Food Poisoning Outbreak in Tikrit City, Iraq, 2013: Staphylococcus aureus and Salmonella Typhimurium were the Incriminated Pathogens

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ABSTRACT:

BACKGROUND:

On June, 22nd, 2013, Communicable Disease Control Center (CDCC) in Baghdad notified on an outbreak of Food Poisoning (FP) involving more than 100 persons attending a restaurant in Tikrit City, Salah Al Din province on21st, June.

OBJECTIVE:

to identify source, and causative agents of the outbreak.

PATIENTS AND METHODS:

A case seeries study conducted on accessed cases in Tikrit and Sala Al Din hospitals. Information on basic, clinical and food item consumed were collected using a questionnaire. Environmental assessment of the restaurant using a standardized checklist and bacteriology testing of food samples, patients' stool specimens and different specimens from food handlers were conducted. **RESULTS**:

A total of 214 persons who attended the restaurant sought medical care for acute gastroenteritis; 82 (38.3%) were admitted. Only 175 patients (including 11 affected food handlers) were accessed. Main symptoms were diarrhea (92.5%), nausea (87.5%), and vomiting (84.5%). Apart of one death, all other patients recovered completely. 32% of patients' stool samples were positive for *Salmonella typhimurium, and 30% of* food specimens were positive for *Staphylococcus aureus*, and 10% for *coliform bacteria; 13* food handlers were examined and specimens of blood, urine; and stool, and under the finger nail swabs, were negative. Health inspection of the restaurant revealed unhygienic food processing and poor personal hygiene of food handlers.

CONCLUSION:

Staphylococcus aureus and *Salmonella typhimurium* were the responsible pathogens. Contaminated food stuff and unhygenic foodhandlers practices were the source. Strengthening the role of health inspection, and upgrading local laboratory capacity were recommended.

KEY WORDS: food poisonings, outbreak, staphylococcus aureus, salmonella typhimurium

INTRODUCTION:

Food poisoning (FP) is a common, costly-yet preventable-public health problem ⁽¹⁾. Immediate notification and reporting of these diseases or outbreaks by physicians, and other public and

private health care providers to local health departments are recommended $^{(1, 2, 3)}$.

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Foodborne disease outbreaks are recognized by the occurrence of illness within a variable but usually short time period after a meal, among individuals who have consumed foods in common ^(4,5). It is more commonly occurred after eating at picnics, school cafeterias, large social functions, or restaurants ⁽⁶⁾. Main symptoms include: diarrhea, nausea and vomiting, abdominal cramps, fever, etc ^(4,7). Food may become contaminated during production, processing, distribution or during preparation and handling ^(6,8).

Foodborne illnesses are classified as *infections* or *intoxications*. *Foodborne Infections* are caused by

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consuming foods or liquids contaminated with bacteria, viruses, or parasites that cause infection. This will lead to either invading and multiplying in the lining of the intestines and/or other parts of the body, or invading and multiplying in the intestinal tract and releasing a toxin (Bacteria only). *Foodborne Intoxications* are caused by consuming foods or beverages already contaminated with toxins from bacterial, poisonous chemicals, or natural toxins found in animals, plants, and fungi ^(9,10).

Globally, the incidence of foodborne disease due to microbiological hazards is increasing as a result of changes in farm practices, extensive food distribution systems, changes in eating patterns, increasingly longer interval between processing and consumption of foods and the increasing prevalence of eating food prepared outside the home ⁽¹¹⁾.

WHO estimates that food and waterborne diarrheal diseases kill about 2.2 million people annually, 1.9 million of them are children ⁽¹²⁾. In USA, 1 in 6 Americans (48 million people) gets sick, 128,000 hospitalized, and 3,000 die of foodborne diseases annually ^(1,9,13). Related medical costs and lost wages are significant, accounting for a yearly loss of up to \$17 billion ^(9,10). In UK, it is estimated that foodborne diseases affect around a million people annually; around 20,000 people receive hospital treatment; cause 500 deaths; and cost nearly £1.5 billion⁽¹⁴⁾. In Australia, FP results on average in 5.4 million cases a year (including 120 deaths), 1.2 million visits to doctors, 300,000 antibiotics prescriptions. It costs annually about \$1.25 billion and 2.1 million days of lost work $^{\left(15\right) }.$

In Iraq, although FP outbreaks occurred frequently, they are rarely notified, investigated or documented. A mass outbreak of organo-mercury poisoning due to consumption of treated grain by farmers and their families occurred in Iraq in 1971-72, leading to admission of 6,530 cases, and 459 deaths ⁽¹⁶⁾. In the last few years several FP outbreaks were notified from military camps and universities and other settings, but unfortunetally most were inadequately investigated or published. ^(17, 18)

OBJECTIVE:

Of this investigation were to describe the outbreak by person, place and time model, identify the cause and source of infection, and develop suitable recommendations.

METHODS:

Outbreak Notification: On June, 21st, 2013, CDCC in Baghdad notified about an outbreak of FP involving more than 100 patients who attended a restaurant in Tikrit City. Patients sought medical care from Tikrit and Salah Al Din Hospitals. All were complaining of signs and symptoms of FP after eating in that restaurant.

