

Food Borne Disease Outbreak in Abqaiq (Security Facility campus)

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Abstract:

Food borne diseases is a toxic or infectious illness that can be caused by bacteria. This illness results from eating toxic, contaminated, or spoiled foods. In the current outbreak that occurred in a security campus in Abqaiq on 15 November 2020, case-control study on 106 students experienced symptoms of illness and 210 controls. with the support of laboratory examination, the aim of this investigation was achieved through evaluation of the bacterial cause (Staphylococcus Aureus) and discovering its' source (The Salad) and extent of the cases, to prevent future outbreaks.

Keywords: Food poisoning, Staphylococcus. aureus poisoning, outbreak, outbreak in Saudi Arabia, bacillus cereus, salmonella.

المخلص

المقدمة: الأمراض المنقولة عن طريق الأغذية ، تسبب أمراضا سامة أو معدية عن طريق البكتيريا و غيرها. ويعد تناول الأطعمة السامة أو الملوثة أو الفاسدة المسبب الرئيسي لهذه الأمراض و تتباين أعراضها ما بين وعكة خفيفة إلى مرض شديد يتطلب دخول المستشفى أو يمكن أن يؤدي إلى حالات معدية أحيانا. في الفاشية الحالية التي حدثت في حرم أحد المرافق الأمنية في مدينة بقيق في المملكة العربية السعودية بتاريخ نوفمبر 15، 2020 ، تم الرصد و التبليغ عن حالة تفشي مرض منقول في الغذاء لـ 106 طلاب في حرم أحد المرافق الأمنية في مدينة بقيق في المملكة العربية السعودية. وقد ساهمت النتائج المخبرية و التحقيق الوبائي (بمقارنة الحالات بـ 210 طالبا سليما) على تحقيق الهدف من هذه الدراسة وهو تحديد العامل البكتيري المتسبب للتسمم (ستاف اوريوس) ، والمصدر الغذائي له (السلطة) و تحديد مدى انتشار الحالات لمنع تفشي أمراض مماثلة مستقبلا.

الكلمات المفتاحية: التسمم الغذائي ، التسمم بسبب المكورات العنقودية،الفاشيات الغذائية في المملكة العربية السعودية،بكتيريا سيريوس العصوية،السلمونيلا.

Introduction:

Food borne diseases have been an issue for all demographics, it is a toxic or infectious illness that can be caused by bacteria, parasites, viruses, or chemicals. However, bacteria are the most common causing agent followed by parasites. (1)

The rationale of this current study was to get a better understanding about the events and defects that had led to (FBDOs) in a security campus in Abqaiq in Saudi Arabia on November 15, 2020, in order to decrease its impact on individuals and communities.

Objectives:

- 1- Confirm the existence of the outbreak.
- 2- Confirm diagnosis.
- 3- Define the cases.
- 4- Assess the extent, source and risk factors of the outbreak.
- 5- Initiate appropriate control measures.

Method of Investigation:

Analytic study design

A case-control study is conducted to identify the potential main vehicle of the outbreak. This study design is the most efficient for expressing the exposure and result relation.

Setting

This FBDO is the first incidence reported of its' kind in this facility campus. Abqaiq Governorate is located in the Eastern Province of Saudi Arabia, 75 km south of the city of Dammam.

The security campus is situated in Abqaiq Governorate and holds 800 students.

Food is allowed only through the internal kitchen by serving three meals a day, 16 cooks are responsible of preparing 3 meals, which each takes in 2 and a half hours to do so.

These meals are prepared according to a fixed scheduled menu in the kitchen, the following stages are accomplished by the 16 workers, ending with carrying the food by a mini truck to a nearby building composes of a hall where the food is reserved for half an hour in heating trollies, then transferred to the dining rooms in single boxes.

The food preservation hall is connected to 3 dining rooms; each seat 258 students (each chair is assigned for a specific student with a name tag) and monitored by 8 different workers for each dining room. All meals are served in a fixed schedule, breakfast from 7-7:40, then lunch from 1-1:40, and dinner from 8-8:30.

Ethical approval

This study did not require ethical approval because it was conducted as a part of the MOH investigation of the food poisoning outbreak in November 2020. All cases were investigated using the standard food poisoning investigation forms of the MOH. All data, cases, and contacts personal identification information kept confidential.

Clinical case definition

Persons who reside in the security facility campus and ate any of the meals at November 15,2020 then for 2-10 hours, had any of these symptoms (abdominal pain, nausea, vomiting, or diarrhea).

Case finding

An interview was conducted on the campus for 25 of the first diagnosed cases by the FETP investigation team, in addition to obtaining information through pre-structured (food-poisoning) questionnaire by the Ministry of Health , for all 106 cases and 210 controls which were collected randomly. A list of daily food menu was provided to the investigating team.

