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A Food Poisoning Outbreak in a Restaurant in Chiayi City

1. Introduction

Vibrio parahaemolyticus is a common pathogen of food-borne gastro-enteritis with significant seasonal variations; it is often more prevalent in warm seasons. It is common in Taiwan, Japan, Southeast Asia and the United States (USA). In the period between January and June 1994 in Taiwan, of the 57 food-poisoning outbreaks reported, 18 (31.6%) were caused by *Vibrio parahaemolyticus* (data from the Bureau of Food Sanitation, Department of Health). Since Japanese are fond of raw fish and shellfish, more than 60% of their food-borne poisonings are reportedly caused by *Vibrio parahaemolyticus*[1]. In Florida, USA, in the period between 1981 and 1988, there had been 333 reports of *Vibrio parahaemolyticus*-induced gastro-enteritis. Investigation showed the primary agent of the incidents was crab. Therefore, the Florida State Health Department requires in its case reports not only information concerning the intake of sea food (raw or cooked, name of sea food), but also whether there has been any exposure to sea water during the week of onset, and whether a victim is alcoholic, has hepatitis, diabetes, has had gastric operation, immuno-deficiency, and uses anti-acid[2]. In the USA there have even been reports that *Vibrio parahaemolyticus* induces infection of wounds, gangrene, and primary septicaemia syndromes[3]. *Vibrio parahaemolyticus*-induced diarrheal syndromes have been reported in India[4]. In colder countries such as the United Kingdom, Canada and Australia, poisoning by this agent is rare, and less *Vibrio parahaemolyticus* is found in their sea waters and gulfs[5].

2. The Background

On 12 June 1994, a group of 430 persons had dinner in 43 tables at a restaurant in Chiayi City. A total of 380 persons became sick after dinner and were treated for food poisoning. To understand the cause of the outbreak, a team was dispatched to the restaurant to investigate the sources and processing of foods, and the sanitary conditions of the restaurant on that date. Guests of the dinner were also telephone-interviewed. Of the 43 tables, two were vegetarian, none of the guests at those

tables became ill.

3. Materials and Methods

1) Persons interviewed

Guests of the dinner come from different parts of the Province. Telephone interview was made to 161 of the 222 guests whose names had been supplied by the host. Of them, 10 did not eat, the 151 others had taken dinner.

2) The questionnaire

A structured questionnaire was used for the interview through telephone. The questionnaire included items on personal background, whether the dinner was attended on that night, time of dinner, food items eaten, any subsequent discomfort, and, if so, when, what symptoms, when recovered and whether cared for medically. Information collected was treated with Epi-Info and SAS.

3) Definition of case

A case was defined as a person who had dinner at this restaurant between 7 and 9 pm on 12 June 1994, with subsequent diarrhea and two or more of the following symptoms: nausea, vomiting, fever, headache, prostration, abdominal pain.

4) Laboratory testing

(1) Food specimens

Food specimens: shark's fin with chicken, bamboo shoots and pig's leg, perch in oyster sauce, sticky rice with crab, crab cooked in casserole, raw shrimp, chicken, raw shark's fin, and water were collected and sent to the Southern Area Laboratory of the National Laboratories for Foods and Drugs for testings for *Vibrio parahaemolyticus, Bacillus cereus, Staphylococcus aureus,* enterotoxin, and enteropathogenic *E. coli.*

(2) Human specimens

Thirteen rectal swab specimens were collected from patients on 14 June either in the hospitals or at home for testings for: *Vibrio parahaemolyticus, Bacillus cereus, Staphylococcus aureus, Campylobacter jejuni,* enteropathogenic *E. coli,* cholera, typhoid, paratyphoid, and Salmonella. All tests were done by the Southern Area Laboratory of the National Institute of Preventive Medicine.

4. Findings

Of the 222 guests identified by the host, 161 (72.07%) were telephone-interviewed.

Of these, 10 had not eaten, 150 had taken the dinner, and one guest who had taken dinner refused to be interviewed.

1) Distribution of cases

Of the 150 interviewed, 124 met the criteria of a case; the attack rate thus was 82.67%. The male-female ratio was 1:1.21. The time of onset ranged from 3 to 20 hours with concentration at 11 to 18 hours. The case distribution curve is shown in Figure 1. The median incubation period was 13 hours, and the illness lasted from 1 to 86 hours with a median duration of 25 hours. Symptoms included: diarrhea (100%), fever (40.3%), nausea (22.6%), lower abdominal pain (22.6%), vomiting (19.4%) and upper abdominal pain (14.5%). Most patients recovered within three days after onset.

2) X^2-test

Of the 160 persons interviewed, those who ate at the vegetarian tables and the 10 who attended the meeting but did not eat did not become ill. To identify the food items which possibly caused the poisoning, X^2-test was used (see Table 1). With the exceptions of cashew nuts, scallops and cabbage and water melon, the rest of the food items were significantly related to the poisoning ($p<0.05$).

