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An Epidemiological Investigation of a Food-Poisoning Outbreak in a Taitung County Village

1. Introduction

Statistics of the "Report of Food Poisoning Outbreaks" issued by the Department of Health show that, of all 1994 food poisoning outbreaks by sites of foods served, after restaurants the most frequent site was outdoor cooking, accounting for 9 outbreaks and 269 victims. The reasons were either contamination or faulty processing of foods. Outdoor cooking often involves the use of poor facilities; the practice poses many problems in the control of sanitation at informal food preparation sites. In the period between 1981 to 1994, of the 1,010 reported food poisoning outbreaks in the Taiwan area, 31 or 3.07% were caused by the pathogen *Escherichia coli.*

Outdoor cooking by either individual cook or restaurant staff is relatively inexpensive and usually festive; it thus enjoys public popularity. However, most cooks or restaurants in this business are not registered; they lack definite business sites. This makes their control difficult and they are thus often a major source of food-poisoning outbreaks. Epidemiological investigations are aimed at identifying causes, then taking measures to prevent and control such outbreaks.

2. Background

The Tseng family, residents of a Taitung County village, were celebrating the homecoming of their just-married daughter. They asked a cook from Chi-pen Village to prepare lunch on 8 April 1995 for some 20 tables of guests. The party left-overs were distributed for guests to take home. On 9 April, 10 villagers became ill from eating food either at the lunch party or as left-overs; all 10 were treated for suspected food-poisoning. On 10 April, local Health Station personnel visited the Tsengs themselves, as well as the patients, for an investigation. Three rectal swab specimens from the patients and one specimen of the left-overs were collected for laboratory testing. Unsure whether the outbreak was caused by the cook's poor food-handling practices or had come from contamination of left-overs, the Health Station requested assistance from the Field Epidemiology Training Program (FETP) of the National Institute of

Preventive Medicine. Notified on 15 April, FETP investigators began their work on 17 April.

3. Materials and Methods

a. Individuals Investigated

As the cause of the outbreak was suspected to be associated with either the 8 April homecoming party itself or the party left-overs, the Tsengs were asked to provide a list of guests. The guests had been so numerous that the Tsengs themselves could not remember them all but, finally from the book the lunch-goers had signed, 112 individuals were identified. Of these, 67 were finally located.

Those 67 individuals were then telephone-interviewed by public health nurses based at the Health Station. Two of the guests refused interview; four could not be reached. The 61 interviewees helped to identify 46 more guests. The total number interviewed was, thus, 107.

b. Tools of Investigation

Investigation was conducted through a structured questionnaire and the interview noted above. The questionnaire contained items such as personal information; presence at the Tseng's party on 8 April; food items consumed; any discomfort suffered, with time of onset; symptoms; time of recovery; medical care, if any; handling of the left-overs, and whether any family member had become ill from eating those. Information thus collected was processed with Epi-Info and SAS.

c. Case Definition

A case was defined as one who had become ill from eating either foods at the Tseng's party on 8 April or the party left-overs, and had then developed at least two of the following symptoms: (1) diarrhea, (2) nausea, vomiting, fever or abdominal pain.

d. Laboratory Testing

(1) Food specimens:

The one food specimen collected by the Taitung County Health Bureau from the left-overs of the party of 8 April was sent for testing to the National Laboratories of Foods and Drugs (NLFD) of the Department of Health. Test items included testing for *Bacillus cereus, Vibrio parahaemolyticus, Salmonella,* Pathogenic *Escherichia coli*

and *Staphylococcus aureus*. On 19 April, one specimen of the spring water used for cooking was also collected for testing by the National Institute of Preventive Medicine.

