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Outbreak Investigation of Foodborne Illness among Political Rally Attendees, Cuddalore, Tamil Nadu, India

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Summary

In July 2015, we investigated a foodborne illness outbreak in Sithalikuppam and Verupachi villages, Cuddalore district, Tamil Nadu, among the political rally attendees to determine the risk factors for illness. We conducted a retrospective cohort study, calculated risk ratio for the food exposures, and cultured stool specimens. Of 55 rally attendees, we identified 36 (65%) case patients; 32 (89%) had diarrhea and 20 (56%) had vomiting. Median incubation period was 14 h. Eighty-nine percent (32/36) of those who ate lemon rice at dinner had illness compared to 21% (4/19) of those who did not (RR 4.2). Of the six nonattendees who ate leftovers on July 25, all ate only lemon rice and became ill. Stool cultures were negative for *Salmonella*, *Shigella*, and *Vibrio* species. Lemon rice was probably contaminated with enterotoxins such as from *Bacillus cereus*. Our findings highlighted need for community food safety education and importance of thorough outbreak investigations.

Keywords

Acute diarrheal disease; *Bacillus cereus* ; bacteria; foodborne outbreak; India

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Conflicts of interest

There are no conflicts of interest.

The World Health Organization estimates that worldwide as many as 600 million persons, or almost 1 in 10, suffer foodborne illness each year.[1] In India, despite reports of only a few foodborne illness outbreaks, usually those with high rates of illness or in urban areas, foodborne illness, and acute diarrheal disease constituted nearly half of all outbreaks reported to the Integrated Disease Surveillance Programme during 2011–2015.[2] In India, analytic epidemiologic investigations of foodborne illness outbreaks remain uncommon, and outbreak etiologies are infrequently identified. In 2013, the National Centre for Disease Control in Delhi, in collaboration with the US Centers for Disease Control and Prevention, began a pilot project in two districts of Tamil Nadu state in southern India to enhance detection and response to diarrheal illness outbreaks. The project focused on strengthening district-level epidemiologic and laboratory capacity to detect and systematically investigate foodborne illness outbreaks.[3] One pilot district was Cuddalore (2011 census: population ~2.6 million), located approximately 175 km south of Chennai.

On July 25 and 26, 2015, 36 persons from adjacent Sithalikuppam and Verupachi villages in Cuddalore sought care for diarrhea or vomiting at the primary health center. All ill persons reported attending a political rally 250 km away at Tiruchirappalli on July 24. On July 27, we initiated an investigation to describe the epidemiology and identify risk factors associated with the cases.

We defined a case as diarrhea (≥3 loose stools in 24 h) or vomiting between July 24 and 26, 2015, among residents of Sithalikuppam or Verupachi villages. We conducted active surveillance through house-to-house visits in both villages to identify additional cases in the area. We inquired about clinical symptoms and timing of illness. Hypothesis-generating interviews indicated that all rally attendees ate food that was specially prepared for the journey to the rally. This food was lemon rice, curd (yogurt) rice, lemon pickle, and packaged drinking water. Thus, the structured questionnaire focused on ingestion of these items.

We also conducted a retrospective cohort study to identify risk factors. We defined the cohort as persons from Sithalikuppam and Verupachi villages who attended the political rally on July 24. Exposed were defined as persons who attended political rally on July 24 and ate specific food items. Unexposed were defined as persons who attended the political rally on July 24 and did not eat specific food items. We interviewed rally attendees using a structured questionnaire to collect information about sociodemographic characteristics, symptoms, and food items eaten on July 24. We used Open Epi 3.03 software (Emory University, Atlanta, Georgia, USA)[4] to calculate attack rates (ARs) among exposed and unexposed persons. We conducted bivariate analysis to determine whether an association existed between foods eaten by rally attendees and development of illness and considered $P \leq 0.05$ as statistically significant.

Stool specimens collected from 42 case patients were sent to Cuddalore district public health laboratory for microbiological culture. This laboratory can conduct culture and isolation for 3 enteric pathogens: *Shigella*, *Salmonella*, and *Vibrio cholerae*. Toxin-based testing was not available. We interviewed the cook about recent illness and preparation of implicated food

items. We also evaluated the storage and delivery practices used for the food prepared for the rally.

