ISSN 1021-366X

Investigation of a Food Poisoning Outbreak in Fanyuan, Changhua County

Abstract

On October 5, 1997, to celebrate the completion of their new house, the Chen's of Fanyuan Township, Changhua County, gave a party. That night, some guests developed symptoms such as diarrhea and abdominal pain and were treated at the Erhlin Branch of the Changhua Christian Hospital. The purpose of epidemiological investigation is to identify food item(s) responsible for the food poisoning and the pathogenic agent(s). The present investigation used a structured questionnaire to telephone-interview guests of the party for information concerning their demographic background, food items consumed, and physical conditions.

Of the 108 guests interviewed, 70 met the criteria of a case, 35 each males and females, and aged between 5 and 73. Symptoms were: diarrhea (100%), lower abdominal pain (80.0%), upper abdominal pain (78.6%), weakness (62.9%), headache (45.7%), vomiting (42.9%), fever (37.1%), chilliness (32.9%), nausea (28.6%), sore throat (1.4%), and rash (1.4%). The median incubation period was 16 hours, ranging from 6 hours to 56 hours, with a mode of 16 hours. Analysis of the 14 courses of food served at the party showed that the odds ratio of having lobster salad was 6.5 times higher than not having the salad (95% confidence interval at 2.1-20.5); the odds ratio of not drinking was 6.5 times higher than drinking (95% confidence interval at 2.5-16.9). Vibrio parahaernolylicus of type K7 was isolated from the leftover of the lobster salad. Again, Vibrio parahaernolylicus (mainly of type K6) was isolated from 11 of the 19 rectal swabs of the patients. It was, therefore, decided that the food item responsible for the incident was the lobster salad, and the pathogenic agent was Vibrio parahaemolyuicus.

Introduction

For economic reasons, catering service is popular. However, most caterers are not licensed and without permanent business places. Food is often cooked outdoors under relatively poor sanitary condition. They often cause food poisoning and are a blind spot for the control of food sanitation.

The Erhlin Branch of the Changhua Christian Hospital reported to the health authorities on October 6, 1998 some suspected food poisoning cases. The FETP of the National Institute of Preventive Medicine, Department of Health, soon collaborated with the Changhua County Health Bureau in the investigation to identify the cause and pathogenic agent of the food poisoning for the prevention of future outbreaks.

Background

The Chen's of Fangyuan Township, to celebrate the completion of their new house, gave a party of 120 tables at noon of October 5, 1998. The party was catered for, 60 tables each, by two cooks surnamed Lin and Hsu. The actual number of tables occupied was 113, and the number of guests was around 1,000. That night, some guests developed symptoms such as diarrhea and abdominal pain, and were treated at the Erlin Branch of the Changhua Christian Hospital.

Materials and Methods

1. The Site and the Questionnaire Survey

   Investigation on the site showed that the patients had been at the Chen's party on October 5; and that all diarrhea cases had the food served by Cook Lin. Guests of the party came from all parts of the island, they could not be easily located and reached. The present investigation, therefore, applied the case-control method to identify suspected food items. Those in the case group were either patients of the Hospital or individuals referred by the host. Those in the control group were members of the Erhlin Lion¡¦s Club, volunteers of the local fire brigade, and their dependents who had been to the party, had the food served by Cook Lin, and yet had not become ill. A structured questionnaire was used in the survey to telephone-interview members of both groups for their demographic background, food items consumed at the party, and physical conditions.
2. Definition of Case

   A case was defined as one who had been at the Chen's party at noon, on October 5, 1997, had eaten the food prepared by Cook Lin, and had developed diarrhea (more than twice a day) and one of the following symptoms: nausea, vomiting, fever, upper abdominal pain, and lower abdominal pain.
3. Statistical Analysis

Information was processed with Epi-Info 6.0, verified, and analyzed. X 2 test was used to test each food item. The estimated odds ratios (EOR) and their 95% confidence intervals (CL) were calculated. The information was then analyzed by multiple logistic regression to identify food items that were significantly associated with the food poisoning.