(2) Human specimens:

Three rectal swab specimens were collected on 10 April from some patients who had already been medically treated. On the same day, rectal swab specimens were also collected from the cook and his five assistants. These specimens were sent to the Division of Bacteriology of the National Institute of Preventive Medicine (NIPM) for testing. Test items included: testing for *Vibrio parahemolyticus, Bacillus dysenteriae, Staphylococcus aureus, Salmonella, Bacillus cereus,* Pathogenic *Escherichia coli* and *Vibrio cholerae.*

4. Fidnings

a. Distribution of cases:

Of the 107 persons interviewed, 19 did not eat at the party; none of the those became ill. Of the 88 who had eaten either food at the party or the left-overs, 21 became ill, giving an attack rate of 23.86%. The incubation period ranged from 4 to 25 hours, with a median of 21 hours; 52.30% of the cases occurred in the 21-22 hour period (Figure 1). The attack rates by sex were 15.79% for men and 30.00% for women. Some major symptoms were diarrhea (81.00%), abdominal pain (100%), nausea (19.00%), vomiting (52.40%) and fever (66.70%).

b. Food consumption and illness:

Of the 21 who became ill, 9 had eaten left-overs. Of those nine, four had had food at the party as well. The remaining 12 had eaten food only at the party.

c. Food items and illness:

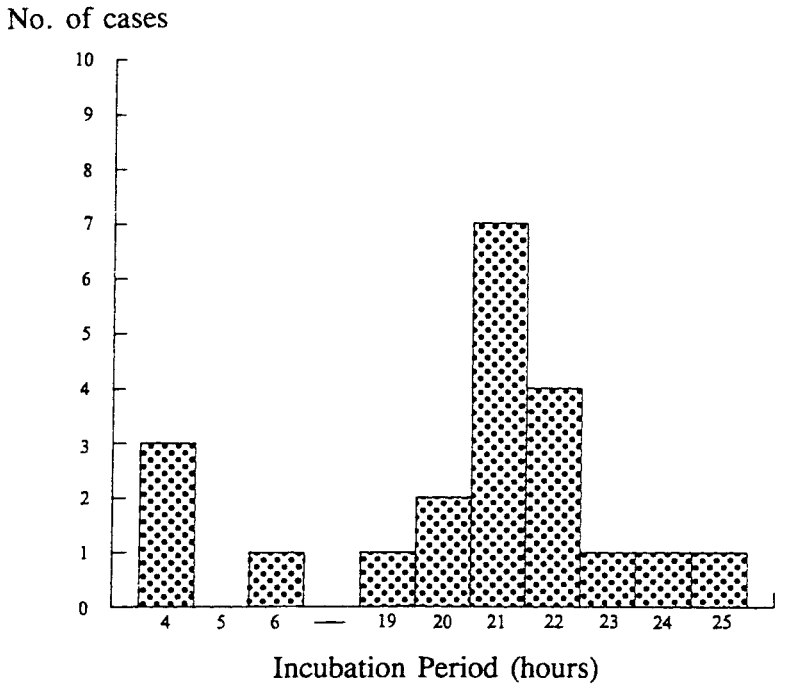
Four food items (meat with bamboo shoots, lobster, hair-like vegetable soup and glutinous rice with eight treasures) were found to be related to the outbreak (Table 1) with statistically significance ($p<0.05$).

d. Laboratory Testing:

(1) Food specimens:

Pathogenic *Escherichia coli* (serotype O27:H18) was isolated by the NLFD from the food specimens collected on 8 April.

Figure 1. The Epidemic Curve (N=21)



(2) Human specimens:

The three rectal swab specimens sent on 11 April to the Division of Bacteriology of the NIPM for testing were all found to be negative. The six rectal swab specimens provided by the cook and his assistants, sent on 19 April to the laboratory, were also found to be negative.

(3) Environmental specimens:

No pathogenic agent was isolated from the single specimen of spring water collected on 20 April, tested by the Division of Bacteriology of the NIPM.