The investigation was a public health response to an outbreak as part of the India Epidemic Intelligence Service Program, undertaken with the purpose to identify the source of spread for immediate control of outbreak and intended for benefit of the community at large. The investigation did not involve any human laboratory sample collection for research purposes and there were no invasive investigations or medical interventions/experiments. All Government of India ethical principles and guidelines were adopted during the outbreak response: the investigation was aimed at achieving public good (beneficence) and collective welfare (solidarity); no harm was done to any individual (nonmaleficence); fair, honest, and transparent (accountability and transparency); and participants' data were de-identified before analysis (confidentiality).

Results

From primary health center records and house-to-house searches, we identified 42 case patients from Sithalikuppam (40 [95%]) and Verupachi (2 [5%]) villages; 24 (57%) were male, and the median age of all case patients was 50 years (range: 22–80 years). Of the 42 case patients, 38 (90%) had diarrhea and 23 (55%) had vomiting. All patients recovered completely within 24 h; no deaths occurred. Cases were uniformly distributed by location, and we detected no geographic clustering. The overall AR for Sithalikuppam and Verupachi villages was 5% (42/855). The ARs were 65% (36/55) for those who attended the rally and 0.8% (6/800) for those who did not attended the rally.

The rally attendees left Cuddalore district at 9 a.m. on July 24 to travel to Tiruchirappalli district. All attendees ate only food prepared for the trip; lunch was at 3:30 pm. and dinner at 9 pm. Thirty-six (65%) of 55 attendees reported becoming ill between 5 a. m. and 6 p. m. on July 25 [Figure 1].

None of the food items eaten by rally attendees at lunch on July 24 was associated with illness [Table 1]. Analysis of the four dinner items revealed that only eating lemon rice was significantly associated with illness (AR among exposed and unexposed was 89% and 21%, respectively, with relative risk 4.2 (1.8–10.2) [Table 1]. The median incubation period from lemon rice ingestion at dinner and illness onset for rally attendees was 14 h (range: 9–20 h).

Six additional case patients who did not attend the rally reported eating leftover lemon rice, the only remaining food item from the rally, at 9 a. m. on July 25 [Figure 1]. All six persons reported vomiting between 8 p. m. on July 25 and 1 a. m. on July 26. The median incubation period from lemon rice ingestion to illness onset was 12 h (range: 10–15 h).

All ten (24%) stool specimens collected from the 42 identified case patients were negative for *Shigella*, *Salmonella*, and *V. cholera* by culture and microscopy.

The cook reported no diarrhea, vomiting, or other gastrointestinal illness symptoms during the month before the outbreak. Lemon rice was prepared on the ground in an open space from 3 a.m. to 5 a.m. on July 24. The cooked rice was spread over a dry cotton cloth (placed

directly on the earthen ground) for approximately 1 h to cool. The rice was then placed in a vessel and mixed with lentils and spices that had been tempered in oil and peeled lemon. The preparation was then packed in four stainless steel containers and placed near the bus's engine during the 6–7-h journey. The highest ambient recorded temperature on the rally day was 40°C (104°F).

We investigated a foodborne outbreak of diarrhea and vomiting among political rally attendees, as well as nonattendees who ate leftovers from the rally, in Cuddalore district, Tamil Nadu. The rapid response and detailed epidemiologic investigation identified illness associated with ingestion of lemon rice.

Even without laboratory confirmation, the epidemiologic, clinical, and environmental findings suggest the most likely etiologic agent was *Bacillus cereus*. Outbreaks of diarrheal *B. cereus* typically have a clinical presentation of mostly diarrhea and some vomiting after an incubation period of 8–16 h.[5] Consistent with these characteristics, this outbreak had a similar incubation period and a predominance of diarrhea (90%) with some vomiting (55%). Sources of *B. cereus* include the soil, where end ospores are abundant.[5] Many outbreaks of *B. cereus* have been associated with ingestion of boiled or fried rice kept at a high ambient temperature for a prolonged time, which results in bacterial growth and production of heat-resistant enterotoxins.[6] In this outbreak, the lemon rice was not refrigerated after possible contamination with spores during preparation on an earthen surface. The *B. cereus* spores probably germinated as the rice cooled, and transport and storage at high ambient temperatures promoted bacterial growth with resultant enterotoxin production.