4. Laboratory Testing

1) Testing of food residues

Leftovers of the lobster salad, abalone salad, and sticky rice were collected from the refrigerator of the Chen's by the Erhlin Health Station. Two water specimens were collected from houses of the cooks and the host. They were sent in sterilized containers to the Central Laboratory of the National Laboratories of Food and Drugs of the Department of Health for laboratory testing of: Staph ylococcal aureus, its enterotoxin types, Salmonella, Bacillus cereus, pathogenic Escherichia coli, and Vihrio arahaemolyticus.

2) Human specimens

Rectal swabs were collected from 19 patients at the Hospital and two cooks. They were sent in Cary-Blair medium to the Central Laboratory of the National Institute of Preventive Medicine for testing of: Vibrio cholerae, Vibrio parahaernolyticus, Shigella spp, Salmonella typhi and paratyphi, Salmonella, Staphylococcus aureu.v and its enterotoxin types, Bacillus cereus, and pathogenic Escherichia coli.

Resutis

1 Clinical Characteristics

From patients at the Hospital and individuals referred by the host, 108 persons had been successfully interviewed; of them, 70 met the criteria of a case, 35 each males and females. Their ages ranged from 5 to 73, with a median of 40 years and a mode of 37 years. The clinical symptoms were: diarrhea (100%, 70/70), lower abdominal pain (80%, 56/70), upper abdominal pain (78.6%, 55/70), weakness (62.9%, 44/70), headache (45.7%, 32/70), vomiting (42.9%, 30/70), fever (37.1%, 26/70), chilliness (32.9%, 23/70), nausea (28.6%, 20/70), sore throat (1.4%, 1/70), and rash (1.4%, 1/70). The incubation period was 16 hours, ranging from 6 hours to 56 hours, averaging 18.8 hours, with a mode of 16 hours (Figure 1)

2 Laboratory Testing of Food

There were altogether 14 courses of food: lobster salad, abalone salad, crab salad, shark's fin soup, sticky rice, sweet and sour pork, scallop soup, pork tripe, ginseng chicken, fried fish, fruit, ice cream, cake, and wine. Analysis by each food item (Table 1) showed that lobster salad, abalone salad, shark's fin soup, sweet and sour pork, and wine were associated with the incident (all p values smaller than 0.05). The consumption of lobster salad (EOR=7.76, 95% CL2.44-25.71), abalone salad (EOR=4.03, 95% CL=l.35-l2.29), shark's fin soup

(EOR=3.25, 95% CL=1.14-9.37), and sweet and sour pork (EOR=2.95, 95% CL=1.15-7.70) was positively related to the poisoning and statistically significant. Drinking seemed to be protective (EOR=0.13, 95% CL=0.05-0.36); those who drank did not become ill.

Table 2 shows the multiple logistic regression analysis of those four food items and drinking. Throughout models 1 to 4, the lobster salad was always strongly related ($p<0.01$) to the poisoning; drinking was found to be related to the poisoning under model 4 ($p<0.01$); the other food items were not statistically significant ($p>0.05$). It was then calculated from model 4 that the odds ratio of having lobster salad was 6.5 times higher than not having it (95% CL=2.1-20.5); and that the odds ratio of not drinking was 6.5 times higher than drinking (95% CL=2.5- 16.9).

3. Laboratory Testing

1) Testing of water and food residues

Vibrio parahaenzolyticus of type K7 ($1.5x10^3$ MPN/g) and Bacillus cereus ($1.5x10^6$CFU/g) were isolated from the lobster salad; and Vibrio parahaemolyticus of type K7 ($9.3x10^2$MPN/g) and Bacillus cereus (1.5x 106 CFU/g) were also isolated from the abalone salad (Table 3). Water specimens collected from houses of the host and the cooks were all negative.

