5, 95 percent confidence interval [CI] = 3.0-914.8) was consumed by 3 patrons, and rabbit (RR = 33.3, CI = 1.8-613.5) was consumed by 5. Although limited by a small sample size (resulting in wide CIs), the higher relative risk associated with consuming charcuterie as well as isolation of the outbreak strain of _C. jejuni_ in a worker at establishment A, where the chicken livers were produced, focused the investigation on chicken livers.

PulseNet identified a 4th Vermont isolate indistinguishable by PFGE from the outbreak strain. Patient 4 had not reported eating chicken livers when originally interviewed in June 2012 by VDH, which investigates all reports of campylobacteriosis. But upon re-interview as part of this investigation, patient 4 reported eating pan-fried chicken livers at another Vermont restaurant (restaurant B) several days before becoming ill. An interview with restaurant B staff members revealed that establishment A was the source of their chicken livers in June 2012.

VDH notified other New England states in which establishment A products were distributed and requested information on any patients with _C. jejuni_ infection who reported consumption of chicken livers or whose isolates had PFGE patterns indistinguishable from the outbreak strain. PulseNet identified an April 2012 isolate from a New Hampshire resident (patient 5) with a SmaI PFGE pattern indistinguishable from the outbreak strain. The New Hampshire Department of Health and Human Services performed additional PFGE testing on this isolate using KpnI and found the pattern to be indistinguishable from the outbreak strain. Patient 5 reported purchasing raw chicken livers from a New Hampshire grocery store and cooking them to medium rare at home for herself and family members, one of whom was a female New York resident (patient 6) who had been hospitalized in April 2012 with _C. jejuni_ infection. Following notification of the outbreak, New York state analyzed the isolate from patient 6 and found its PFGE pattern indistinguishable from the outbreak strain.

The 6 patients ranged in age from 19 to 87 years (median: 53.5 years);
3 were female. Two were hospitalized, but all 6 had recovered by the time of their initial interviews.

Environmental Investigation

VDH inspected restaurants A and B. Both restaurants passed inspection with no critical violations noted. Stool specimens collected from all
8 food handlers at restaurant A did not yield _Campylobacter_. Both restaurants confirmed that they received fresh chicken livers from establishment A and froze them until needed. Interviews with both chefs revealed that chicken livers were lightly cooked to maintain their texture. In accordance with VDH health regulations for food service establishments, the menu at both restaurants contained the required general consumer advisory regarding the increased risk of foodborne illness from consuming raw or undercooked poultry. VDH regulations do not require that the menus at food service establishments identify specific food items that are potentially hazardous and served raw or undercooked; therefore, the chicken liver dishes at restaurants A and B were not individually labeled as lightly cooked.

The New Hampshire Department of Health and Human Services reviewed grocery store records and, based on the purchase date reported by patient 5, identified establishment A as the source of the livers that patients 5 and 6 consumed.

USDA-FSIS conducted a food safety assessment at establishment A and found that the establishment had a well-designed food safety system, which included application of antimicrobial cleaners to the poultry products. When observed during the assessment, these cleaners were used as intended to reduce contamination on the surfaces of all poultry carcasses and parts. The assessment revealed no extrinsic factors, such as cross contamination, that would likely cause the chicken livers to be tainted.

Laboratory Investigation

Frozen chicken livers collected from restaurant A were sent to the VDH laboratory, where they were minced into 13 25-gram subsamples and enriched in accordance with the instructions for the

Campylobacter immunoassay. Two of the 13 subsamples screened with the immunoassay for the presence of _Campylobacter_ gave positive results, but the pathogen could not be recovered in culture.

VDH then collected fresh chicken livers directly from establishment A and delivered them to the VDH laboratory, where they were processed in accordance with testing instructions. _C. jejuni_ was recovered from these chicken livers, and one isolate had PFGE patterns indistinguishable from the outbreak strain.

Additional characterization of the 6 human isolates and the chicken liver isolate by antimicrobial susceptibility testing identified this outbreak strain as susceptible to 8 of 9 antimicrobials tested on the CDC National Antimicrobial Resistance Monitoring System panel but resistant to tetracycline. Multilocus sequence typing identified the outbreak strain as sequence type 1212.

Establishment A was notified of the results of the investigation on 9 Nov 2012. The establishment ceased selling chicken livers that same day.

