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Short Communication

Clinico epidemiological investigation of an outbreak of food poisoning in a girl's hostel of an educational institute

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ABSTRACT

Food poisoning results from ingestion of contaminated food or beverages, commonly presenting as gastroenteritis. Prompt epidemiological investigation is essential for source identification and prevention. In February 2025, following a farewell celebration at a girl's hostel of an educational institution in India, multiple students developed acute gastroenteritis. The event was catered for by an external vendor, and all affected individuals were female students. Objective was to determine the magnitude, source, and causative agent of the outbreak, and to identify contributing environmental and epidemiological factors. A retrospective cohort study was conducted. All symptomatic individuals were included as cases. Data on symptoms, exposure history, and food consumption was collected via interview and medical record review. Attack rate (AR), relative risk (RR), and attributable risk (AR%) were calculated for each food item. Seventeen of 160 students (AR 10.6%) developed symptoms within 8-24 hours post-exposure. Diarrhoea occurred in all cases, vomiting in 66%, abdominal pain in 76.4%, and fever in 11.8%. Gol Gappa (AR=9.95%) and rice (AR=6.79%) were most strongly associated with illness. Based on symptomatology and incubation period, *Salmonella typhimurium* was the most probable causative agent; microbiological confirmation was not possible due to lack of food samples. A small-scale outbreak of food poisoning was linked to consumption of Gol Gappa and rice, likely contaminated due to improper handling and storage. Strengthened food hygiene practices and timely outbreak investigations are crucial to prevent recurrence.

Keywords: Food poisoning, Outbreak, Hostel, Salmonella

INTRODUCTION

Food poisoning is defined as an illness caused by ingestion of food or drinks contaminated with living bacteria or their toxins, or inorganic chemical substances and poisons derived from plants and animal.[1] Contaminated foods commonly cause gastroenteritis, which is infection and inflammation of the digestive system. The symptoms of gastroenteritis include abdominal pain, diarrhoea and vomiting. For many people, symptoms settle within a few days. However, some people, particularly the very young, the elderly, pregnant women, and people with underlying health problems or a weakened immune system, may experience more severe disease and complications, including death. The clinical presentation of foodborne diseases varies depending on the causative agent.[2]

Foodborne illnesses are broadly categorized into bacterial and non-bacterial aetiologies. Predominant bacterial

pathogens implicated in food poisoning include *Salmonella* spp., *Staphylococcus aureus*, *Clostridium perfringens, Bacillus cereus, Escherichia coli,* and *Clostridium botulinum*.[3-10] In the domain of non-biological causes, heavy metals have historically been recognized as toxic agents; however, over the past several decades, the role of synthetic organic compounds particularly agricultural pesticides has gained increasing epidemiological and toxicological relevance.[11-13]

Serious cases may result in life-threatening neurologic, hepatic, and renal syndromes, which may further lead to permanent disability or death. Majority of the cases being mild recover without any specific treatment. Some patients with severe disease do require hospitalization, aggressive hydration, and antibiotic treatment.[14] A foodborne disease outbreak is operationally defined as the occurrence of two or more epidemiologically linked cases of illness exhibiting a similar clinical presentation, attributable to the consumption of a common contaminated food source.[15]

Worldwide foodborne infections are a leading cause of illness and death. The resulting diarrheal disease can have long term effects on the growth of children, besides their physical and cognitive development. In industrialized countries, foodborne infections cause considerable illness; and heavily affect the healthcare systems.[16] Food borne illnesses being diverse in aetiology, can follow ingestion of infectious organisms or non-infectious substances. Food borne diseases (FBDs) constitute a serious public health problem in the United States. Food borne diseases include classic toxin mediated food poisoning, e.g., botulism, gastroenteritis following ingestion of preformed *Staphylococcus aureus* toxin, ingestion of chemicals in foods, besides bacterial, parasitic, and viral infections.[17] Systematic investigation of food poisoning outbreaks is essential to elucidate their epidemiological, clinical, and microbiological dimensions, ultimately informing strategies for prevention and control in future occurrences. The present study delineates the findings of a food poisoning outbreak investigation in a girl's hostel of an educational institute.

The institution accommodates approximately 160 students across all academic years. On the occasion of one batch passing out, a farewell celebration was organized in the evening of 05 February 2025 within the hostel premises. An external vendor was engaged for the event, who prepared and served the food on-site within the hostel premises.