5. Discussion

In 1945, Bray isolated some antibody-like micro-organisms from the stools of 42

Table 1. Testing Relationship Between Foods and Illness (n=88)

Food items	Eaten			Not Eaten			Relative Risk	95% Confidence Interval	χ^2 Value	P-Value
	Ill	Not ill	Attack Rate (%)	Ill	Not ill	Attack Rate (%)				
Pork rib soup	15	42	26.32	6	25	19.35	1.36	0.59<RR<3.15	0.54	0.464
Meat with bamboo shoots	20	44	31.25	1	23	4.17	7.50	1.06<RR<52.87	7.05	0.010*
Roast duck	13	43	23.21	8	24	25.00	0.93	0.43<RR<2.00	0.04	0.850
Lobster salad	17	26	39.53	4	41	8.89	4.45	1.63<RR<12.16	11.37	0.001*
Stewed chicken	16	57	21.92	5	10	33.33	0.66	0.28<RR<1.52	0.89	0.338
Hair-like soup	18	35	33.96	3	32	8.57	3.96	1.26<RR<12.45	7.48	0.010*
Fried chicken wings	14	54	20.59	7	13	35.00	0.59	0.28<RR<1.26	1.77	0.184
Assorted plate	13	49	20.97	8	18	30.77	0.68	0.32<RR<1.45	0.97	0.325
Glutinous rice	12	54	18.18	9	13	40.91	0.44	0.22<RR<0.91	4.69	0.030*
Fish	12	30	28.57	9	37	19.57	1.46	0.69<RR<3.11	0.98	0.322
Dessert	11	33	25.00	10	34	22.73	1.10	0.52<RR<2.32	0.06	0.803

Note: * P-value smaller than 0.05 (with significant difference)

of the 44 infants who developed diarrhea through nosocomial infection[1]. In 1949, Giles et al.[2] and Taylor et al.[3] suggested that these diarrheal incidents were caused by *Escherichia coli*. The serological procedure to identify *E. coli* O serogroup and H serogroup was not developed until 1950[4-6]. Reports thereafter show that pathogenic *E. coli* is widely spread. In 1961, Taylor et al.[7] isolated enterotoxigenic strain *Escherichia coli* (ETEC) from stools of diarrheal children, and demonstrated that it could produce positive reaction in the rabbit-loop reaction. In 1970, it was pointed out that the ETEC group could produce both heat-stable and heat-unstable types of toxins[8].

The investigation described here indicated that the outbreak could have been related to the contamination of foods at the party. Of the 107 persons interviewed, 19 who had attended out did not eat at the party and none of them became ill. Of the 88 who had foods either at the party or as left-overs, 21 became ill. Of those, 12 had food only at the party, 4 had food both at the party and as left-overs, and 5 had left-overs only. From the epidemic curve (Figure 1), it can be noted that the onset came in two peaks, and that the incubation period was 4-25 hours with a median of 21 hours. Literature shows that the incubation period of illness caused by pathogenic *E. coli* is 12-36 hours. Pathogenic *E. coli* (serotype O27:H18) was isolated from the food specimen. Specimens had been collected from only a few food items. Though no other pathogenic agents had been isolated, the chances of foods being contaminated by other pathogenic agents could not be eliminated. Since patients had been treated with antibiotics before collection of the specimens, it is understandable that rectal swab specimens gave negative findings. However, in exactly what way the foods at the party were contaminated was hard to pinpoint. They could have been contaminated through either inadequate handling by the cooks or through the water, although the former is the more likely cause. If it was by the water, cases would have not come only from those who had either foods at the party or the left-overs. Though no pathogenic *E. coli* was isolated from the rectal swab specimen collected from the cook on 19 April, the chances of contamination through inadequate handling by the cook remain since there was a lapse of 11 days between the party and the collection of specimens. Pathogenic *E. coli* can spread through many channels. On another occasion of out-door preparation by the same cook on 19 April at a community center, it was noticed that foods were left on the ground, cooked near the toilet and were covered with flies. Foods can be easily contaminated under such conditions, and food poisoning occurs as a consequence.

