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Original Article

Incident of *Salmonella* Poisoning by Roast Duck in Kaohsiung in 2011

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Abstract

In early May 2011, an incident of food poisoning occurred in Kaohsiung. After eating roast duck purchased from a shop, 75 people sought medical care for gastrointestinal symptoms. All of the patients had diarrhea, 52 (69%) of them had fever, 51 (68%) complained of abdominal pain, 29 (39%) felt fatigue, 18 (24%) had headache, 13 (17%) had been vomiting (17%), and 12 (16%) patients complained of nausea. *Salmonella* serotype O7 was found in samples collected from 11 patients, 2 shop workers, and 3 uneaten pieces of duck meat. From the gastrointestinal symptoms presented, the timing of the illness, the incubation period and test results, it was concluded that the cause of this outbreak was *Salmonella*. Survey results showed that roast duck meat purchased from the shop was statistically significantly related to the illness, and should be considered as the cause of this incident. As *Salmonella* was found on the staff in charge of cutting the roast ducks at the restaurant, cooked food in the shop could have been contaminated by staff members who were carrying the bacteria on their hands.

Keywords: food poisoning, *Salmonella* serotype O7, *Salmonella* Bareilly

Introduction

On 9 May, 2011, the Taiwan Centers for Disease Control (Taiwan CDC) received reports of food poisoning from three hospitals, all of which were related to the consumption of food purchased at a roast duck shop in Kaohsiung – the same shop that had been closed on 29 April, 2011 because of *Salmonella* poisoning and which had only just reopened. Food poisoning cases started on 7 May, with more people seeking medical advice after the media reported the incident on 13 May. To ensure a proper investigation, Kaohsiung City Government Department

of Health requested the assistance from Taiwan CDC Fifth Branch and Field Epidemiology Training Program (FETP).

Salmonella bacteria are a major cause of food poisoning around the world [6,11-12], as well as a zoonotic pathogen that can be spread between humans and animals. It can be found in the intestines of most wild or domestic animals such as cows, sheep, chicken, ducks and geese. Carrier animals spread the bacteria in their manure and other discharges, polluting the environment, contaminating animal and plant products such as poultry meat and eggs or bean sprouts, and causing salmonellosis [1-2, 4, 13]. Symptoms include diarrhea, fever, and abdominal cramps after an incubation period of 12-72 hours, and can last four to seven days. Most patients recover by themselves [1]. *Salmonellae* are rod-shaped, Gram-negative bacteria, with over 25,000 serotypes. Due to the vast variety of food sources and ways of cooking, levels of *Salmonella* poisoning vary among different countries [6,11]. Other than using anti-serum to identify the serotypes of *Salmonella* isolates, antimicrobial resistant test and Pulsed Field Gel Electrophoresis (PFGE) [3, 9] have been used internationally for epidemiological analysis of different isolates and to monitor antibiotic abuse.

Materials and Methods

1. Epidemiological survey

The investigation aimed to establish if there was an outbreak of food poisoning, estimate the scale of the epidemic, identify the causative agent and food source, and find out why the outbreak occurred. This retrospective case-control study used a convenience sampling method by telephone interviewing people who had consumed food purchased from the roast duck shop on 7–8 May. A semi-structured questionnaire was used to record respondents' demographic information, time eaten, food eaten, clinical symptoms, disease onset time, and doctor visits. A case was defined as someone who had eaten food purchased from the roast duck shop on the 7–8 May, 2011; had two or more diarrhea incidents per day within three days after consuming the food; and had one of the following symptoms: fever, abdominal pain, flatulence, nausea, vomiting, headache, and dizziness. Those who had consumed food from the roast duck shop but did not have any of the above symptoms were categorized into the control group. Data collected by the questionnaire was entered and debugged by Epi-Info before being analyzed using Chi-square to find the correlated factors. If more than one food was found to be related to the disease ($P<0.05$), a logistic regression model was used to identify the most possible food.

2. Sample collection and analyses

Kaohsiung City Government Department of Health collected anal swabs from patients and workers at the roast duck shop. Food samples in the environment were also collected. These human and food samples were sent to the department's laboratory as well as Taiwan CDC Southern regional laboratory for testing. Anal swabs were smeared on SS (Salmonella-Shigella) and HE (Hektoen enteric) agar plates and incubated at 37^{o}C. Suspected colonies were selected for further identification on the next day using API 20E BioMérieux.