On the early morning of 06 February 2025, 03 individuals from a training institution presented to the local primary health centre/dispensary with primary complaints of diarrhoea, fever, severe myalgia, nausea, vomiting, and abdominal pain. Over the course of the day, an additional 05 individuals developed similar symptoms and sought medical attention by 2200 hours. All eight symptomatic individuals were subsequently referred to the nearest tertiary care hospital for further evaluation and management.

On 07 February, 09 more individuals reported with similar gastrointestinal symptoms consistent with foodborne illness and were also referred for tertiary-level care. This brought the total number of referred cases to 17, thereby confirming a cluster of food poisoning within the institution.

Objectives of our epidemiological iinvestigation were to assess the extent and severity of the outbreak to quantify its public health impact, to investigate the underlying environmental, and epidemiological factors contributing to the occurrence of the outbreak; and to ascertain the etiological agent, identify the probable source(s) of infection, and delineate the mode(s) of transmission.

METHODS

Research design

The study design was a retrospective cohort study design. The study was carried out in the Girls hostel of an educational iinstitution in a Metro city in India in the year 2025.

Data collection

All individuals giving history of gastrointestinal symptoms were included as cases. Relevant epidemiological history was taken from all the cases and recorded on an epidemiological case sheet. Case sheets and laboratory reports were perused for abnormally high incidence of other food and water borne diseases. Search for more cases was made by visiting private practitioners and government civil hospital of the city. No additional cases were found by medical survey other than those who had already reported sick. Data obtained from all the above sources for all cases was analysed. Meteorological data was also noted. Ethical approval of the institutional ethical committee was obtained prior to data collection.

RESULTS

Person distribution

All 17 (100%) reported cases were female trainees enrolled in the educational institution, which, as per policy, admits only female students. No institutional staff members were affected. A total of 160 individuals had consumed dinner on the evening of 05 February 2025, prior to the onset of symptoms.

Clinical profile

Diarrhoea

(Prevalence=100%). Out of the 17 reported cases, all individuals experienced diarrhoea, characterized by the

passage of loose, yellowish stools without any evidence of blood in stool.

Onset

The onset ranged from 08 hrs to 36 hours post consumption of the suspected meal.

Frequency

The frequency of diarrhoeal episodes varied from a single occurrence to more than six episodes per day.

Fever

Out of 17 reported cases, 02 individuals exhibited mild to moderate pyrexia, with recorded body temperatures ranging from 99-103°F. This gave prevalence of 11.76%.

Pain abdomen/headache/ body ache/ fatigue

Out of 17 patients, 13 patients experienced cramping pain abdomen, thereby giving a prevalence of 76.4%.

Vomiting

(Prevalence=66%), patients reported episodes of vomiting, with the emesis predominantly comprising yellowish, partially digested food matter. The vomitus was neither bile-stained nor blood-tinged.

Treatment

All cases were clinically mild in nature and were managed with supportive treatment, including antibiotics, oral rehydration solution (ORS), and intravenous fluids. Patients were observed for several hours and subsequently discharged. An additional consideration in not admitting cases was scheduled award distribution ceremony for the passing out batch on the following day. During the award ceremony event a few individuals experienced transient episode of faintness and postural instability due to mild persistent weakness but recovered fully with prompt first aid.

AR, RR; and attributable risk of various food items consumed by the students is tabulated in Table 1.

Time distribution

The temporal distribution of cases indicated that all individuals developed symptoms within 08 to 24 hours following consumption of the implicated food item. An epidemic curve illustrating the hour-wise onset of cases is presented in Figure 1.

Possible source of the food poisoning was one of the food items, cooked and consumed on night of 5 February 2025 possibly Gol Gappas (AR=9.95%)/rice (AR=6.79%).

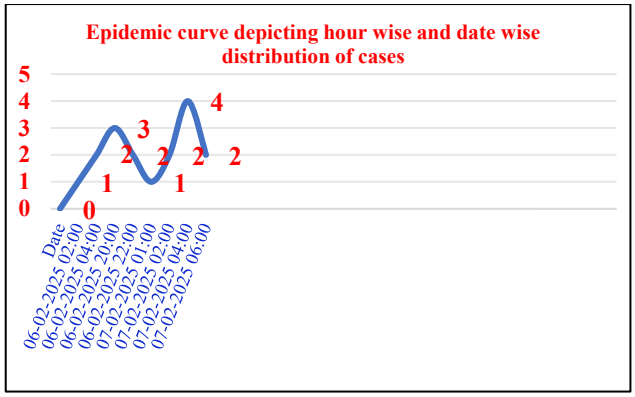

Figure 1: Epidemic curve.

