Epidemiological and Clinical Characterization of Staphylococcal Food Poisoning at a Military Training School in Zarqa: Report of an Outbreak

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ABSTARCT

Objective: To report and to determine the cause and source of food poisoning which occurred at a Military Training School in Zarqa at July 15th 2009, and to characterize staphylococcal food poisoning.

Methods: A total of 243 students who developed signs and symptoms of suspected food poisoning at a Military Training School in Zarqa on July 15th 2009 were interviewed using a structured special food poisoning questionnaire. Data were transferred to a specified food poisoning attack rate table where the incubation period, attack rates, attributable risks, relative risks, chi square, confidence intervals and p-value were calculated. Stool specimens, food and water samples were collected and analyzed.

Results: The data collection, laboratory and environmental sanitation indicate that this food poisoning was caused by Staphylococcus aureus and the incriminated food was the dairy product (Labanah) component of a breakfast meal.

Conclusion: This outbreak highlights the public health significance of positive food poisoning outbreaks that may involve a large number of people in a close community.

Key words*:* Epidemiology, Outbreak, Staphylococcus aureus.

JRMS March 2015; 22(1): 75-78 / DOI: 10.12816/0009791

Introduction

Food borne diseases (FBD), including food borne intoxications and food borne infections, are terms applied to illnesses acquired through consumption of contaminated food; they are frequently and inaccurately referred to as food poisoning. These diseases include those caused by chemical contaminants such as heavy metals and many organic compounds; the more frequent causes of food borne illnesses are: (1) *Toxins* elaborated by bacterial growth in the food before consumption (*Staphylococcus aureus* and *Bacillus cereus*, (2) *Bacterial*, *Viral*, and *Parasitic* infections (*Brucellosis*, *Campylobacter enteritis*, *E.coli*, and (3) *Toxins* produced by harmful algal species.[1] Surveillance of food borne illnesses is complicated by several factors, the first is underreporting, although food borne illnesses can be severe or even fatal.[1]

Among the bacteria involved in these diseases, Staphylococcus aureus is a leading cause of gastroenteritis.[2] FBDs are defined by the World Health Organization (WHO) as "Diseases of infectious or toxic nature caused by, or thought to be caused by the consumption of food or water".[3] FBDs outbreaks are recognized by the occurrence of illness within a variable but usually

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Manuscript received April 30, 2014. Accepted September 4, 2014

short time period; also many countries defined FBD outbreaks as the occurrence of two or more cases of a similar illness resulting from the ingestion of a common food.[1,3] FBDs are suspected of ~ 76 million illnesses, 325,000 hospitalization and 5,200 deaths each year.[3] The symptoms of Staphylococcal food poisoning are abdominal cramps, nausea, vomiting, sometimes followed by diarrhoea (never diarrhoea alone), the onset of symptoms is rapid from 30 minutes to 8 hours, usually 2-4 hours, and spontaneous remission is observed after 24 hours.[1,3]

Methods

A total 243 students at the Military School in Zarqa ate their breakfast on July 15th, 2009. The meal was prepared at the school's kitchen. A number of school students developed clinical signs and symptoms of food poisoning within few hours after breakfast and were investigated to determine the source and the agent of the outbreak. All the students were males with age range of 18-24 years (mean age 21 years). All attendants of the breakfast meal were included in the investigation. The breakfast meal consisted of olives, milk, hummus, cheese and dairy product (labaneh),

Collection of field data was performed through face to face interviews of the 243 students at the Military School, using a special food poisoning structured questionnaire. The interviews were conducted by two trained physicians on the same day of the outbreak. The questionnaire covered the following data: clinical details of the illness such as nausea, cramps, vomiting, diarrhoea, fever, time of onset following breakfast and details of consumed foods. A case was defined as a person who experienced at least one of the following symptoms within 12.5 hours of eating the school meal: cramps, nausea, vomiting or diarrhoea (three or more loose stools). Staphylococcal food poisoning was defined as a gastro-intestinal illness in two or more persons with a common food exposure and adequate isolation of $10^{(5)}$ or more micro-organisms from the implicated food.

Stool specimens for culture were collected from ill students and food handlers. No food handlers had symptoms or signs suggesting skin infections. Food samples were also obtained for bacteriological and toxicological analysis. Also nasopharyngeal swabs were taken from all eight asymptomatic food handlers working in the military school kitchen; all these samples were sent to specialized laboratories: Jordan Military Laboratory for Quality Control and Princess Iman Centre for Research and Laboratory Sciences.

Sanitation

A complete kitchen sanitation inspection was conducted at the school on the day of the outbreak. The inspection included the refrigeration, food preparation procedures, general cleanliness, water tanks and general condition of kitchen equipment. Eight water samples were collected from different sites and sent for bacteriological examinations.

Data Analysis

All information obtained from the questionnaire was transferred into specific food poisoning attack rate table. Attack rates for those who had eaten and those who had not eaten the specified food item were calculated using the formula of: Attack rate, Attributable, Relative risk, X^2 (Yate's correction), Confidence interval (CI) and p-value.

Results

Face to face interviews revealed that of the 243 cadets interviewed, 146 (60%) were ill, and met the case definition. Of those, 54 students (37%) were discharged following supportive treatment at the Emergency Department and 92 (63%) were treated at the school clinic (Table I). Regarding the most common symptoms and complaints, the most common complaint was vomiting (86%) followed by abdominal cramps (79%) and diarrhoea (66%). Subjective fever was reported by 4% patients only, as shown in Table II.