Epidemiological investigation

In addition to the use of the validated questionnaire by the Ministry of Health, on November 17, 2020, the FETP team conducted an interview with all cases. Information was obtained on demographic details, the time of onset and the duration of symptoms, symptoms of gastrointestinal illness prior any of the meals, the food eaten in each meal, any suspicious change on the food, as well as hospitalization.

Laboratory investigation

Laboratory report of previous Samples were received providing the result of environmental swabs, stool culture and analysis in addition to throat swabs from 10 % of the cases, and throat swabs and stool analysis from 12 out of 32 (38%) workers and cooks.

Environmental investigation

In addition to the laboratory report inspection of the kitchen, workers' bathroom, fridges, storage area, food preparing space, food transferring truck, pre-serving food hall, and dining rooms were all checked.

Analytic investigation

A case control study is to be conducted for the analytic investigation, with case to control ratio 1:2. Odds ratio was calculated for each food item with 95% confidence interval, to determine the association between food items and the poisoning.

The standard level of significance of 5% is chosen, p- value less than 0.05 is considered significant.

Statistical analysis performed using Microsoft EXCEL, and SPSS.

Result:

A total of 318 students, 106 cases and 210 controls. The subjects' average age is 24.5 years, and the median age was 24 years. Stomachache and diarrhea were reported by 76% of the cases and vomiting by 73%. High fever was one of the symptoms that was recognized by 13% the cases, yet, not as a main complaint. Other symptoms were less frequent and are represented in Table 1.

Table 1. rate of common symptoms in the outbreak.

Symptoms	Rate
Stomachache	76%
Nausea	29%
Vomiting	73%
Diarrhea	76%
Dizziness	8%
Fever	13%

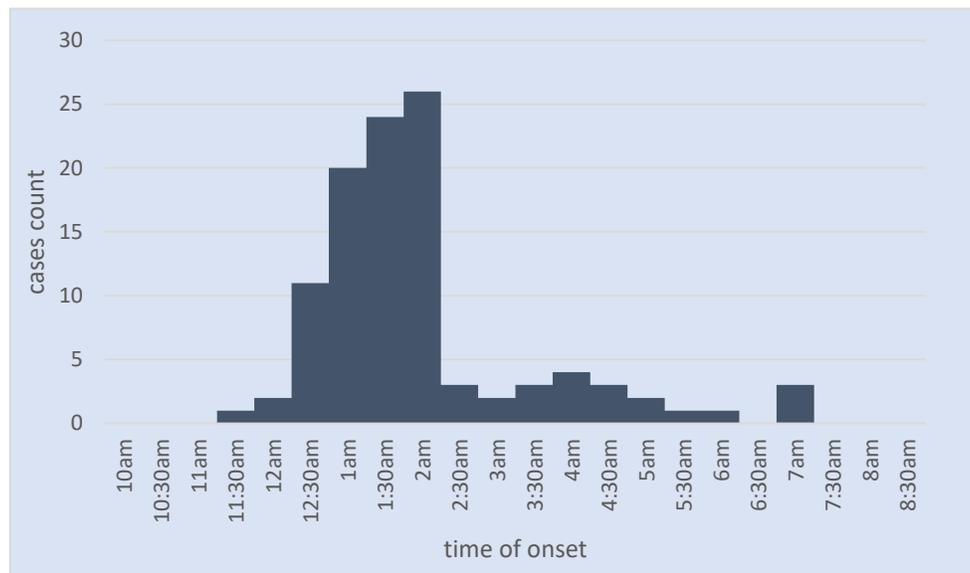
Food is prepared in the kitchen by 2 cooks and 16 assistants, the kitchen is spacious, containing two halls, one as a walk-in with multiple fridges each containing either dairy products, meat, chicken, fish, or eggs, the other hall is a food storage area. Both fridges and storage halls are monitored for any temperature changes by the kitchen staff. Two separate stations are designed for handling, washing, or cutting either meat or vegetables.

A routine food serving process is approved by the security facility institute for years to regulate serving of all meals in a fixed daily schedule with a fixed menu.

Preparing a meal begins 3 hours before serving, and the meal is kept in the cooking pots then transferred in to serving plates that are all loaded into a truck all at once to the dining hall where they are conserved in three thermal food containers, (maintenance follow up card aren't available) for half an hour then transmitted to the serving tables in three dining halls by 6 workers before the students enter the halls to start their dinner at 8:00 pm.

All cases revealed experiencing symptoms 4-12 hours after serving dinner. The first case went to the campus clinic at 11:30 am, afterwards, cases continued to increase and peaked at 2 am, last case had the onset of the disease at 8 am (Shown in the Figure 1).