Possible causative organism

Based on the clinical manifestations observed among affected individuals and the documented incubation period of the illness, *Salmonella typhimurium* emerges as the most plausible etiological agent. The association between the clinical profile and potential microbiological causes is illustrated in Table 2. However, due to the absence of preserved food samples, direct microbiological confirmation from the implicated food source could not be undertaken. The catering was outsourced to an external vendor, who subsequently retrieved all leftover food and disposed of it at an unspecified location, thereby precluding laboratory analysis.

Environmental factors which likely enabled the outbreak to occur

Environmental factors contributing to the outbreak were examined in detail. Gol Gappa, along with its accompanying water, was one of the food items served during the evening party on 05 February 2025. Many of the students also gave the history that the Gol Gappas were soggy, and sour in taste. Both components i. e., Gol Gappa and its accompanying water were procured from a local vendor and prepared several hours prior to consumption, then stored at ambient temperature without refrigeration. The water was repeatedly handled during serving, increasing the risk of microbial contamination. Inadequate hygienic practices during preparation, storage, and service likely facilitated contamination of both the Gol Gappa and its water with *Salmonella typhimurium*.

Evaluation of ecological factors

Evaluation of ecological factors was undertaken at the site of the outbreak. Overall hygiene and sanitation at the party venue were found to be satisfactory. Nevertheless, the possibility of contamination of certain food items served during the evening event on 05 February 2025, particularly Gol Gappa and its water, cannot be excluded. Waste disposal practices at the venue were adequate, and daily monitoring of free chlorine levels in the supplied water confirmed its presence at the consumer end.

Table 1: AR, RR and attributable risk of various food items consumed by the students.

Food items	Those who ate the item				Those who did not eat the item				RR	Attributable risk
	Became sick	Did not become sick	Total	AR among those cases who consumed the item	Became sick	Did not become sick	Total	AR among those cases who did not consume the item		
(a)	(b)	(c)	(d)	(e)=b/dx 100	(f)	(g)	(h)	(i)=f/hx 100	(j)=e/i	(k)=e-i
Gol Gappa	16	109	125	12.8	1	34	35	2.85	4.49	9.95
Cold drink	8	97	105	7.61	9	46	55	16.36	0.47	-8.74
Rajma	10	105	115	8.69	7	38	45	15.56	0.56	-6.87
Rice	15	108	123	12.20	2	36	37	5.41	2.26	6.79
Baingan	4	103	107	3.74	13	40	53	24.53	0.15	-20.79
Poori	9	94	103	8.74	8	49	57	14.04	0.62	-5.30
Gajar halwa	7	88	95	7.37	10	55	65	15.38	0.48	-8.02
Chapati	2	107	109	1.83	15	36	51	29.41	0.06	-27.58
Paneer	6	100	106	5.66	11	43	54	20.37	0.28	-14.71
Raita	3	108	111	2.70	14	35	49	28.57	0.09	-25.87
Chicken curry	3	96	99	3.03	14	37	61	22.95	0.13	-19.92
Peanuts	1	104	105	0.95	16	39	55	29.09	0.03	-28.14
Custard	1	106	107	0.93	16	37	53	30.19	0.03	-29.25

Table 2: Correlation of clinical picture with microbiological cause.

Micro organism	Clinical features									
	Diarr	Vom	Nausea	Fev	AC	BIS	DE	NS	Median incubation period	Remarks
S. aureus	+	+++	+++	-	-	-	-	-	½ to 6 hrs.	
***B. cereus* type I**	+	+++	+++	-	-	-	-	-	½ to 6 hrs.	
S. typhimurium	+++	+	++	+++	+	-	++	-	14 to 30 hrs.	
C. perfringens	+++	+	+	+	+++	-	-	-	12 to 18 hrs.	
***B. cereus* type II**	+++	+	+	+	+++	-	-	-	12 to 18 hrs.	
Shigella	+	+++	+++	+++	+++	-	++	-	4 to 6 hrs.	
C. botulinum	+	+++	+++	+++	+++	-	++	+++	4 to 24 hrs.	
Present episode	+++	+	+	+	+	-	++	-	Avg. 22 hrs.	*S. typhimurium*

*Legend: Diarr=Diarrhea, Vom=Vomiting, Nau=Nausea, Fev=Fever, AC=Abdominal cramps, BIS=Blood in stools, DE=Dehydration, NS=Neurological symptoms.