2) Testing of human specimens

In 8 of the 19 rectal swabs collected from patients, Vibrio parahaemolyticus of type K6, and in one each of the specimens, types K37, K46, and K53 were isolated, giving an isolation rate of 57.9% (11/19). In two specimens, both Staphylococcus aureus enterotoxin of C type and Vibrio parahaemolyticus of type K6 were isolated. Rectal swabs of the two cooks were negative.

Discussion

In the last four years, almost 40%, and 82% in 1996, of all bacterial food poisoning outbreaks in Taiwan were caused by Vibrio parahaernolyticus(2). Food poisoning outbreaks of Vibrio parahaemolyticus in Taiwan, like in the US and Japan, occur more often between May and November(2)ibrio parahaernolvticus is salt- loving, and is often found in fresh fish and shellfish. The infection is global, particularly among people fond of raw fish. On marine products not processed properly, heated sufficiently, or frozen adequately, pathogenic agent will multiply rapidly to a level sufficient to induce infection. Under optimal temperature (30-37℃. the bacteria will multiply by twofold in every 10-12 minutes. If the number of colonies on the surface of a freshly caught marine product is 10^2g, by the time it reaches the market, the number of colonies will increase to $l0^3$-10^4/g. A colony size of 105/g and larger is pathogenic(2).

The incubation period of Vibrio parahaernolyticu.s-induced food poisoning is 2- 24 hours, averaging 10-20 hours. Whether a person becomes ill depends on the amount of the pathogenic agent consumed. More consumption leads to shorter

incubation period and more serious symptoms[2]. Symptoms last for 1-5 days, averaging 2 days. Diarrhea and abdominal pain appear first. Other symptoms are: nausea, vomiting, fever, chilliness, and headache. Fatality is low. The major symptom of patients of the present incident was diarrhea, accompanied by other symptoms such as abdominal pain, nausea, vomiting,, fever, chilliness, and headache. These are symptoms of Vibrio parahaemolyticus-induced food poisoning. The incubation period of the present incident, 16 hours, averaging 18.8 hours, and with a mode of 16 hours, also corresponded to that of the Vibrio paharahemolyticus-induced food poisoning. Vibrio parahaemolyticus was isolated from both food and human specimens. It was, therefore, decided that the pathogenic agent of the present food poisoning outbreak was Vibrio parahaemolyticus.

Bacillus cereus-induced food poisoning has two types: the vomiting type and the diarrhea type. The vomiting-type has an incubation period of 1-5 hours and produces symptoms such as nausea and vomiting. The diarrhea type has an incubation period of 8-16 hours and produces symptoms such as abdominal pain and watery diarrhea. Bacillus cereus multiplies rapidly in food not consumed in time after cooking and under temperature of 28-35 ℃ The bacilli also multiply in food not kept above 60℃ The time required for each cohort (time needed for the number of colony to increase from one to two) under laboratory condition is 18-27 minutes; and 26-31 minutes in cooked rice. The longer the food specimens are kept under room temperature, the more the colonies multiply[3-6] . Although Bacillus cereus was isolated in some food residues, as none was isolated from the human specimens, and the symptoms and incubation period of the present incident differed from those of the Bacillus cereus-induced food poisoning, Bacillus cereus should have not been the cause of the present outbreak.

The food was prepared by Cook Lin, his son, and his friend. Of them, only the son has a Class-C technician license for Chinese food cooking. The food for the party was bought at 4 a.m. on October 5 and processed on the spot. They were delivered to the house of the host about 5 a.m. The lobsters were delivered in cartons. They were cooked about 10 a.m. and placed in water in bucket. At 11 a.m., they were removed from bucket, dried, peeled the shell, sliced, placed on plates, and wrapped in PVC sheet. The plates were placed one above the other, and served about 12:10. It was hot that day, and no large enough freezing facilities were available to store salad for 60 tables. The already contaminated food were placed under room temperature in PVC wrapping for about an hour, providing an optimal environment for Vibrio parahaemolyticus to multiply in number. How the food was contaminated by Vibrio parahaemolyticus in the first place was not clear. The contamination could have been due to the inadequate processing by the cook such as the use of the same chopping board, knife, containers, and kitchen clothes for the raw and the cooked food in preparing the salad. The already contaminated salad was not placed under low temperature, Vibrio parahaernolyticus thus multiplied in number sufficient to induce the poisoning.

