

## **An Epidemiological Investigation of a Food Poisoning Outbreak in Paisha Township, Penghu County, Taiwan**

### **Abstract**

On May 7, 2001, the Wu's family of Niaoyu Village, Paisha Township, Penghu County, had a wedding lunch party at the village recreational center by catering service. In the evening, some tens of guests developed symptoms of food poisoning such as diarrhea, nausea, vomiting, and abdominal pain. None of the vegetarians became ill. Of the 280 guests questionnaire-interviewed, 85 met the definition of case, giving an attack rate of 30.4%. Their major symptoms included, by order, watery diarrhea (100%), abdominal pain (83.5%), vomiting (32.9%), nausea (29.4%), dizziness (29.4%), chill (16.5%), and fever (10.6%). The incubation period was 3-33 hours, with a median of 16 hours. Most cases recovered within 3 days. By these specific features and the *Vibrio parahaemolyticus* isolated from the 22 rectal swabs, it was concluded that *Vibrio parahaemolyticus* was the pathogenic agent of this food poisoning outbreak.

The results of food item analysis showed that the cold dish was statistically associated with the outbreak. Its age-adjusted odds ratio and the 95% confidence limit were 2.37 and 1.19-4.71 respectively. Although no *Vibrio parahaemolyticus* was isolated in 12 specimens of food leftover, the cold dish was still considered a likely cause of the present outbreak.

## Introduction

*Virio parahaemolyticus* is a common pathogenic agent of food-borne gastroenteritis. Since 1991, bacterial food poisoning accounted for the most food poisoning incidents in the Taiwan Area<sup>(1-10)</sup>. Until 1994, *Vibrio parahaemolyticus* has replaced *Staphilococcus aureus* to become the major pathogenic agent of bacterial food poisoning. Food poisoning outbreaks caused by *Vibrio parahaemolyticus* occur more often in the warm months of May through November in Taiwan<sup>(1-10)</sup>, and in the United States as well. In Japan, they occur more often in June through October, more so in August and September.

For economic and other reasons, celebration parties are often held through catering services. They very often work outdoors and their facilities are relatively poor. About 10-20% of all food poisoning outbreaks were associated with catering services<sup>(1-12)</sup>. At noon on May 7, 2001, a wedding lunch party was held at the village recreational center by the Wu's family of Niaoyu Village, Paisha Township, Penghu County. The guests totaled 200-300. Twenty of them were vegetarians and did not become ill. Several tens of the rest developed symptoms of suspected food poisoning such as nausea, vomiting, diarrhea, abdominal pain, and chillness in the evening. No such cases were noted in the village on the day or after the day of the outbreak. It was suspected that the outbreak was associated with the catering service. An epidemiological study was then conducted to investigate the likely food items associated with and the pathogenic agents concerned.

## Materials and Method

### Study Subjects

Anyone who ate the dishes on May 7 at the Wu's wedding party by catering service held at the village recreational center of Niaoyu Village, or whoever had

some of the dishes brought home from the wedding party was investigated.

### Case Definition

A case was defined as one who ate the dishes on May 7 at the Wu's wedding party by catering service held at the village recreational center of Niaoyu Village and developed two or more diarrheas a day, and at least one of the following symptoms, abdominal pain, nausea, vomiting, fever, and chill.

### Study Method

For not being able to find all guests of the wedding party, the case-control method was used. The case group had patients who met the definition of food poisoning case. The control group had guests who did not meet the definition of case.

### Questionnaire Interviewing

A semi-structured questionnaire was designed to collect the information including the eaten food items, clinical symptoms or signs, time and date of onset, medication, time and date of medical care, and time and date of recovery from both cases and controls. Investigation was conducted on the evening when most residents of Niaoyu Village were at home. To facilitate questionnaire interviewing, local policemen were asked to accompany the investigators.

### Collection of Specimens

#### 1. Human Specimens

On May 8, health officials of the Penghu County Health Bureau collected 3 hand specimens from cooks of catering service, 46 rectal swabs and 1 vomit specimen from food poisoning patients. These specimens were sent to the Fourth Branch Office of the Center for Disease Control (CDC) of the Department of Health (DOH) for laboratory testing. Items of testing included

*Staphylococcus aureus*, enterotoxin of *Staphylococcus aureus*, *Bacillus cereus*, *Vibrio parahaemolyticus*, *Salmonella enteritidis*, *Salmonella typhi* and *paratyphi*, *Vibrio cholerae*, *E. coli*, and *Bacillus dysenteriae*.

## 2. Food Specimens

On the same day, leftovers of the foods served on the wedding party were collected from houses of the guests. They included cold dish, shark fin potage, steamed garoupa, sour lobster, braised shrimp, rice cakes, pig's heart soup, pig's stomach soup, fried squid ball, fried chicken drumsticks/wings, stewed pork shoulder, and stir-fried seafood. They were also sent to the South Branch Office of the National Laboratories of Foods and Drugs (NLFD) of the Department of Health for laboratory testing. Items of testing included *S. aureus*, enterotoxin of *S. aureus*, *V. parahaemolyticus*, *S. enteritidis*, *E. coli*, and *Bacillus cereus*.