DISCUSSION

In recent years, emerging and re-emerging foodborne pathogens have presented significant public health challenges. Despite advancements such as cold chain logistics, chemical preservatives, and improved microbiological insights, foodborne illnesses remain a major concern across both developed and developing nations.[18,19]

A study by Pardal et al documented a localized outbreak of foodborne illness that had occurred within an officers' mess. Based on clinical presentation and epidemiological assessment, *Salmonella typhimurium* was suspected as the most probable causative agent. However, definitive microbiological confirmation could not be achieved due to the absence of food samples at the time of investigation.[20] Present study has carried out under same study methodology.

Salmonella has historically been one of the leading etiological agents of foodborne infections and, until 2005, was the most frequently reported foodborne pathogen in Europe.[21] In 2006, salmonellosis ranked as the second most common foodborne infection in the European Union (EU), with a notification rate of 34.6 cases per 100,000 population.[22] The incidence of salmonellosis has markedly declined following the rigorous implementation of targeted control measures, resulting in nearly a 50% reduction in reported human cases between 2004 and 2009. This trend has been paralleled by a substantial decrease in the prevalence of *Salmonella* contamination in poultry populations. Despite these advances, *Salmonella* continues to pose a major global public health challenge, with an estimated 94 million cases of gastroenteritis annually, including approximately 155,000 associated deaths. *Salmonella enteritidis* and *Salmonella typhimurium* remain the most frequently isolated serovars worldwide. The economic impact of human salmonellosis in Europe alone is estimated at approximately 3 billion euros annually.[22]

Globally, in 2022, Udani reported a total of 369 confirmed and probable cases of Salmonella Typhimurium infection associated with the consumption of Belgian chocolate.[23] Furthermore, *Salmonella Typhimurium* has historically been implicated in 153 documented outbreaks during the period from 1983 to 1987.[24] Lanier et al and Singh et al reported chicken liver as the incriminating food item in several food poisoning outbreaks in the US.[25,26]

Between 1973 and 1997, a total of 604 outbreaks of foodborne illness were reported in school settings. The median annual number of reported outbreaks was 25, with a range of 9 to 44 per year. Etiological agents could not be identified in 60% of outbreaks, and in 45% of cases, the specific food vehicle responsible for transmission remained undetermined. Among outbreaks with confirmed etiology, *Salmonella* emerged as the most frequently identified pathogen, accounting for approximately 36% of cases. The most implicated food vehicles included poultry (18.6%), salads (6.0%), Mexican-style cuisine (6.0%), beef (5.7%), and dairy products excluding ice cream (5.0%). Contributing factors most frequently reported were improper food storage, inadequate holding temperatures during storage, and contamination of food by handlers.[20,27]

Employing a mixed-methods design integrating a structured survey of 530 participants with ethnographic observation at 120 street food vending sites, Ribadeau Dumas interrogated the gendered dimensions of street food consumption in Purnea, a rapidly urbanizing urban center in North India. The findings reveal a pronounced gender asymmetry in culinary preference, with approximately three-quarters of female respondents identifying Gol Gappa (pani puri) as their favored snack, in contrast to the more heterogeneous gustatory choices reported by male respondents, which encompassed tea, samosas, and momos. Ethnographic data further indicate that Gol Gappa stalls disproportionately attract female clientele relative to other street food outlets.[28]

A recent feature based on a survey reported that 75% of women identified Gol Gappa (pani puri) as their preferred street snack, a proportion notably higher than that observed among men. The article contextualizes this preference within the broader sociocultural landscape, suggesting that in a society where women's mobility, time, and leisure in public spaces are often constrained, consuming Gol Gappa may represent one of the few socially acceptable and "guilt-free" pleasures available to them in public life (BoloBolo Show).[29]

In the present study, it was observed that nearly all trainee students, all of whom were female, consumed Gol Gappa, notwithstanding their expressed perception that it was soggy and sour in taste. The findings of our study are consistent with the findings of both the above studies.

In the present investigation, among the food items evaluated, rice demonstrated an attributable risk (AR) of 6.79%, while Gol Gappa exhibited an AR of 9.95%, suggesting a comparatively higher potential contribution of Gol Gappa to the observed outbreak, although both values indicate a modest attributable risk in epidemiological terms.

Limitations

No microbiological confirmation could be carried out as no food sample was available for carrying out microbiological confirmation.

CONCLUSION

A small-scale outbreak of food poisoning occurred in mess of a teaching institution. Gol Gappas and rice dish are found be most likely reason for the outbreak. No

microbiological confirmation could be carried out as no food sample was available for carrying out microbiological confirmation. The catering was outsourced to an external vendor, who subsequently retrieved all leftover food and disposed of it at an unspecified location, thereby precluding laboratory analysis.

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