Of all Vibrio parahaernolyticus-induced food poisoning outbreaks in Taiwan, most of them are caused by either secondary or cross contamination. The process is likely to be as follows: temperature for freezing not sufficiently low; containers, chopping board, and kitchen clothes used for marine products not properly washed afterwards; no separate sets of containers, knives, chopping board, and kitchen clothes used for raw or cooked food; cooked food not placed in the upper part of the freezer and contaminated by the water of the fresh marine products.

The catering service is mobile without a permanent business place. They are difficult to supervise. Cooks and staff of catering service are likely to be lowly educated. Facilities are poor, often without adequate frozen services Food poisoning outbreaks in the course of catering service are rather frequent[7].

In the cases of food poisoning, the punishment to the individuals responsible as specified in the Law for the Control of Food Sanitation, by the judicial court, is considered to apply only to individuals with an intention to induce food poisoning. An unintentional caterer is found not guilty of the incident. This interpretation of law makes health workers at the grass root level frustrate in their handling of food poisoning outbreaks. A recent case involving a food poisoning outbreak as a result of outdoor catering in Linkou Township, Taipei County, initially ruled not guilty, was appealed to the higher court by the prosecutor. The higher court overruled the decision of the lower court and decided that the punishment specified in the Law for the Control of Food Sanitation was not meant to apply only to individuals with intention. The judgement was revoked, and the caterer was found guilty[8]. This decision of the court should bring warning messages to the caterers, and food poisoning outbreaks are expected to decrease.

Conclusion

The pathogenic agent of the present food poisoning outbreak was considered to be Vibrio parahaemolyticus of type K7; the food responsible was the lobster salad.

Recommendations

1. Frozen facilities are often poor in catering service, hot food should be served. Sea food salad should be avoided to safeguard the safety of food.
2. Workers in catering service should receive training in food sanitation to learn more about ways to safeguard the safety of food. A licensure system for cooks should be established to improve the standard of food sanitation.
3. Mass media should be used to educate the public on ways to prevent food poisoning.
4. The Law for the Control of Food Sanitation should be amended to apply not only to individuals with intention alone. Food manufacturers should be made legally responsible for any food poisoning incidents by intention or by accident In this way, the safety of food can be ensured.

Acknowledgement

Thanks are due to the Central Laboratory of the National Institute of Preventive Medicine, the Central Laboratory of the National Laboratories for Foods and Drugs, and the Changhua County Health Bureau for their assistance in the investigation. Our thanks are also due to Mr FL Wang of the Ministry of Justice and Lienta Law Office for information on the rulings of the court on food poisoning cases.

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Table 1. Cases of Food Poisoning by Food Items (N=108)