Pathogenic *E. coli* is found in the intestinal tracts of men and animals. Food or water sources are contaminated through feces of infected men or animals and consumption willl bring about diarrheal diseases. Five types of diarrhea induced by different kinds of pathogenic *E. coli* have different toxicity, serotypes, clinical symptoms and modes of transmission[9]: (1) enterotoxigenic, (2) enteroinvasive, (3) enteropathogenic, (4) enterohemorrhagic and (5) enteroaggregative. The two common kinds are (1) enteroinvasive *E. coli* which, by entering the intestinal tracts of men, induces *Shigellosis*-type poisoning such as acute enteritis, with bloody or mucal stools in an incubation of 10-18 hours; (2) enterotoxigenic *E. coli* induces cholera-like symptoms such as watery diarrhea *Enterotoxigenic E. coli* may bring about dehydration; some of the toxins produced are heat-resistant, but some can be destroyed by heat; the incubation period

is 12-36 hours and the symptoms are diarrhea, abdominal pain, nausea, vomiting and fever. Preventive measure include (1) adequate heat-processing of foods and drinking water; (2) regular testing of water quality; (3) prohibiting infected persons from handling foods and (4) washing and sterilizing food utensils and containers.

6. Conclusion

a. The epidemiological investigation showed that the present outbreak of gastro-enteritis was associated with foods served at the home-coming party. Food items such as meat with bamboo shoots, lobster, hair-like vegetable soup, and glutinous rice with eight treasures were found to be related to the illness.

b. From the epidemic curve (Figure 1), it can be noted that the agent of the present incident was the pathogenic *Escherichia coli* (serotype O27:H18).

c. Though 9 persons who became ill had only party left-overs, 12 persons who ate at the party itself also became ill. The cause of the incident was thus considered to be the contamination of foods at the party.

d. Both the meat with bamboo shoots and the hair-like vegetable soup were among the left-over food items. Five persons who became ill from eating left-overs were found to have had those two food items.

e. Though spring water had been used for cooking, the fact that cases were identified from those who had either foods at the party or the left-overs suggested that the incident was not caused by contamination of the water. Also, no pathogenic agent was found in the water specimen.

7. Recommendations

a. Findings from laboratory testing can be further improved if reporting hospitals and clinics collect specimens from the vomitus or excretion of food-poisoning cases, prior to medication.

b. Control of the work practices of cooks who specialize in out-door food preparation should be strengthened. Courses in food sanitation can be organized either by the association of the chefs or by the health authorities. Tests can be administered, and certificates issued to those who have passed the tests. Through effective control, the last five-year's increase in the number of food-poisoning incidents caused by out-of-door cooking in the last five years can be reduced.

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References:

1. Bray J. Isolation of antigenically homogeneous strains of *Bact. coli neapolitanum* from summer diarrhoea of infants. J Pathol Bacteriol. 1954; 57: 239-247.
2. Giles C, Sanoster G, Smith J. Epidemic gastroenteritis of infants in Aberdeen during 1947. Arch Dis Child 1949; 24: 45-53.
3. Taylor J, Powell BW, Wright J. Infantile diarrhea and vomiting: A clinical and bacteriological investigation. Br Med J 1949; 2: 117-125.
4. Edwards PR, Ewing WH. The genus *Escherichia.* In: Identification of Enterobacteriacea, 3rd ed. Minneapolis: Burgess Publishing, 1972.
5. Kauffmann F. The serology of the coli group. J Immunol 1947; 57: 71-100.
6. Kauffmann F, Dupont AJ. *Escherichia* strains from infantile epidemic gastroenteritis. Acta Pathol. Microbiol Scand 1950; 27: 552-564.
7. Taylor J, Wilkins MP, Payne JM. Relation of rabbit gut reaction to enteropathogenic *Escherichia coli.* Br J Exp Pathol 1961; 42: 43-52.
8. Smith HW, Gyles CL. The relationship between two apparently different exterotoxins produced by enteropathogenic strains of *Escherichia coli* of porcine origin. J Med Microbiol 1970; 3: 387-401.
9. Benenson AS. Control of Communicable Diseases in Man. American Public Health Association, 15th ed., 1990; 130-139.