Figure 1. Epidemiological Curve of a Food Posioning Outbreak in Chiayi City (12-23 June 1994)

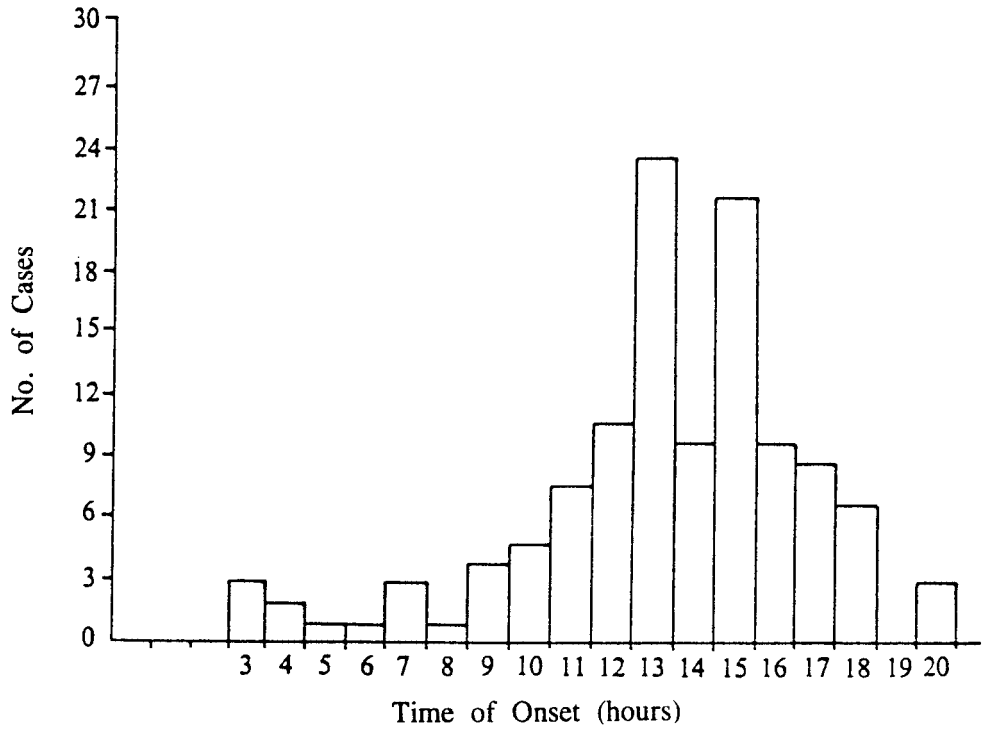

Table 1. Relation Between Foods and Illness (N=150)

Food	Eaten			Not Eaten			Relative Risk	Greenland 95% Confidence Interval	X^2 Value	P Value
	Ill	Not Ill	Attack Rate %	Ill	Not Ill	Attack Rate %				
Cashew nut	73	14	83.90	51	12	80.95	1.12	0.7 <RR<1.79	0.22	0.637
Chicken in wine	104	11	90.43	20	15	57.14	3.58	2.13<RR<6.01	20.76	0.000
Jellyfish	84	7	92.30	40	19	67.80	2.27	1.60<RR<3.20	15.01	0.000
Snail	83	5	94.32	41	21	66.13	2.44	1.79<RR<3.34	20.17	0.000
Meat jelly	81	6	93.10	43	20	68.25	2.22	1.61<RR<3.06	15.75	0.000
Scallop and cabbage	50	6	89.28	74	20	78.72	1.29	1.00<RR<1.66	2.73	0.098
Perch	72	5	93.51	52	21	71.23	1.93	1.46<RR<2.55	12.97	0.000
Three-thread soup	71	5	93.42	53	21	71.62	1.89	1.43<RR<2.49	12.43	0.000
Clam soup	73	1	98.65	51	25	67.10	1.48	1.87<RR<2.93	26.04	0.000
Srimp ball	95	12	88.79	29	14	67.44	2.30	1.43<RR<3.71	9.75	0.001
Crab	85	5	94.44	39	21	65.00	2.57	1.86<RR<3.54	21.78	0.000
Sticky rice	81	9	90.00	43	17	71.67	1.89	1.30<RR<2.73	8.44	0.003
Shark's fin	118	20	85.51	6	6	50.00	4.77	1.67<RR<13.6	9.71	0.002
Pig's leg	98	10	90.74	26	16	61.90	2.93	1.86<RR<4.64	17.55	0.000
Dessert	50	4	92.59	74	22	77.08	1.42	1.14<RR<1.76	5.80	0.016
Water melon	64	8	88.89	18	60	23.08	1.43	1.05<RR<1.96	3.74	0.053

3) Multivariate logarithmic regression analysis

X^2-test, though good for testing the relation between dependent and independent variables has the following finding, if the relation between independent variables is too significant, the relation with dependent variables can be affected. Therefore, multivariate logarithmic regression analysis was applied to further study the relationship (see Table 2). The result was that ony the chicken in wine and the crab were found to be related to the poisoning ($p<0.05$).