After getting administrative approval, the investigating team composed of FETP residents, CDCC, CPHL and Health Inspection Department employees and Salah Al Din communicable diseases, and health inspection sections was dispatched on 23rd, June. WHO, US CDC and other guidelines of FP outbreaks were reviewed, and used to develop the questionnaire.

Epidemiological investigation: The FP case was defined as a person with diarrhea (three or more loose stools during a 24-hours period) or vomiting who had eaten food from that restaurant during 21st, June, 2013. Cases were identified from the

registry books in emergency room and hospital wards in Tikrit and Salah Al Din Hospitals.

A questionnaire was developed and filled through direct interview with accessed cases. It gathered demographic information (age, sex, and job), clinical information (signs/symptoms, date and time of food consumption and onset, and treatment outcome) besides food items consumed.

Thirteen food handlers were examined by a physician and a dermatologist for obvious illness and skin lesions.

Environmental investigation: The restaurant's environment and food processing and handling techniques were assessed by health inspection team, using their standard checklist and interviews with the food handlers. Twenty specimens of leftover food and raw materials were sent for bacteriology testing in Kirkuk Public Health Lab (PHL).

Microbiological investigation: Twenty-five stool samples from the cases were tested for bacteriology in Tikrit PHL and then sent for Baghdad CPHL for confirmation and further tests. Under the fingernail swabs, blood, urine and stool samples were taken

from 13 food handlers and sent for bacteriology testing in Baghdad CPHL.

RESULTS:

Epidemiological data: Out of 214 cases complaining of signs and symptoms of gastroenteritis following consuming meals in the

restaurant sought medical treatment from Tikrit and Salah Al Din Hospitals; 82 (38.3%) required hospital admission. The most affected age groups were 26-35y (32.2%) and 16-25y (29.9%). Mean age was 26.5y. Males represented 59.3% of the cases (Table 1).

Age group	Sex		Total
(Years)	Male (%)	Female (%)	(%)
< 5	3(27.3)	8(72.7)	11(5.1)
5-15	12(46.2)	14(53.8)	26(12.1)
16-25	42(65.6)	22(34.4)	64(29.9)
26-35	46(66.7)	23(33.3)	69(32.2)
36-45	21 (67.7)	10(32.3)	31(14.5)
> 45	3 (23.1)	10(76.9)	13(6.1)
Total	127 (59.3)	87 (40.7)	214 (100)

Table 1: Age and sex distribution of food poisoning cases, Tikrit, 2013.

Only 175 cases (including 11 affected food handlers) were accessed and interviewed. Of these, 148 (84.5%) were civil workers, 16 (9%) were military recruits and 11 (6%) were food handlers. About one hour after eating in the restaurant, two cases aged 26 and 44 years developed nausea, vomiting, diarrhea and abdominal cramps.

Subsequently, FP cases continued showing up to the emergency units in both hospitals.

Epi-curve (Fig.1) shows that all interviewed cases developed FP signs and symptoms between 1-19 hours after food consumption in the restaurant. More than two-thirds of cases experienced illness within eight hours of food consumption.



Fig.1:Epi-curve of the food poisoning outbreak, Tikrit, 2013

The main signs and symptoms (in order of their frequencies) were diarrhea, nausea, vomiting; and

abdominal cramp (Fig 2). Only one death occurred due to acute renal failure. All other cases recovered completely without any complication.



Fig 2: Frequency distribution of signs and symptoms of food poisoning cases, Tikrit, 2013.

There was 17 food items served on the afternoon and evening of 21^{st} , June at the restaurant. The proportion of patients consumed different types of food items served are shown in figure 3. The attack

rate ratios for the specific food items were not calculated as there was no control group. Also, we couldn't find the receipts that can serve as a denominator and gave a clue about number of attendees and served food items.



Fig 3: Proportion of food poisoning cases consumed different food items, Tikrit, 2013

Environmental data: Environmental assessment conducted by health inspection team revealed that gloves were not used, and temperatures of cooked and cooled foods were not checked. Also, hands, cooking utensils, vegetables and other food stuffs were inadequately washed. The overall personal hygiene of food handlers was unsatisfactory. Interviewing food handlers revealed that: only one worker (of the thirteen interviewed) had a valid health card, three workers had history of diarrhea 2-3 days before the outbreak (all were in direct contact with served food stuff) and none had

attended food safety education and training session held by Health Inspection Section.

Microbiological data: From the 25 stool samples cultured for common gastrointestinal pathogens; eight (32%) were positive for *Salmonella typhimurium*. Six (75%) of these growths were shared same sensitivity and resistance. All stool, blood, urine and under the fingernail swabs samples from the food handlers showed no growth. Eight of 20 (40%) leftover food samples showed bacteriological contamination. Six of them were contaminated with *Staphylococcus aureus* while the other two were contaminated with *Coliform* bacteria (Table 2).

