



Outbreak, Surveillance and Investigation Reports

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Acute Gastroenteritis Outbreak Associated with a Sports Event in Bumthang, Bhutan, 2012

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Abstract

On 6 Sep 2012, a medical officer from Bumthang Hospital notified the Royal Center for Disease Control, Ministry of Health in Thimphu, Bhutan, of an outbreak of gastroenteritis among students following an annual sport event. We investigated this outbreak to verify the diagnosis, identify risk factors and recommend control measures. A case control study was used to assess risk factors and determine the cause of the outbreak. We identified 202 cases among 587 participants, giving an overall attack rate of 34.4%. Cases were three times more likely to have eaten beef curry (odds ratio = 2.9, 95% CI = 1.89-4.31) and twice as likely to have drunk pond water (odds ratio = 2.1, 95% CI = 1.39-3.14) than controls. Four of 32 stool samples were positive for *Campylobacter jejuni*, and one was positive for *Shigella sonnei*. This was the first gastroenteritis outbreak related to a sport event in Bhutan possibly caused by *Campylobacter jejuni* which was associated with the consumption of beef curry.

Keywords: gastroenteritis, risk factor, outbreak, Bhutan

Introduction

Outbreaks related to foodborne gastroenteritis occur in relation to social gatherings of people such as those in institutions, schools, restaurants and military units.^{1,2} Most foodborne illnesses are undetected as the illness is self-limiting or the cases are sporadic. Bacteria, parasites and viruses as well as chemical agents may cause these outbreaks.^{3,4} Of these agents, *Campylobacter* is recognized as a major cause of bacterial foodborne gastroenteritis among people of all age groups in both developed and developing countries.³⁻⁶

The most recently reported outbreaks of gastroenteritis in Bhutan were linked to poor sanitation and contaminated water.⁷⁻⁸ In all these instances, the causative organism was from *Shigella* species. Data on foodborne gastroenteritis outbreaks are limited in this country and only scant information is available on *Campylobacter* infections. As per the surveillance on diarrheal disease for children below five years of age, the Royal Center for Disease Control (RCDC) has identified 1.4% and 1.1% of

Campylobacter infection in 2015 and 2016 respectively.⁹ The RCDC under the Ministry of Health in Thimphu is the only laboratory facility available to identify *Campylobacter*. All stool specimens have to be shipped from distant sentinel hospitals to RCDC to identify enteric pathogens. Here, we report on the investigation of the first institutional outbreak of gastroenteritis among participants of a three-day sport event held in Ura Middle Secondary School (UMSS), Bumthang, Bhutan. An investigation was carried out on 7-15 Sep 2012 to verify and describe the characteristics of the outbreak, identify risk factors, and recommend appropriate prevention and control measures.

Methods

Epidemiologic Investigation

A case-control study was used for this outbreak investigation. A suspected case was defined as a person who participated in the three-day sport event at UMSS, and developed diarrhea or abdominal pain with any of the following symptoms: fever, headache, vomiting or joint pain at any time from 31 Aug to 9

Sep 2012. Controls were students or staff who participated in the sport event at UMSS, yet did not develop the gastroenteritis symptoms. Controls were selected from the same school as the cases by convenient sampling, without using any matching variable to have one control for each case.

Active case findings were obtained by visiting all seven schools in Bumthang District that participated in the sport event. Active cases were sought through personal interview with respective school principal and teachers as well as by visiting every class and asking students about their health status relating to acute gastroenteritis. We interviewed both cases and controls, and collected information on demographic characteristics, clinical information and exposure to various foods and drinks during the sport event.

We asked food handlers about the history of diarrheal disease before the sport event as well as procurement of food, storage and food preparation process prior to and during the event. A list of food and drinks served during the event was obtained from the mess in-charge as well as from the participating students.

Environmental Investigation

Environmental hygiene was assessed by inspecting the hygienic conditions of kitchen, water sources and latrines. Water samples from the piped water and pond in the school were tested for fecal coliform bacteria by Millipore membrane filtration method. All specimens were tested in the Bumthang Hospital by the investigating team from the RCDC, Thimphu.