Figure1. Epidemic curve of food poisoning outbreak in a security facility Abqaiq province.



39% noticed changes in the smell and color of the fish, only 2% reported change in the smell of the Molokhea, 1% reported change in the smell of the salad, the other cases did not notice any difference in any food item (that might be because of their tiredness and hunger at the end of the day as they reported). (Table2)

Table 2. changes reported by the students in dinner served food items in Abqaiq security facility,15 November,2020

Food item	Taste	Color	Smell	Texture	**% Reported changes
Rice	2				37
Fish	6	5	2	6*	2
Molokhea with chicken	2			1	1
Salad	1				
Orange					
Seven up					
*4 reported dry,2 oily texture					
**17% of cases did not reply,43%reported no changes					

Stool analysis and culture of were collected from 32 cases, this revealed 1 case with Entamoeba histolytica, another case with Salmonella, and 7 samples of Staphylococcus Aureus were extracted from a throat swab. 13 kitchen staff stool samples were negative with only Staphylococcus Aureus isolated from their throat sample. There was no evidence of any salmonella, E. coli, or Staphylococcus Aureus in any sample of dinner served items. Yet, Bacillus Cereus was extracted from a kitchen wall swab.

Environmental inspection of the kitchen premises including cooking area, meat washing and handling area, vegetable washing and handling area, storage area, and three separate walk-in fridges were all satisfactorily hygienic, and fridge temperatures were monitored all day. All kitchen staff share one bathroom, that lacks hygienic standards, and hand washing soap or sanitizers.

Table 3. shows all dinner items consumed by the subjects in this study, the salad was the most associated with the symptoms (OR= 34.50, P-value =0.00, 95%CI = 17.54-67.92), Molokhea and chicken (OR= 3.33, P-value =0.003, 95%CI =1.44-7.71), (OR) of both the Rice and Fish suggests that these food items act as a protective factor in relation to the food poisoning. So, the most likely incriminated risk factor is the salad with degree of association of 34.50 and statistical significance of = 17.54-67.92, chi-square = 146.43 and p value less than 0.05.

Table 3. Description of consumed foods, odds ratio, value, chi-square, and 95% CI.

Food	Odds ratio	chi-square	95%CI	P
Rice	0.51	0.047	0.61-0.71	0.477
Fish	0.50	1.98	0.97-1.00	0.159
Molokhea and chicken	3.33 7.71	8.61	1.43-	0.003
Seven up	0.00 0.35	33.38	0.25-	0.000
Salad	34.50 67.92	146.34	17.54-	0.000
Orange	1.88 3.20	5.62	1.11-	0.018

Discussion

In this current food poisoning outbreak on 15 November 2020, salad and Molokhea with chicken were the incriminated food items based on the highest statistically significant odds ratio (OR). The clinical manifestation of the cases and the incubation period (1-8) hours are all consistent with *Staph. aureus* bacteria (2)

A *Staph. Aureus* Symptoms mainly include explosive vomiting, nausea, abdominal cramps, and most people complain of diarrhea. (2) in this outbreak, abdominal cramps, vomiting, and diarrhea were expressed by more than 70% of the cases. In contrast to a reported *Staph. Aureus* outbreak food poisoning in 2009, 90% had vomiting, 89% nausea, 73% reported diarrhea, and 69% exhibited abdominal pain (3). however, severity of associated symptoms depends on the susceptibility to the toxin, amount consumed of contaminated food, amount of ingested toxin, and general health of the consumer. (4)

considering staph. Aureus outbreak, its clear that the lunch menu composes of almost all Staph. Aureus vehicles. Suspected bacterium is commonly found in Vegetables, egg, diary product, chicken, or fish (2), As Salad is consumed without cooking, it is more vulnerable to contamination with Staph. Aureus. in Quetta, 100 salad samples were collected ,59%were positive for Staph. Aureus. (5)

It is unexceptional for staph aureus not to be distinguished in food by not causing any changes (2). 1% of cases detected change in the salad and 39% in the fish (Table 2) yet, all study group stated during the interview that the exhaustion hinders their concentration on the foods ‘quality especially, on the last meal. Thus, it is expected not to detect any case complaining of any bad odor or difference in the texture of the causative item When staph. Aureus is believed to be the source of the outbreak. Staph. Aureus growth in salad could be induced by unhygienic transferring or preparing or inadequate cooling. Preserving the salad for more than an hour in unmonitored heating trollies jeopardize the food items’ safety (food should be kept in 60 °C, and cooled food should be kept in 4 °C or cooler). (6) A military unit lunch party in the United States, at July 2012 November, detected food poisoning related to eating chicken, the initial source was not known but could be caused by improper handling and refrigerating of the meal that permitted the proliferation of the Staph. Aureus toxin. Enterotoxin- producing Staph. aureus was found in on food handlers’ hands and their nostrils. (7)