Serotypes were again tested by agglutination. Antimicrobial resistance was tested by putting disks of ampicillin (10ug), nalidixic acid (30ug), ciprofloxacin (5ug), trimethoprim/sulfamethoxazole (1.25/23.75ug), tetracycline (30ug), chloramphenicol (30ug), and cefotaxime (5ug) on Muller Hinton agar plates, which were then incubated at 37°C for 24 hours. After incubation, the plates were checked for growth of bacteria. Using PFGE, fragments of DNA were separated and matched using a computer database in order to compare the similarities among different strains.

Results

The investigation interviewed 96 customers who had lunch or dinner at the restaurant on 7–8 May, and 75 of them met the case criteria. The attack rate was 78% (Table 1).

There were 41 (43%) male cases and 55 (57%) female cases. Medical treatment was sought by 59 (61%) customers after eating the food, 27 (28%) customers were kept in the emergency area for observation, 13 (14%) were hospitalized, and one (1%) case went into ICU. One (1%) patient went into labor at 36 weeks. Of the 75 cases, all had diarrhea, 52 (60%) had fever, 51 (68%) had abdominal pain, 29 (39%) complained of fatigue, 18 (24%) had headache, 13 (17%) had been vomiting, 12 (16%) had nausea, 11 (15%) felt dizzy, and 2 (3%) experienced trembling. Seventy-two cases remembered when their symptoms started, with the onset period between 2 to 52 hours. The median was 16 hours (Fig. 1). Univariate analysis

Table1. Date and time when the food was consumed

Date	Lunch customers	Dinner customers	Total
7 May	18	20	38
8 May	20	17	37
Total	38	37	75

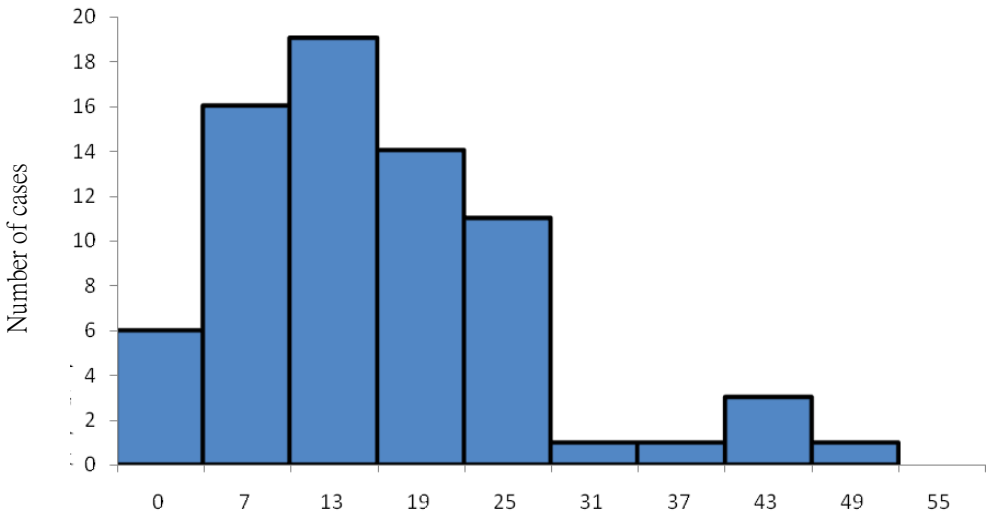

Figure1. Epidemic curve of Kaohsiung roast duck shop *Salmonella* poisoning incident (n=72)

showed that the odds ratio (OR) was 29.6 (95% CI =3.2 – 264.1) for the duck meat and 4.19 (95% CI = 1.3-13.4) for the accompanying pancakes. Both were statistically significant. However, logistic regression identified that only duck meat was statistically significant (OR = 21.1; 95% CI = 2.1-211.1) (Table 2).