Laboratory Investigation

Total 70 stool specimens were collected from students, teachers and food handlers during the time of outbreak and when patients visited the hospital. Specimens were processed on modified charcoal cefoperazone deoxycholate agar (mCCDA; HiMedia Laboratories Pvt. Ltd, India), Hektoen enteric agar (HEA; Becton, Dickinson and Company, USA) and

Mac-conkey agar (Becton, Dickinson and Company, USA). Except for mCCDA which was incubated in microaerophilic atmosphere, all other media were incubated aerobically at 37°C. The isolated organisms were identified biochemically using triple sugar iron, indole, lysine decarboxylase and mannitol motility media. Antisera were used for serological typing of *Shigella* species.

Statistical Analysis

Epi Info version 7.2¹⁰ was used for statistical analysis. Descriptive analysis was presented in terms of percentage, mean, standard deviation and graphs. Odds ratios (OR) and 95% confidence intervals (CI) were computed for various food items consumed by cases and controls. Attributable risks for the suspected food items were calculated by subtracting the attack rate of unexposed subjects from the attack rate of exposed subjects.

Results

Descriptive Study

The Ministry of Education, Royal Government of Bhutan organized an annual school-based sport event in UMSS, Bumthang from 31 Aug to 2 Sep 2012. Students from seven different schools in Bumthang District participated in the event. All participants were provided with three meals a day, including hostel facilities during the sports event. Of 587 participants, 202 suspected cases were identified, with an attack rate of 34.4%. The attack rate for boys was higher than that for girls (46.1% vs. 25.4%, p-value <0.01). The attack rate for staff was 10.8%. The overall attack rate was the highest with Wangdichoeling Lower Secondary School (WLSS) (77.8%) followed by UMSS (33.8%) and Geytsa Lower Secondary School (GLSS) (32.7%) (p-value <0.01) (Table 1). Most cases (56.4%) were 10-15 years old. The median age was 16 years for males (range 11-49 years) and 15 years for females (range 12-21 years).

Table 1. Attack rate (AR) by schools of participants who attended a 3-day sport event in Bumthang, Bhutan, 2012 (n=587)

School	Male student			Female student			Staff		
	Total	Sick	AR (%)	Total	Sick	AR (%)	Total	Sick	AR (%)
UMSS	80	39	48.8	50	10	20	15	0	0
GLSS	22	14	63.6	24	1	4.2	3	1	33.3
SKHSS	22	10	45.5	24	2	8.3	1	0	0
CMSS	58	12	20.7	62	11	17.7	5	0	0
WLSS	33	29	87.9	35	26	74.3	4	1	25
JHSS	25	11	44.0	30	7	23.3	4	0	0
THSS	42	15	35.7	43	11	25.6	5	2	40
Total	282	130	46.1	268	68	25.4	37	4	10.8

UMSS = Ura Middle Secondary School

GLSS = Geytsa Lower Secondary School

SKHSS = Sonam Kuenphen Higher Secondary School

CMSS = Chumey Middle Secondary School

WLSS = Wangdichoeling Lower Secondary School

JHSS = Jakar Higher Secondary School

TLSS = Tang Lower Secondary School

No cook or food handler reported symptoms of gastroenteritis before or after the event.

A total of 238 participants consumed beef curry, resulting in 143 cases (60.1%). Out of 181 participants who drank the pond water, 108 (59.7%) of them were cases. These two items also revealed the highest attributable risk, with 25.6% for beef curry and 18.4% for pond water (Table 2).

Onset of the first case was on 31 Aug 2012 (Figure 1). The number of cases increased sharply by 2 Sep and peaked on 3 Sep 2012. The shape of the epidemic curve was also compatible with a common-point

source outbreak. The most common symptoms were diarrhea (90%) and abdominal pain (87%), and 35% of the cases reported passing blood in stools. All cases have recovered, without any deaths. The mean duration of illness was 3.6 ± 1.4 days.

Analysis of Suspected Risk Factors

Of 587 participants, 409 persons were included in the case-control study (202 cases and 207 controls). Univariate analysis calculated statistically significant values for consumption of beef curry (OR = 2.9, 95% CI = 1.89-4.31) and for drinking pond-water (OR = 2.1, 95% CI = 1.39-3.14) (Table 3).