This bacterium appears in food that requires a lot of handling, transmitted through unwashed hands, or inadequately heated or stored in room temperature. (8) Multiple cooks and food handlers in this outbreak emphasis the possible transmission of the bacteria through the workers, especially that inspection visit revealed their unsatisfaction of the hygienic situation in the workers bathrooms’. 41% of 781 food poisoning events in Riyadh, which were reported to Ministry of health in the period (1991-1993), were introduced by Staph. Aureus bacterium toxin (9). In the current situation staph. Aureus is proposed to be the responsible microorganism; it was extracted from 22% of cases and 8% of workers throat swab. a single case of positive salmonella was recorded among cases, that excludes the possibility of its transmission to the others. (10)

Overall, food samples are reserved immediately after preparing in special refrigerator as a daily routine. Usually, swabs are extracted when needed by inspectors, confirming the poisoning vulnerability of the served food as it is served after cooking by more than two hours. source of transmission (salad) is still to be considered, Although, all food swabs were negative. Fortunately, *Bacillus Cereus* was extracted only from the kitchens' wall, and its incubation period (6- 24 hours) is in consistent with the present outbreak. (11) and it was not isolated from any of the food items, cases or food handler.

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Fortunately, *Bacillus Cereus* was extracted only from the kitchens' wall, and its incubation period (6- 24 hours) is in consistent with the present outbreak. (12) 16and it was not isolated from any of the food items, cases or food handler. In 2002, 750 Bahrainis became intoxicated by supplied sandwiches provided at a wedding reception, the country's largest mass poisoning incident ever. Unfortunately, no final report was made public. But Depending on the length of the unspecified incubation period, the etiological agent could be *Salmonella* or *Staphylococcus aureus* enterotoxin. (13)

A similar outbreak occurred to constrictor employee in February 2011, in Hail, staph. *Aureus* was isolated from salad and rice and from nasal and under nails swabs of food handler. The salad that was provided had a strong epidemiologic link to the outbreak. (14)

Although the source of contamination cannot be definitely pinpointed, but it could be due to unsafe handling of (salad) where the staph. *Aureus* were transmitted from the food handlers; statistical calculating of odds ratio should be the defining point for specifying food poisoning inducing item.

By calculating the odds ratio, it is found that “illness with the outbreak bacterium was strongly associated with consumption of the salad”, means it was eaten 34.50 times more by cases than controls, and there is a zero chance in one hundred that 34.50 odds ratio would result by chance if the Salad is not actually associated with the illness. However, the Molokhea with chicken odds ratio of 3.33 concluding that this item was 3.33 times more eaten by the cases than the controls, and the related P-value 0.003 implies the significance of this association.

Obviously, the affect – exposure relation is distorted by an item (confounding factor). Through reviewing the different properties of potential confounders, Molokhea with chicken could be the confounding factor.

Stratification is suggested to control the confounding factor particularly in a completed data analysis study (15). In this study data is divided to a group which ate Molokhea with chicken and another group that did not eat the Molokhea with chicken, risk between Salad and the symptoms are then calculated for both groups. The odd’s ratio between Salad and the symptoms for the group that ate Molokhea with chicken was (OR=36.1), while the odd’s ratio of Salad and the symptoms that was calculated for the other stratum was not clear because who did not consume Molokhea with chicken did not do the same for the Salad. That summarizes the following (who did not consume Molokhea did not consume Salad as well) which explains the link between Salad and Molokhea with chicken. Accordingly, Salad is the recommended causal factor in this study.

Conclusion

The result of the study including Food poisoning of 106 students in the security facility, concludes that salad is the food poisoning incremented item, and staph. Aureus bacteria as a causative agent. This result was supported by the incubation period, symptoms, epidemiologic investigation, and laboratory results that concise with the suggested bacterium and the salad. In such events, as long as food is prepared, stored, and served in large quantities by several food handlers, over a long period of time, food will be more prone to infection. recommended sanitation in such circumstances will not be as expected, yet the type of food served will guide the nature of bacterial. The clinical and laboratory investigation pointed a Staph. Aureus bacteria, statistical investigation pointed to the suspected salad which was vulnerable to the bacteria by the food handler's negligence.

In order to prevent such happenings in the future, following recommendations were suggested.

Recommendations:

Food handlers and utensils used for cooking and serving on daily basis. Health education regarding food hygiene should be imparted to all food handlers and supervisors on regular basis. Periodic examination of all the food handlers, heating trolleys, and examination results and maintenance record for all appliances should be preserved. Any kind of such incident should be immediately reported by the to the higher authorities facilitating the quick action.

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