During the outbreak, 31/38 samples from patients were positive, and 2/7 samples from restaurant workers were positive. Nine food samples were also collected and the three positive samples were all from duck meat. During the last outbreak on 29April, 14 samples were collected from patients and 13 of them were positive. Both outbreaks were caused by the same *Salmonella* serotype. Testing with ampicillin, nalidixic acid, ciprofloxacin, trimethoprim/sulfamethoxazole, tetracycline, chloramphenicol, and cefotaxime revealed none of the isolated strains were resistant to the antibiotics. Thirty-four strains were found in cases, chefs, and food. PFGE results showed that they all belonged to group C1, Bareilly (Fig. 2).

Table 2. Food consumed and symptoms

Food	Cases		Controls		OR[a]	95%CI[b]
	Eaten	Did not eat	Eaten	Did not eat		
Roast Duck Meat	74	1	15	6	29.6	3.3-264.1
Pancake	67	8	14	7	4.19	1.3-13.4
Sauce	63	12	14	7	2.63	0.9-7.9
Spring Onions	50	25	12	9	1.50	0.6-4.0
Stir-fried roast duck	59	16	15	6	1.47	0.5-4.4

*indicates that it's statistically significant, α=0.05 [a]OR: odds ratio [b]CI: confidence interval

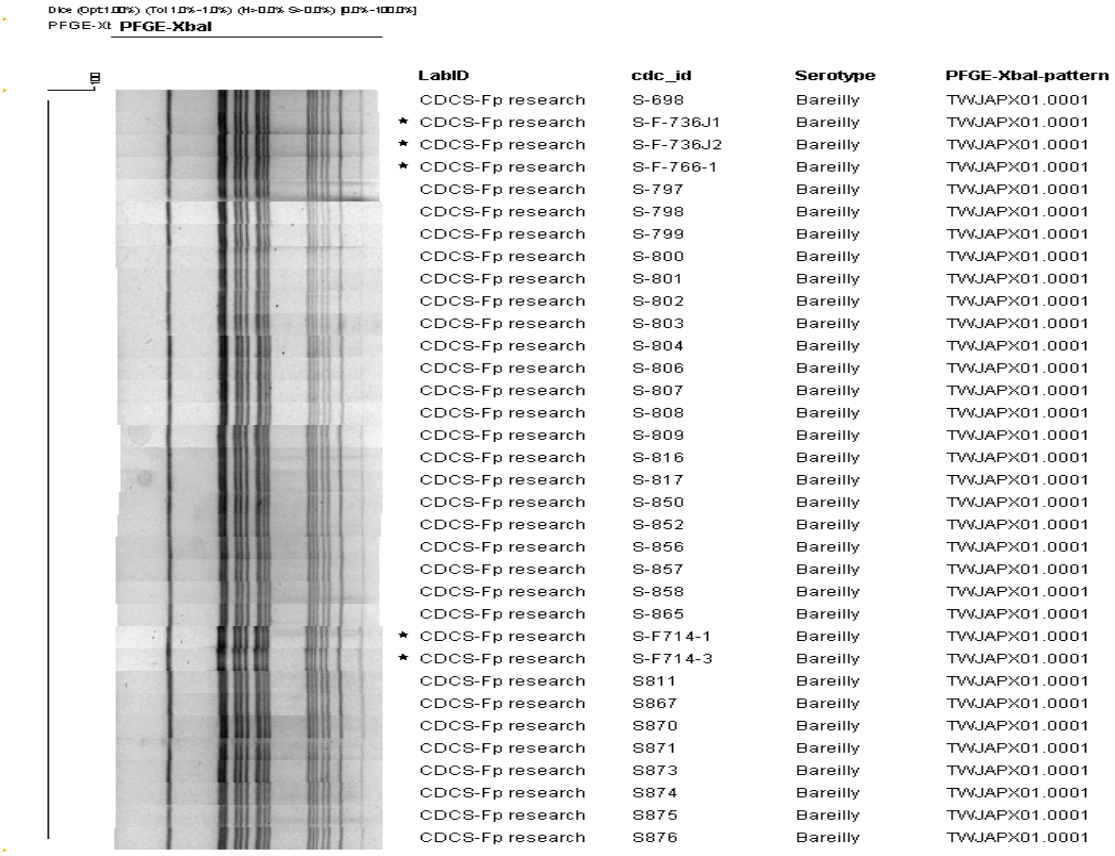

Figure 2. PFGE results of *Salmonella* strains identified from samples collected during the roast duck shop food poisoning incidents in Kaohsiung.