Food Item	Source	Results	Contaminant Organism
Hummus Be tehina	Local	Not valid	Staphylococcus aureus
Aborigine Salad	Local	Valid	
Cucumber and Yoghurt Salad	Local	Valid	
Beef Shawarma	Local	Valid	
Chicken Shawarma	Local	Not valid	Staphylococcus aureus
Fried Lamb	Local	Not valid	Staphylococcus aureus
Stuffed Chicken	Local	Valid	
Yellow Rice	Local	Not valid	Coliform Bacteria
Red Rice	Local	Valid	
White Rice	Local	Valid	
Kebab (not Barbecued)	Local	Not valid	Coliform Bacteria
Lamb meat (not fried)	Local	Valid	
Lamb Kofta (raw, not	Local	Not valid	Staphylococcus aureus
Barbecued)			
Chicken Kofta (raw, not	Local	Not valid	Staphylococcus aureus
Barbecued)			
Olive Salad	Local	Not valid	Staphylococcus aureus
Potato and Hummus Salad	Local Valid		
Bean Soup	Local 172 d		
Spaghetti	Local	v and	
Pepsi Cola	Local	Valid	
Yoghurt (Activia)	Import	Valid	
	ed		

Table 2: Bacteriology tests results of leftover food items, Tikrit, 2013.

DISCUSSION:

Too often, outbreaks of foodborne disease go unrecognized, unreported or not investigated. Many resources are available for the investigation of foodborne disease outbreaks, but few are directed at developing countries ⁽¹⁹⁾.

CDC guide to confirm diagnosis of foodborne disease gives the differential diagnoses for such outbreak ⁽²⁰⁾. The short incubation period, abrupt appearance of the signs and symptoms and the microbiology results for cases' stool samples and leftover food items, pointed to *S.aureus* and *S.typhimurium* as the incriminated organisms for this FP outbreak. No tests for *S. aureus* enterotoxin identification or quantification and no *S. typhimurium* serotyping and phage typing were available.

S.aureus FP was confirmed by isolation of the micro-organism from six implicated food items and the clinical presentation. Longitudinal studies showed that about 20% of individuals are persistent *S.aureus* nasal carriers, 30% are intermittent carriers and about 50% are non-carriers ⁽²¹⁾. Foods commonly implicated in FP outbreaks caused by *S. aureus* include cooked meats and poultry ^(22, 23).

This is consistent with microbiology results of leftover food items.

Non-typhoid *Salmonella* was confirmed by isolation of *S.typhimurium* of same strain from stool specimens of eight ill persons. Foods commonly implicated in FP outbreaks caused by *S. typhimurium* included meat, poultry, fish, shellfish and raw vegetables.

One aspect in investigations of FP outbreaks is to determine how implicated foods become contaminated. Food can be contaminated during production and processing or during preparation and handling. During production and processing; animals naturally harbor many foodborne bacteria in their intestines that can cause illness in humans, but often not in the animals. During slaughtering, meat and poultry carcasses can become contaminated when exposed to small amounts of intestinal contents. Other foods, such as fruits and vegetables, may be contaminated if washed or irrigated by water contaminated with pathogens from animal or human feces ^(9, 10).

During *preparation* and handling. crosscontamination between food items occurred when the same cooking equipment and utensils used without washing or disinfection. Since, most foodborne pathogens are shed in the feces of infected persons and these pathogens may be transferred to others via the fecal-oral route (9, 10, 24). Specifying the food item causing the outbreak and detecting the pathogen is not always possible; accordingly epidemiological methods are used to decide on the food causing the outbreak. In this outbreak, the attack rate ratios of different food items cannot be calculated since there was no comparison group.

Environmental investigations showed unsatisfactory personal hygiene and unhygienic food processing, which suggested that both crosscontamination and infected individuals were responsible for transmission of the pathogens.

Contamination during production and processing, or cross-contamination in the kitchen, was reported as a contributing factor in one-third of outbreaks identified in U.S data of FP outbreaks compiled by CDC from 1998 to 2002 ⁽²⁵⁾. Furthermore, any surface touched by infected workers while preparing food can easily become contaminated ⁽²⁶⁾. Cross-contamination from activities such as use

²⁷⁾. Cross-contamination from activities such as use of the same cutting board for chicken, meat and salad without intermediate cleaning or spreading of pathogens via the kitchen environment seems to be of great importance.⁽²⁸⁾

Studies of FP outbreaks emphasized the role of food handlers in the spread of the disease. The most frequently reported factors associated with involvement of infected worker were bare hand contact with food without proper hands' washing, inadequate cleaning of processing or preparation equipment or utensils, cross-contamination of ready-to-eat foods by contaminated raw ingredients, and temperature abuse. ^(29, 30)

The main limitations of the study were unavailability of important lab investigations, and lack of a comparison group.

CONCLUSION:

S.aureus and *S.typhimurium* were the incriminated pathogens. Contaminated food and unhygienic practices of food handlers act as the source and mode of transmission. Strengthening health inspection role through regular examination and training of food handlers, and monitoring restaurant

environment and food processing, enhance timely investigation, and response to FP outbreak, and raising capacity of PHL through provision of necessary investigations were recommended.

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