## 3. Environmental specimens

Seven water specimens were collected on May 10 from the village recreational center of Niaoyu Villag and sent to for the laboratory testing by the South Branch office of NLFD. Items of testing included *S. aureus*, enterotoxin of *S. aureus*, *V. parahaemolyticus*, *S. enteritidis*, *E. coli*, and *Bacillus cereus*.

## Data Processing and Analysis

Data collected by questionnaire interviews was entered and validated by the Epi-Info software. In addition, SAS<sup>®</sup> software was used for the description and statistical testing of variables. The association between each food item and the food poisoning outbreak was indicated by crude odds ratios (COR) and age-adjusted odds ratios (AOR) and their 95% confidence limits. Both AOR and COR were estimated by the logistic regression analysis. Since none of the vegetarians got sick, therefore, they were excluded from data analysis.

## Results

A total of 280 non-vegetarian persons who either had the food at the wedding party or had the food brought home from the wedding party were interviewed by a questionnaire. Of them, 129 (46.1%) were males and 151 (53.9%) females. Their ages ranged from 2 to 81, with a median of 28 years. A total of 85 persons, 45 males and 40 females, met the definition of case, giving an attack rate of 30.4%. The ages of those who became ill ranged from 3 to 75, with a median of 33 years. Of those who did not become ill, the ages ranged from 2 to 81, with a median of 20 years. There was a statistically significant difference between the two medians of age (Mann-Whitney test,  $p < 0.05$ ).

Symptoms of the 85 cases included watery diarrhea (100.0%), abdominal pain (83.5%), vomiting (32.9%), nausea (29.4%), dizziness (16.5%), and fever (10.6%). The single-peak epidemiological curve (Figure 1) showed that the incubation period ranged from 3 to 33 hours, with a median of 16 hours. Most cases developed symptoms in 13 to 18 hours after food intake and recovered within three days.

The foods served on the wedding party included cold dish (of wine preserved chicken, slices of pork tongue, slices of abalone, shrimp balls, and shellfish), shark fin potage, steamed garoupa, sour lobster, braised shrimp, rice cake, pig's heart soup, pig's stomach soup, fried squib balls, fried chicken drumsticks/wings, stewed pig's shoulder, stir-fried seafood, pudding and jello. Results of analyzing of each food item (Table 1) showed that the cold dish, shark fin potage, steamed garoupa, sour lobster, and stir-fried seafood were statistically significantly associated with the food poisoning outbreak (the 95% confidence limit of each food item did not include 1.0). These food items were still significantly associated with the outbreak even when age was

adjusted. Their individual age-adjusted odds ratios and 95% confidence limits were 3.41 (1.94-6.05) for the cold dish, 2.58 (1.50-4.44) for shark fin potage, 2.27 (1.32-3.90) for steamed garoupa, 2.70 (1.57-4.63) for sour lobster, and 2.03 (1.15-3.58) for the stir-fried seafood. These four food items were all fishery products. After adjusting age difference between cases and controls, results of multiple logistic regression analysis showed that cold dish was the only dish statistically associated with the food poisoning outbreak. The age-adjusted odds ratio and its 95% confidence limit for the cold dish were 2.37 and 1.19-4.71 respectively.

Results of laboratory testing had isolated *V. parahaemolyticus* in 22 of the 46 rectal swabs. No *V. parahaemolyticus* was isolated from any of the 12 food specimens, 7 environmental specimens, and 3 hand specimens from the cooks.

## Discussion and Conclusion

*Vibrio parahaemolyticus* is a common pathogenic agent of food poisoning in coastal countries such as Taiwan, Japan, Southeast Asia, the UK, the Netherlands and the USA<sup>(13,14-18)</sup>. Infections occur more often in warm months<sup>(13,19)</sup>. *V. parahaemolyticus* grows under 35°C to 37°C, and sometimes, even under 10°C to 44°C. Under optimum conditions, *V. parahaemolyticus* can multiply by two-folds in 12 to 18 minutes<sup>(20)</sup>. *V. parahaemolyticus* lives often in oceans on shell and fish<sup>(21)</sup>. A just-caught fishery product for instance, the surface colonies at time of catch are 10<sup>2</sup> CFU/g, they are 10<sup>3</sup> to 10<sup>4</sup> CFU/g when the product reaches the market, and in three to four hours, the colonies will increase to a poisoning dosage of 10<sup>5</sup> to 10<sup>7</sup> CFU/g. Incubation periods of *V. parahaemolyticus* infection vary with the amount of bacteria taken in, and range generally from 12 to 24 hours<sup>(22)</sup>, or even as short as four hours, or as

long as 96 hours. Illness generally lasts for two days (from one to five days). Diarrhea and abdominal pain are the early symptoms<sup>(12,23)</sup>, and are seen in most cases. Other symptoms such as vomiting, nausea, fever, chill, and dizziness are also common. The epidemiological curve (Figure 1) of the present outbreak showed that most cases developed symptoms 3 to 33 hours after the intake of food, with a median of 16 hours. Symptoms were primarily diarrhea and abdominal pain, together with vomiting, nausea, dizziness, chill and fever. Most of them recovered in two to three days. These facts corresponded to the specific characteristics of *V. parahaemolyticus* food poisoning<sup>(22)</sup>. In addition, *V. parahaemolyticus* was isolated in 22 of the 46 rectal swabs. It was speculated that the pathogenic agent of the present food poisoning outbreak was *V. parahaemolyticus*.