Table 1. Attack rate and attributable risk for different food items among participants who attended a 3-day sport event in Bumthang, Bhutan, 2012

Food item	Ate			Did not eat			Attributable risk (%)
	Total	Case	Attack rate (%)	Total	Case	Attack rate (%)	
Beef	238	143	60.1	171	59	34.5	25.6
Pond water	181	108	59.7	228	94	41.2	18.4
Salad	354	182	51.4	55	20	36.4	15.0
Pork	244	125	51.2	165	77	46.7	4.6
Boiled egg	267	140	52.4	142	62	43.7	8.8

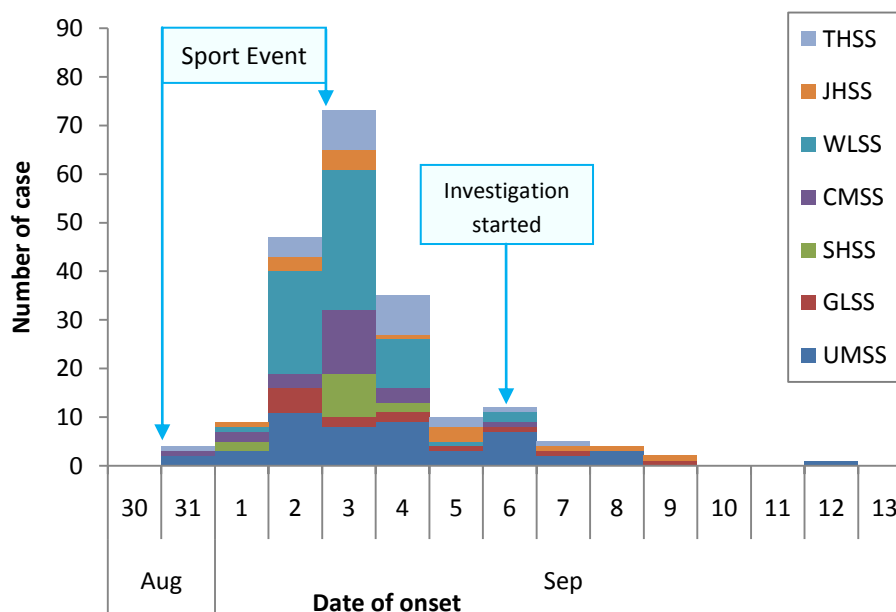


Figure 1. School-wise epidemic curve of acute gastroenteritis outbreak among participants who attended a 3-day sport event in Bumthang, Bhutan, 2012 (n=202)

Table 3. Univariate analysis of suspected risk factors for gastroenteritis among participants in a 3-day sport event in Bumthang, Bhutan, 2012

Food item	Exposed		Non-exposed		Odds ratio	95% CI
	Case	Total	Case	Total		
Beef	143	238	59	171	2.9	1.89-4.31
Pond water	108	181	94	228	2.1	1.39-3.14
Salad	182	354	20	55	1.8	0.90-3.34
Pokora*	164	314	38	95	1.6	0.96-2.61
Pork	125	244	77	165	1.2	0.81-1.82
Boiled egg	140	267	62	142	1.4	0.93-2.15

*Pokora is a popular fast-food item. Cabbage, onion, potato, chillies, salt, wheat powder are mixed and deep-fried in oil.

Environmental Study

Fresh food, such as meat, cheese, vegetables and chilies, were brought in from a bordering Indian town and kept for up to one week on the cement shelves adjacent to the kitchen (Figure 2). Refrigeration was not available, and daily temperatures varied between approximately 12.2-22.3°C. Meals were prepared on a daily basis and were not kept overnight. None of the participants reported bringing foods from outside the school.



Figure 2. Vegetables stored in the kitchen on the cement-shelves at the sport event venue in Bumthang, Bhutan, 2012

The school was supplied with water from an unprotected ground well about half kilometer from the school campus. Domestic animals were grazing around the well. There was intermittent rain during the investigation. Participants drank untreated piped water as well as pond water, which was neither chlorinated nor boiled before consumption.

Availability and accessibility of pond water made students more convenient to drink water directly from the pond rather than drinking boiled water from the kitchen.

Laboratory Study

Laboratory analysis indicated that both piped and pond water were contaminated with fecal coliform bacteria with more than 30 colony-forming units per 100 ml in piped water sample and over 50 colony-forming units per 100 ml of pond water sample.