*indicates five strains from food samples S-698 was the strain from samples collected on 29 April. S850 and S852 were strains isolated from the chef samples.

Discussion

Results of the questionnaire showed that duck meat was statistically significantly related to this outbreak. *Salmonella* was also detected in duck meat. It was therefore concluded that duck meat was the main cause of this outbreak. As *Salmonella* can survive in high temperatures, high fat, and low water content conditions, and is often present in the intestines of humans, mammals, birds, and amphibians, contamination by direct contact occurs easily. Reports showed that 89% of those infected were consumers who had been in contact with poultry within a week [2]. PFGE is commonly used to detect and identify the epidemic relationship between pathogens and meats [9,11]. Taiwan CDC has also joined the network of PulseNet. The *Salmonella* bacteria in this incident belonged to Group C1 *Salmonella* Bareilly. Annually, approximately 1% of cases identified in Taiwan are attributed to *S*. Bareilly. This serotype has also been reported in the UK [5]. The matching of molecular biological characteristics proved that *Salmonella* had never ceased to exist in the roast duck shop. Because the identified strain did not show resistance to any tested antimicrobial agents, it is reasonable to believe that the strain came from its natural environment and had not been treated. This is in contrast to the fact that as antibiotics have been widely used in agriculture to control diseases, a high percentage of antibiotics-resistant bacteria have been isolated from domestic and foreign meat, vegetables, fruits and seafood. [9,11,13].

According to the information of "date and time of eating" in the questionnaire, patients mainly had lunch or dinner on either 7 or 8 May. This showed that the outbreak was unlikely to be caused by a single lot of food. Two of the workers who were in charge of slicing the ducks were found to carry *Salmonella*. This outbreak was therefore concluded to have been caused by staff members who contaminated the duck meat during processing. *Salmonella* infections can have mild or no symptoms, but the pathogen can continue to be excreted from the body for up to 102 days after recovery. Most of the infections were caused by contamination from poultry or egg products [4,11,13]. Earlier studies reported that food handlers were often the reservoir of bacteria [7-8,16-18]. Authorities should strengthen the training and education of restaurant workers.

The same roast duck shop had caused similar food poisoning on 29 April, when 14 people sought medical care. Although *Salmonella* was detected in both patient and food samples at the time, no samples were collected from the shop workers, so the opportunity to locate the source and prevent further infection was lost. It is important that any intervention with regards to avoiding food poisoning caused by *Salmonella* must start from monitoring food workers. Those who have infectious diseases, especially those who are suffering or recovering from gastrointestinal illnesses, are bacteria carriers and must be registered, settled and treated immediately. After treatment and returning to work, they must be monitored and re-checked regularly [15-16]. On 2 June, the shop was taken to court by Kaohsiung City Government Department of Health for breaching Clause 34.3 of the Food

Hygiene Regulation. In the wake of this incident, on 14 July, the department also ran an educational course on food poisoning and the prevention of gastrointestinal infectious diseases to educate its staff about sample collection for food poisoning outbreak.

In summary, it is recommended that for suspected *Salmonella* food poisoning outbreaks, health authorities should follow the regulations of the Administrative Principles of Food Poisoning Investigations and the Manual for Infectious Specimen Collection to collect samples from possible sources and food handlers in order to meet the need for disease prevention. This will help to identify the true source of the disease. Restaurant workers need to pay attention to personal and food hygiene, and to stop handling food when they have gastrointestinal symptoms. This is the best way to prevent food poisoning [14].

Acknowledgements

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References:

1. CDC. Multistate outbreak of Salmonella serotype Tennessee infections associated with peanut butter -United States 2006–2007. MMWR 2007;56:521-4.
2. CDC. Investigation update: Multistate outbreak of human Salmonella Altona and Salmonella Johannesburg infections linked to chicks and ducklings. 2011 Aviliable at:http://www.cdc.gov/salmonella /altona-baby- chicks/062911/index.html.
3. Richard E Hoffman, Jesse Greenblatt, Bela T Matyas, et al. Capacity of State and territorial health agencies to prevent foodborne illness. Emerg Infect Dis 2005;11:11-6.
4. Carl M Schroeder, Alecia Larew Naugle, Wayne D Schlosser, et al. Estimate of illnesses from Salmonella Enteritidis in eggs United States 2000. Emerg Infect Dis 2005;11:113-5.
5. O'Brien S, Ward L, Hampton M, et al. Increase in Salmonella Bareilly in the United Kingdom. Euro surveillance Weekly 2003;7**:**2-3.
6. Shukho Kim. Salmonella serovars from foodborne and waterborne diseases in Korea 1998-2007. Total isolates decreasing versus rare serovars. Emerging J Korean Med Sci 2010;25:1693-9.
7. Todd EC, Michaels BS, Smith D, et al. Outbreaks where food workers have been implicated in the spread of foodborne disease. Part 3 Factors contributing to outbreaks and description of outbreak categories. Food Prot 2007;70:2199-217.
8. Honish L, Hislop N, Zazulak I, et al. Restaurant foodhandler-associated outbreak of Salmonella Heidelberg gastroenteritis identified by calls to a local telehealth service Edmonton Alberta 2004. Can Commun Dis Rep 2005;31:105-10.
9. E Cardinale, J D Perrier Gros-Claude, K Rivoal, et al. Epidemiological analysis of Salmonella enterica ssp. Enterica serovars Hadar, Brancaster and Enteritidis from humans

and broiler chickens in Senegal using pulsed-field gel electrophoresis and antibiotic susceptibility. Journal of Applied Microbiology 2005;99:968-77.

10. C Papadopoulou, R H Davies, J J Carrique-Mas, et al. Salmonella serovars and their antimicrobial resistance in British turkey flocks in 1995 to 2006. Avian Pathology 2009;38:349-57.
11. Z M Pan,S Z Geng,Y Q Zhou, et al. Prevalence and antimicrobial resistance of Salmonella sp. isolated from domestic animals in Eastern China. Journal of Animal and Veterinary 2010;9:2290-4.
12. T M Pan, T K Wang, C L Lee, et al. Food-borne disease outbreaks due to bacteria in Taiwan 1986 to 1995. J Clin Microbiol 1997;35:1260-2.
13. Yu-Chih Wang, Yu-HsinTsai, Chih-Wei Laio, et al. Investigation of Salmonella in Hens and Shell-eggs in Central Taiwan. Taiwan Veterinary Journal. 2010;36:38-44.
14. David L(ed.). Control of Communicable disease manual, 19TH ed. Washington DC American Public Health Association, 2008.
15. Washing and drying of hands to reduce microbial contamination. J Food Prot 2010;73:1937-55.
16. Hundy RL, Cameron S. An outbreak of infections with a new Salmonella phage type linked to a symptomatic food handler. Commun Dis Intell 2002;26:562-7.
17. H Maguire, P Pharoah, B Walsh, et al. Hospital outbreak of Salmonella Virchow possibly associated with a food handler. J of Hospital Infection 2000;44:261-6.
18. Khuri-Bulos N A, M A Khalaf, A Shenhabi, et al. Foodhandler -associated Salmonella outbreak in a university hospital despite routine surveillance cultures of kitchen employees. Infect Control Hosp Epidemiol 1994; 15: 311-4.

Outbreak Investigation Express

Influenza Outbreaks in a Psychiatric Institution in Eastern Taiwan

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Abstract

There are often influenza cases reported every season in Taiwan; especially in autumn and winter, influenza outbreaks reported more frequently. The epidemic period of influenza is mainly from December to March of the next year. In 2012, in the eastern Taiwan, the recorded

influenza clusters were nine times higher than that in 2011 from January to July. In 2012, five influenza clusters reported from a specific psychiatric institution in February, April, May and June separately. In the series of these events, one cluster was associated with influenza B virus and the others were associated with influenza A virus. The cases reported were 9, 66, 162, 11 and 119 with the respective attack rate of 8.4%, 61.1%, 22.1%, 22.4% and 56.1%. Moreover, the outbreak period of each event was 6, 11, 44, 9 and 11 days, respectively. After investigation, the main problems of the outbreaks are delay of outbreak reporting, no day-off policy for sick staff, and not good implementation of monitoring and quarantining policy. This paper provides some suggestions on how to reduce influenza outbreaks for high density institutions and psychiatric institutions.

Key words: influenza, psychiatric institutions, cluster events

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