*V. parahaemolyticus* food poisoning can be induced by contaminated food containers, fishery products not thoroughly cooked, fishery products eaten raw, or cooked food not properly preserved<sup>(24)</sup>. The agent can also be indirectly transmitted through hands, rags, or kitchen utensils such as chopping board, knives and containers to contaminate food<sup>(19,25)</sup>. Analysis of food items showed that the cold dish was statistically significantly associated with the outbreak (age-adjusted odd ratio being 2.37, and 95% confidence limit, 1.19-4.71). The cold dish included wine preserved chicken, slices of pig's tongue, slices of abalone, shrimp balls and shellfish. The abalone was an already processed product bought from a manufacturer, it was ready for serving after unfreezing and slicing. The shrimp balls were also half-processed products bought from elsewhere. They could be served soon after deep-frying. The shellfish was processed on the spot. In the process, it might not be properly cooked and could also be cross-contaminated with other fishery products such as lobster and squid on

the cooking table. Because the cooks refused to be interviewed, there were no ways to know the sources of the foods, their processing and preparation. On the other hand, no *V. parahaemolyticus* was isolated in any one of the 12 food specimens. It was suspected that the cold dish was the likely cause of the present food poisoning outbreak.

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**Table 1. Results of Analyzing Each Food Item Associated with Food Poisoning Outbreak in Niaoyu Village, Paisha Township, Penghu County, Taiwan**

Food Item	Ill			Not Ill			Crude Odds Ratio 95% CI	Age-adjusted Odds Ratio 95% CI
	Eaten	Not Eaten	Exposure Odd	Eaten	Not Eaten	Exposure Odd		
Cold dish*	62	23	2.70	84	111	0.76	3.56 (1.96 ~ 6.50)	3.42 (1.94 ~ 6.05)
Shark fin potage*	56	29	1.93	81	114	0.71	2.72 (1.54 ~ 4.82)	2.58 (1.50 ~ 4.44)
Steamed garoupa*	51	34	1.50	75	120	0.63	2.40 (1.37 ~ 4.20)	2.27 (1.32 ~ 3.90)
Sour lobster*	56	29	1.93	80	115	0.70	2.78 (1.57 ~ 4.92)	2.70 (1.57 ~ 4.63)
Braised shrimp	43	42	1.02	84	111	0.76	1.35 (0.78 ~ 2.34)	1.35 (0.81 ~ 2.25)
Rice cake	37	48	0.77	88	107	0.82	0.94 (0.94 ~ 1.62)	0.89 (0.53 ~ 1.50)
Pig's heart soup	30	55	0.55	59	136	0.43	1.26 (0.70 ~ 2.24)	1.13 (0.64 ~ 1.98)
Pig's stomach soup	31	54	0.57	47	148	0.32	1.81 (1.00 ~ 3.27)	1.65 (0.93 ~ 2.93)
Fried squid ball	42	43	0.98	76	119	0.64	1.53 (0.88 ~ 2.65)	1.52 (0.91 ~ 2.55)
Fried chicken/drumstick/wings	29	56	0.52	79	116	0.68	0.76 (0.43 ~ 1.34)	0.79 (0.46 ~ 1.36)
Stewed pork shoulder	18	67	0.27	27	168	0.16	1.67 (0.81 ~ 3.42)	1.58 (0.81 ~ 3.07)
Stir-fried seafood*	33	52	0.63	44	151	0.29	2.18 (1.20 ~ 3.94)	2.03 (1.15 ~ 3.58)
Pudding & jello	24	61	0.39	67	128	0.52	0.75 (0.41 ~ 1.37)	0.84 (0.47 ~ 1.52)

\* Statistically significant, the 95% confidence limits do not include 1.0

**Table 2. Results of Analyzing Multiple Food Items Associated with Food Poisoning Outbreak in Niaoyu Village, Paisha Township, Penghu County, Taiwan**

Food Item	Age-adjusted Odds Ratio (95% CI)
Cold dish*	2.37 (1.19 ~ 4.71)
Shark fin potage*	1.28 (0.63 ~ 2.60)
Steamed garoupa*	1.01 (0.50 ~ 2.05)
Sour lobster*	1.54 (0.78 ~ 3.06)
Stir-froed seafood	1.30 (0.67 ~ 2.52)

\* Statistically significant, the 95% confidence limit do not including 1.0.