Food		Cases (N=70) NO. (%)	Non-cases (N=38) NO. (%)	Odds Ratio (95% CI)
Lobster salad	eaten	64 (91.4)	22 (57 9)	7.76 (2.44-25.71)*
	not eaten	6 (8.6)	14 (42.1)	1.00
Abalone salad	eaten	62 (88.6)	25 (65.8)	4.03 (1.35-12.29)*
	not eaten	8 (11.4)	13 (34.2)	1 00
Crab salad	eaten	62 (89.9)	30 (78.9)	2.36 (0.69-8.13)
	not eaten	7 (10.1)	8 (21.1)	1.00
Shark fin soup	eaten	60 (85.7)	24 (64.9)	3.25 (1.14-9.37)*
	not eaten	10 (14.3)	13 (35.1)	1.00
Sticky rice	eaten	51 (72.9)	27 (71.1)	2.95 (1 15-7 70)*
	not eaten	19 (27.1)	11 (28.9)	1.00
Pork	eaten	36 (52.2)	10 (27.0)	2.95 (1 15-7 70)*
	not eaten	33 (47.8)	27 (73.0)	1.00
Scallop soup	eaten	48 (69.6)	22 (59.5)	1.56 (0.62-3.89)
	not eaten	21 (30.4)	15 (40.5)	1.00
Tripe	eaten	36 (52.2)	19 (50.0)	1.09 (0.46-2.60)
	not eaten	33 (47.8)	19 (50 0)	1 00
Chicken	eaten	58 (84.1)	25 (65.8)	2.74 (0.98-7 70)
	not eaten	11 (15.9)	13 (34.2)	1.00
Fish	eaten	60 (87.0)	27 (71.1)	2 72 (0.91-8.20)
	not eaten	9 (13 0)	11 (28.9)	1 00
Fruit	eaten	59 (84.3)	26 (68.4)	2.48 (0.88-7 02)
	not eaten	11 (15 7)	12 (31.6)	1.00
Ice cream	eaten	22 (34 9)	8 (21 1)	2.01 (0.72-5.72)
	not eaten	41 (65.1)	30 (78.9)	1 00
Cake	eaten	16 (22.9)	5 (13.2)	1.96 (0.60-6.79)
	not eaten	54 (77.1)	33 (86.8)	1 00
Wine	drunken	12 (17.1)	23 (60.5)	0.13 (0.05-0.36)*
	not drunken	58 (82.9)	15 (39.5)	1.00

*statistically significant, p<0.05 CI: Confidence Interval

Table 2. Results of Analysis of Multiple Food Items (N=108)

Food	Model 1 OR 95% CI	Model 2 OR 95% CI	Model 3 OR 95% CI	Model 4 OR 95% CI
Lobster salad	6.0(1 8-19 2)*	7 1 (2 3-22.1)*	6 5 (2 2-19 4)*	6 5 (2 1-20 5)*
Abalone salad	1 8 (0.5-6 6)*			
Shark fin soup		1 2 (0 4-3 7)		
Pork			1 9 (0 7-4 9)	
Wine**				6 5 (2 5-16 9)*

*statistically significant, p<0.01; **comparing those who did not drink with those who did drink.
OR: Odd Ratio

Table 3. Laboratory Testing of Food Residues and Environmental Specimens

Specimens	*V. cholerae*	*V.parahaemolyticus* (MPN/g)	*Shigella*	*S. paratyphi*
Lobster salad	negative	positive 1.5×10^3	negative	negative
Abalone salad	negative	positive 9.3×10^2	negative	negative
Sticky rice	negative	negative	negative	negative
Water (host)	negative	negative	negative	negative
Water (food stand)	negative	negative	negative	negative

Salmonella	*S. aureus*	*B cereus* (CFU/g)	Pathogenic *E. coli*
negative	negative	positive 1.5×10^6	negative
negative	negative	positive 1.5×10^6	negative
negative	negative	negative	negative
negative	negative	negative	negative
negative	negative	negative	negative

Table 4. Laboratory Testing of Human Specimens

Specimens	*V. cholerae*	*V. parahaemolyticus*	*Shigella*
Cook A	negative	negative	negative
Cook B	negative	negative	negative
Cases (19)	negative	K6 (8 cases) K37 (1) K46 (1) K53 (1) Negative (8)	negative

S paratyphi	Salmonella	S aureus	B cereus	Pathogenic E. coli
negative	negative	negative	negative	negative
negative	negative	negative	negative	negative
negative	negative	Type C toxin (1) negative (17)	negative	negative

Figure 1. Distribution of Incubation Periods (N=70)