Without laboratory confirmation of *B. cereus* toxin, we cannot rule out other possible etiologies. The *Staphylococcal aureus* toxin was another possible etiology in this outbreak given the large proportion of vomiting among case patients,[7] but *S. aureus* outbreaks generally have shorter incubation periods (<6 h).[7] *Clostridium perfringens* is another possible etiologic agent. However, its incubation period is usually at least 24 h, and although clinical presentation is also predominantly diarrhea, vomiting rarely occurs. In addition, the source of infection is usually of animal origin.[8]

Our findings are subject to several limitations. First, recall bias is possible because the cook and case patients were not interviewed until 7 days after the outbreak. There was no toxin testing available. Finally, at the time of the investigation, food samples were no longer available for testing. Nevertheless, the strength of the epidemiologic findings provides sufficient data to conclude an association between ingestion of contaminated lemon rice and development of illness.

Foodborne illness is an underestimated public health problem in India. Robust foodborne disease surveillance combined with high-quality outbreak investigations is needed to better clarify the extent, sources, and risk factors associated with foodborne illnesses. We recommended continued expansion of district-level capacity for laboratory-based surveillance of diarrheal disease pathogens to help detect outbreaks and identify their etiologic agents.

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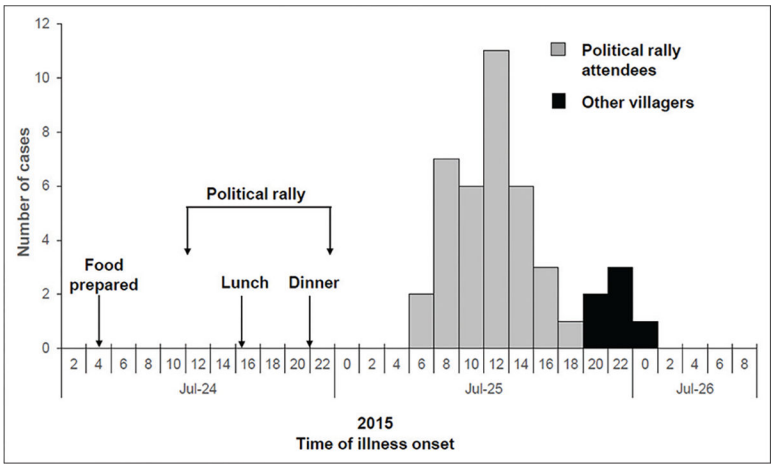

Figure 1:
Epidemic curve of 42 foodborne illness cases in Sithalikuppam and Verupachi villages, Cuddalore, Tamil Nadu, India, between 24 and 26 July 2015.

Table 1:

Comparison of lunch and dinner items eaten to foodborne illness among political rally attendees in Cuddalore, Tamil Nadu, India, on July 24, 2015 (n=55)

Food or drink	Exposed[†]		Unexposed[‡]		Attack rate (%)		Risk ratio (95% CI)
	Ill	Total	Ill	Total	Exposed	Unexposed	
Lunch							
Lemon rice	32	49	4	6	65	67	1.0 (0.5–1.8)
Packaged water	36	55	1	2	65	50	1.3 (0.3–5.3)
Curd rice	26	41	10	14	63	71	0.9 (0.6–1.3)
Lemon pickle	26	43	10	12	60	83	0.7 (0.5–1.0)
Dinner							
Lemon rice	32	36	4	19	89	21	**4.2[*] (1.8–10.2)**
Packaged water	36	55	1	2	65	50	1.3 (0.3–5.3)
Curd rice	3	5	33	50	60	66	0.9 (0.4–1.9)
Lemon pickle	5	8	31	47	63	66	0.9 (0.5–1.7)

[*] Bold text indicates statistical significance.

[†] Persons who ate selected food items

[‡] Persons who did not eat selected food items. CI: Confidence interval