Table III demonstrated that the highest attack rate was for the Labanah compared with other food items. Similarly the attributable risk was also highest in the Labanah meal (67%). The risk of eating Labanah was 35 times more than the risk of eating other food items. Calculated chi-square was 14.2, $p<0.0001$ and 95% confidence interval = 8.4, 130.7 as shown in Table IV.

Laboratory Results

Results of the microbiological analysis of the food samples are summarized in Table V.

Table I: Number of ill students interviewed in the outbreak

Interviewed students	Number	%
Ill	146	60
Well	97	40
Total	243	100

Table II: The number of signs and symptoms among ill patients

Signs & Symptoms	Number	%
Vomiting	127	86
Abdominal cramps	116	79
Diarrhoea	89	66
Fever	8	4

Table III: Specified food poisoning attack rate for food items consumed in the outbreak

Suspected food	Person who DID EAT suspected food				Person who DID NOT EAT suspected food				P-value
	Sick	Well	Total	AR%	Sick	Well	Total	AR%	
Olive	21	25	46	43	46	31	77	60	-17
Labanah	55	30	85	69	1	24	25	2	67
Hummus	23	25	48	47	44	30	74	59	-12
Cheese	44	32	76	57	25	23	48	53	4
Milk	22	24	46	45	47	31	78	60	-15

Table IV: Incidence rate, Relative Risk, Confidence Interval, Chi-square and P-value of the specific food after the outbreak of food poisoning

Food item	AR among who ate specified food %	AR among who did not eat specified food %	RR	95% Confidence Interval	Chi-square	P-value
Oliver	43	60	0.72	0.60-0.87	12.04	0.005<
Labanah	69	2	34.5	8.4-130.7	14.2	0.0011
Hummus	47	59	0.78	0.64-0.92	7.7	0.01<
Cheese	57	53	1.1	0.07-1.3	0.8	0.05*>
Milk	45	60	0.75	0.62-0.90	10.2	0.005<

* Value not significant

Table V: Results of bacteriologic studies, gastroenteritis in a Military school at Zarqa 2009

Source of food sample	Organism/Salmonella, Shigella, Staphylococcus
Oliver	Not isolated
Labanah	Staphylococcus aureus $>10^5$ micro-organisms
Hummus	Not isolated
Cheese	Not isolated
Milk	Not isolated

Table VI. Differential diagnosis of bacterial poisoning, incubation period and clinical signs and symptoms

Causative Organism	Incubation period/hours	Fever	Diarrhoea	Vomiting	Cramps
Staphylococcus aureus	0.5-8	-	±	+	+
Salmonella	6-72	+	+	±	+
Clostridium welchi	6-24	-	+	-	+
Bacillus cereus	1-16	-	±	±	+

Staphylococcus aureus was cultured from the Labanah meal, toxicological analysis of food samples revealed no evidence of performed chemical toxins by the Atomic Absorption Analyzer.[4] Water samples showed no evidence of *E. coli* or other microbiologic contamination, stool cultures were performed from 26-56 sick students with diarrhoea referred to hospital and were all negative for Salmonella and Shigella.[5] Differential diagnosis between different micro-organisms that causes food outbreak supports this conclusion as shown in Table VI.

Discussion

The epidemiologic, clinic, laboratory and environmental investigations indicated that this large food poisoning outbreak was caused by *Staphylococcus aureus* contaminating the Labanah meal. A significant number of students had onset of illness (within few hours of consumption of the implicated meal), with vomiting, consistent with the finding of the Labanah by *Staphylococcus aureus.* Diarrhoea without vomiting is rare in persons with staphylococcal food poisoning.

Food borne disease outbreaks are recognized by the occurrence of illness within a short period of time (a few hours to a few weeks), FBD may be one of the most common causes of acute illness; many cases and outbreaks are unrecognized and unreported.[(1)] In most countries (including the USA and France), bacteria is the leading cause of FBD and appear to be the causative agent of more than two thirds of the recorded FBD outbreaks. The pathogenesis of bacteria using FBD depends in their capacity to produce toxins after ingestion in the digestive tract or before (toxins preformed in foodstuff).[(2)] The responsible pathogen of this outbreak coincides with other studies which revealed that micro-organisms Salmonella, Clostridium perfringens and Staphylococcus enterotoxin were responsible for about 20%, 6% and 3% respectively of the food borne outbreaks in the USA according to CDC surveillance,[(6)] and coincides also with other studies confirmed these results and findings regarding the etiological agents are reported by Adwan[(7)] Asao *et al.* described an extensive outbreak of staphylococcal food poisoning occurred in Kansai in Japan in 2006 where 13,420 cases frequently ingested dairy products.[(8)] Another outbreak with staphylococcus aureus as a causative micro-organism occurred among twelve people attended a birthday party in 1994 was reported by Maria and Luiz [(9)] Other food poisoning outbreak due to staphylococcus aureus was investigated in a military establishment and reported by Mustafa *et al.* in 2009.[(10)] Also in an airforce base in Western Greece had occurred among military personnel as reported by Jelastopulu and Veniere.[(11)]

It has been shown that Staphylococcus aureus is able to colonize milk and dairy products producing toxins that can cause poisoning in humans, causing serious health problem for food security, and was reported by Fueyo *et al.*[(12)] Adwan *et al.*[(13)] reported that Staphylococcus aureus strains produce toxins that are common causes of food poisoning outbreaks.

Conclusion

This outbreak highlighted the importance of food poisoning outbreaks that involve big number of people in a closed community, and satisfactory results could be achieved with a proper treatment.

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