Out of 70 stool specimen containers distributed to the students, 32 cases provided the specimens for culture. Of those, four (12.5%) were positive for *Campylobacter jejuni* and one (3.1%) was positive for *Shigella sonnei*. One of the positive specimens was obtained from a teacher that tested positive for *Campylobacter jejuni*. Four cooks in the school refused to provide stool samples.

Discussion

The clinical symptoms and abrupt onset of illness among young healthy students suggested that the infection was transmitted through food and water or

both, and probably caused by *Campylobacter jejuni*, if it was indeed caused by a single organism^{1,3}. However, *Shigella* also causes similar signs and symptoms as *Campylobacter* like diarrhea, abdominal cramps, fever and sometimes bloody diarrhea, and these symptoms may last for a week. The difference is observed with respect to incubation period and mode of transmission of these two organisms: shigellosis is usually manifested after 1-2 days of infection, while campylobacteriosis is manifested within 2-5 days of infection. *Shigella* is transmitted through a direct exposure to fecal matter mainly via contaminated water and contaminated hands, while *Campylobacter* is transmitted by consuming raw or undercooked meat, dairy products and contaminated water¹¹⁻¹². *Shigella* species was the only enteric pathogen recovered from outbreaks of gastroenteritis reported in Bhutan⁷⁻⁸. Outbreaks with similar symptoms, incubation time and epidemiological curves were reported in Thailand, Taiwan, China and Switzerland, which showed the causative organism was *Shigella sonnei*^{4,3-16}. The clinical symptoms reported by those studies were also consistent with this outbreak. Hence, it was possible to have a mixed infection of *Campylobacter* and *Shigella* in this outbreak.

None of the cases took antibiotics prior to specimen collection, yet delays in specimen processing of the laboratory might have contributed to low recovery of pathogens. Some stool specimens might have been stored overnight in a school at room temperature before submitting for laboratory analysis in the hospital.

The epidemic curve suggested a common-point source outbreak, possibly associated with the consumption of beef. The absence of a cold box or refrigerator for storing the meat could have increased the chances of bacterial growth on beef. The study participants also reported that the beef had not been properly cooked and was difficult to eat. Under-cooked beef had been found to cause gastroenteritis outbreaks during mass feedings in India and Greece.¹⁷ Consumption of under-cooked beef was reported to be associated with an increased risk of campylobacteriosis in France as well.¹⁸ We could not rule out the possibility that contamination of the food was introduced by an infected food handler as their stool specimens were unable to obtain for laboratory testing. No food items were available for testing as every food item was discarded on the day of the event.

Another possible risk factor could have been the pond located near the girls' hostel at the school. Although this pond water was grossly contaminated with fecal coliform bacteria, it was generally believed to be holy

water. This could have encouraged many visiting students to drink the pond water, and some might have opted to drink the pond water in order to avoid the crowds around tap water outlets.

The presence of coliform bacteria in the water supply indicated that the piped water could also have been a source of infection. Gastroenteritis outbreaks related to unchlorinated drinking water had been reported by other studies conducted in Taiwan, China, Switzerland, Sweden and Finland.^{14,15,18-20}

Campylobacter were found in the intestines of many domestic and wild animals, including rodents and a variety of birds, and fecal droppings from such infected animals could introduce *Campylobacter* into water supplies.^{21,22} In addition, continuous rainfall could have washed away human or animal feces which contaminated the water. The failure to isolate *Campylobacter* from the water supply might be explained by the technical difficulties in isolating these organisms from water even though the organism has been reported to survive in water at low temperatures for long duration²³. Therefore, the possibility of transmission of these organisms by drinking water directly from outlet water taps as well as through handling of water could not be overlooked, especially in a setting with poor hygiene and sanitation.

Health education was given to every student, teacher and cook by visiting all schools in Bumthang District about importance of food hygiene and sanitation. The affected students were managed with antibiotics and asked to increase fluid intake in addition to oral rehydration solution provided in the health center. The team also recommended the school management to be more vigilant when food was served at mass gatherings and ensure that foods were cooked properly.

Conclusion

This was the first documented gastroenteritis outbreak related to a sport event at seven schools in Bumthang, Bhutan. This large outbreak which took place in a mass gathering highlighted the importance of food hygiene and water quality in preventing foodborne outbreaks during such events.

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Suggested Citation

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