[Authors: Tompkins BJ, Wirsing E, Devlin V, et al]

Editorial Note

Campylobacter is the 3rd-leading cause of bacterial foodborne illness in the USA (1), and poultry exposure is a well-recognized risk factor for infection. Poultry-associated campylobacteriosis is the pathogen-food pair estimated to be responsible for the greatest burden of foodborne disease in the USA (2). Despite this, documented outbreaks of _Campylobacter_ are relatively rare, with only 1.9 percent of all foodborne outbreaks reported to CDC's National Outbreak Reporting System attributed to this pathogen (3). Rarer still are documented outbreaks caused by poultry livers. Between 1997 and 2008,
5 such outbreaks were reported, but only 2 of these reports confirmed poultry livers as the vehicle (4). Unlike the outbreak reported here, none of these previous outbreaks were multistate, nor did any previous investigation confirm livers as the outbreak source using laboratory evidence.

Outbreaks of _Campylobacter_ infections linked to chicken livers have been reported in the UK (5) and Australia (6). Since 2007, England and Wales have seen a significant increase in the proportion of _Campylobacter_ outbreaks linked to chicken livers used in pate (7).

These outbreaks should not come as a surprise, given that previous studies have shown that 77 percent of retail chicken livers are contaminated with _Campylobacter_ (8) and that, when contamination is present, it is usually in internal tissues, as well as on the surface (9). The FDA food code states that poultry must reach an internal temperature of 165 F (73.9 C) for at least 15 seconds. Studies outside the USA have found that in order for chicken livers to be free of _Campylobacter_, they must be heated to internal temperatures in excess of 158 F (70 C) and held at that temperature for 2-3 minutes (9). In this investigation, the livers were found to be intentionally cooked lightly to maintain a desired texture and taste. This practice might be common, particularly when preparing chicken livers for use in a mousse or pate. A popular recipe for this dish instructs readers to cook "until the livers are just stiffened, but still rosy inside"
(10).

Although USDA-FSIS found that establishment A applied antimicrobial cleaners to the livers, these efforts only affect the external surfaces of chicken livers, and because _Campylobacter_ contamination can be internal, the safety of undercooked chicken livers cannot be assured. Ultimately, establishment A stopped selling chicken livers.

Vermont is one of the few states that investigates all reported cases of campylobacteriosis and performs PFGE on all _Campylobacter_ isolates submitted to the VDH laboratory. This strategy, along with the combined efforts of state and federal partners, enabled the timely detection of the outbreak and identification of the source. This investigation emphasizes the potential risk for _Campylobacter_ infection from consumption of undercooked chicken livers and the potential for this pathogen-food pair to cause outbreaks in the USA.

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[Bacterial hepatitis in birds due to _Campylobacter_ has been reported, but there are generally higher titers of the bacterium on the hepatic surface than internally, which suggests carry-over from surface contamination in many cases. Much chicken liver contamination may occur due to post-slaughter handling.

Not surprisingly, the same association has been made with duck liver as well as chicken liver (Abid M, Wimalarathna H, Mills J, et al: Duck liver-associated outbreak of campylobacteriosis among humans, United Kingdom, 2011. Emerg Infect Dis. 2013;19: 1310-1313). - Mod.LL

A HealthMap/ProMED-mail map can be accessed at:
<http://healthmap.org/r/1hiS>.]

[See Also:
Campylobacteriosis - USA (11): (PA) unpasteurized milk
20130829.1911466
Campylobacteriosis - USA (10): (PA) unpasteurized milk 20130806.1866270 Campylobacteriosis - USA (09): (MN) unpasteurized milk, alert
20130627.1794212
Campylobacteriosis - USA (08): (NY) food festival 20130618.1778606 Campylobacteriosis - USA (07): (PA) raw milk 20130531.1746758 Campylobacteriosis - USA (06): (AK) unpasteurized milk, 2nd cluster

20130524.1735823
Campylobacteriosis - USA (05): (AK) unpasteurized milk
20130507.1697642
Campylobacteriosis - USA (04): unpasteurized milk, 2012
20130505.1692648
Campylobacteriosis - USA (03): (AK) unpasteurized milk
20130305.1572798
Campylobacteriosis - USA: (AK) unpasteurized milk 20130218.1547473 2010

Campylobacteriosis - UK: (England), chicken liver pate 20101104.3995]

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