Table 2. Multivariate Regression Analysis of Relation Between Foods and Illness (N=150)

Food	Regression Coefficient	Standard Error	Odd Ratio	X^2 Value	P Value
Chicken in wine	1.6349	0.7742	5.13	4.4599	0.0347*
Jelly fish	1.0412	0.8323	2.83	1.5649	0.2109
Snail	1.3056	0.9151	3.69	2.0355	0.1537
Meat jelly	0.5089	0.7131	1.66	0.5093	0.4754
Perch	0.9103	0.9187	2.49	0.9818	0.3218
Three-thread soup	0.0209	0.9757	1.02	0.0005	0.9829
Clam soup	2.2359	1.2082	9.35	3.4251	0.0642
Srimp ball	0.9633	0.7553	2.62	1.6265	0.2022
Crab	1.7314	0.9033	5.65	3.6737	0.0553*
Sticky rice	0.1147	0.7838	1.12	0.0214	0.8836
Shark's fin	0.1352	1.0180	1.14	0.0176	0.8934
Pig's leg	0.8969	0.7038	2.45	1.2410	0.2025
Dessert	0.8299	0.9740	2.29	0.7259	0.3944

* $P < 0.05$

4) Laboratory testing

(1) Food specimens

Vibrio parahaemolyticus of serum type K56 was isolated from the sticky rice with crab and crab cooked in a casserole.

(2) Human specimens

Vibrio parahaemolyticus of serum type K56 was isolated from 6 of the 13 rectal swab specimens.

5. Discussion

Some facts in the present food poisoning outbreak: guests at the vegetarian tables and 10 guests who attended the party but did not eat the dinner did not become ill; the epidemic curve showed a median incubation period of 13 hours; and *Vibrio pharahaemolyticus* of K56 type was isolated from both the food and human specimens, indicating that the food poisoning was caused by sea foods contaminated with *Vibrio parahaemolyticus* type K56. *Vibrio parahaemolyticus* is a short, gram-negative aerobic and *Campylobacter jejuni* bacterium, and grows better in sea water at 37°C. It parasitizes on shellfish in spring and summer and lives in the sediment of sea water in winter. With the flow of sediment, the bacteria circulate[6]. Under adequate conditions (30-37°C), the number of bacteria can double in 12 to 18 minutes. The number of colonies on the surface of a freshly caught fish is about 10^2/gram, this number grows quickly to 10^3-10^4/gram by the time the fish reaches the market. A dose of 10^5/gram is pathogenic[7]. Intake of sea food inadequately frozen, raw or improperly prepared, or food contaminated by sea water or inadequately stored after cooking can bring about infection of this type in the gastro-intestinal system. In 1950, there was an outbreak of gastro-enteritis in the Osaka area of Japan. It was not until 1953 that the pathogenic agent was isolated by Fujino et al. from feces of patients and from cooked sardines. In 1963, Sakazaki et al. named the agent *Vibrio parahaemolyticus*[8-10]. The pathogens, by their antigens, can be categorized into 13 O antigen groups and about 65 K sub-groups. Their pathogenicity is related to the hemolysin that induces β-Hemolysis in human blood cells. For identification, the size of hemolysis caused by the colonies on the Wagat-Suma agar — the so-called Kanagawa phenomenon[11] — is observed.

The disease has an average incubation period of 15 to 17 hours (ranging from 2 to 48 hours) depending on the amount of pathogens consumed. The disease generally lasts for two days, or from one to five days. The symptoms are similar to those of Salmonellosis and Shigellosis: sudden watery diarrhea occurring 15 and more times a day, and abdominal pain at the early stage[12,13], then, prostration, fever, chill, headache, nausea, vomiting and dehydration. Deaths, however, are rare[14].

Vibrio parahaemalyticus of serum type K56 was isolated from both the food and human specimens. Epidemiological investigation also found that the outbreak was related to sea foods. On-site investigation showed that the food processing facilities in the kitchen and the temperature of the refrigerator failed to meet regulations. The cook was care less about the preparation of raw and cooked foods and the mixed use of chopboard, kitchen knives and dish cloths, cross contamination of foods could easily happen. *Vibrio parahaemolyticus* is heat resistant. Foods that are not sufficiently heated or properly stored can allow micro-organisms to breed to such a concentration that disease may be induced and food poisoning thus occur.

6. Recommendations

1) Cooks should be careful in preparing raw sea foods to prevent them from contaminating other foods. Hands, apron and chopboard, after contact with raw sea

foods, should be thoroughly washed with clean water.

2) Make sure that cooked sea foods are heated at 70°C for more than 15 minutes.

3) Unprocessed sea foods should be properly frozen to avoid the breeding of micro-oganisms.

4) Cooked foods should be kept at 60°C or more. Otherwise, they should be stored at 4°C or an even lower temperature to avoid the breeding of micro-organisms. Raw and cooked foods should not be kept in the same refrigerator or freezer. If so, cooked foods should be placed on top to avoid the contamination by raw foods.

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