Food Poisoning Outbreak from Contaminated Fish-Balls

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Abstract

On February 9th, 1998, a food poisoning outbreak occurred at a boarding school for underprivileged students. An unmatched case-control study was done. An environmental survey, laboratory study of rectal swab culture, fish-balls, water and the cooking utensils were also performed. There were 132 suspect cases, of which the attack rate in teachers was 9.8 per cent (4/41), 16.7 per cent (1/6) in the food handlers and 15.7 per cent (127/810) in the students. The median incubation period was 18 hours. Analysis of food consumption revealed those who ate lunch noodles had the highest risk (OR 3.8, 95% CI 0.6 – 25.9). In details of food components, those who ate fish-balls in curry had the only significant risk (OR 3.5, 95% CI 1.2 -10.8) of becoming ill when compared to those who did not. Fish-balls in noodles and curry had a dose response relationship. Bacterial culture from 25 grams of fish-balls was positive for *Vibrio parahaemolyticus*. The fish-balls in noodles and curry were identified as the implicated food. The modes of contamination were uncooked food, cooking utensils and the food handlers. The manufacturer, which had no license to operate and had poor standards of sanitation, was closed by the Food and Drug Administration.

Key word : Food Poisoning, *Vibrio Parahaemolyticus*, Thailand

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Vibrio parahaemolyticus outbreaks are recognized by the occurrence of illness within a usually short but variable period of time (from 4 hours to 30 hours) after consumption[1]. In many countries, *Vibrio parahaemolyticus* has been identified as the cause of major food poisoning outbreaks, such as 24 per cent in Japan, 11 per cent in India, 8.5 - 15 per cent in Vietnam, 2.6 - 3.7 in Indonesia and 1.5 per cent in Korea[2].

In Thailand, the attack rate of foodborne disease increased from 85.4 /100,000 population in 1986 to138.2 in 1996. The case fatality rate increased from 0.01 per cent to 0.06 per cent over the same period. *V. parahaemolyticus* was the most common organism[3,4] and the most frequent source of *V. parahaemolyticus* food poisoning resulting from ingestion of seafood, that has been inadequately cooked[3,4].

On February 9th 1998, an outbreak of food poisoning in a boarding school for underprivileged students in Nontaburi Province was reported in many newspapers - 132 persons developed similar lower gastrointestinal symptoms. The severe cases were admitted to Bangkruai community hospital. Almost all of them were discharged within the day. An investigation was conducted to determine the etiology, source and mode of contamination in the outbreak and to recommend prevention and control measures for food poisoning outbreaks.

MATERIAL AND METHOD

Descriptive epidemiological study :

The descriptive study and active case finding were performed by examining hospital records and interviewing members of the affected school. The environmental study was performed by visiting the boarding school and examining the residence, the cooking facilities, the eating areas and collecting rectal swab cultures from all food-handlers. Following this, a visit was made to the shop and factory which provided the fish-balls to the boarding school. The factory was inspected and specimens were collected. Finally, a visit was made to the hospital to interview patients in order to collect the clinical symptoms.

Analytical epidemiology :

The study design was an unmatched case - control study. Odds ratio was used to demonstrate the association between eating food and the risk of becoming ill. Logistic regression by the unconditional method was used to assess the effects of contaminated food by controlling the potential confounders.

Definition

A food poisoning suspect case was defined as a person who ate any item of food in this school and developed one of the following symptoms - diarrhea, nausea/vomiting and abdominal pain between 9th – 11th February 1998.

A confirmed case (for the unmatched case-control study) was defined as a suspect case who had two symptoms or a positive rectal swab culture for *Vibrio parahaemolyticus.*

A control case was a close contact of a case and a rectal swab culture negative for *Vibrio parahaemolyticus.*

An unmatched case - control study was done by interviewing a case and control for eating chicken soup for breakfast, fish-ball noodles and dessert for lunch, fish-ball curry and fried cabbage for dinner, and also the component of each food.

Laboratory study :

Water, fish-balls, swabs taken from cooking utensils, refrigerators, rectal swab culture from the food handlers, cases and controls were sent for culture at the National Institute of Health, Ministry of Public Health.

RESULTS

Descriptive epidemiology

A total of 111 cases were investigated by the mobile health unit at the boarding school on the 10th of February 1998 and the admission records of 16 cases from the Bangkruai hospital were examined. Active case finding was performed by interviewing the children who developed one of the symptoms - diarrhea, nausea/vomiting and abdominal pain. Five cases were detected.

The index case was a student who had the symptoms of diarrhea, nausea/vomiting and abdominal pain at 8 p.m. on the 9th February. But the first case had these symptoms at 2 p.m. and RSC was positive for *Vibrio parahaemolyticus.* The last case developed the symptoms at 6 p.m. on the 11th February (Fig. 1). The median incubation period was therefore 18 hours after lunch. This large number of people who developed similar symptoms in a short period suggested that there was a common source of the outbreak and the most probable

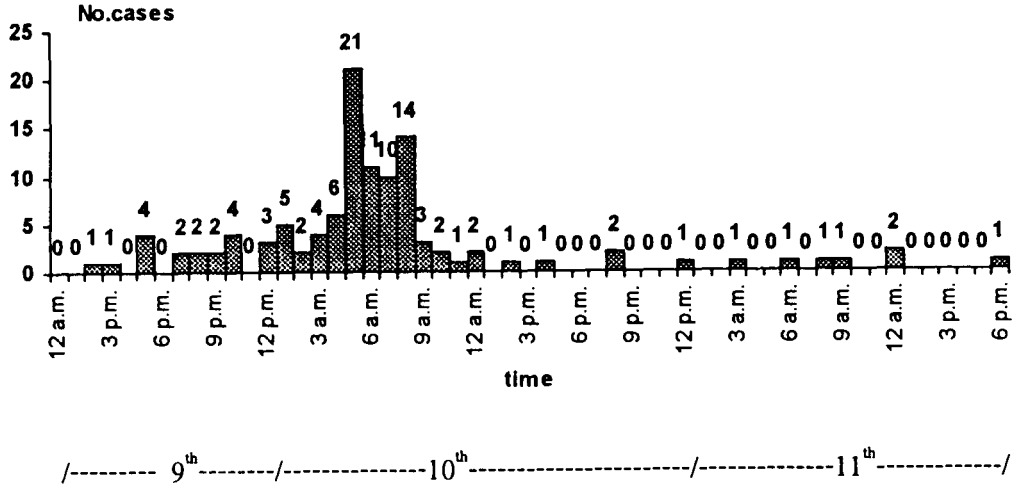

Fig. 1. Number of cases at the boarding school, 9th – 11th February 1998.

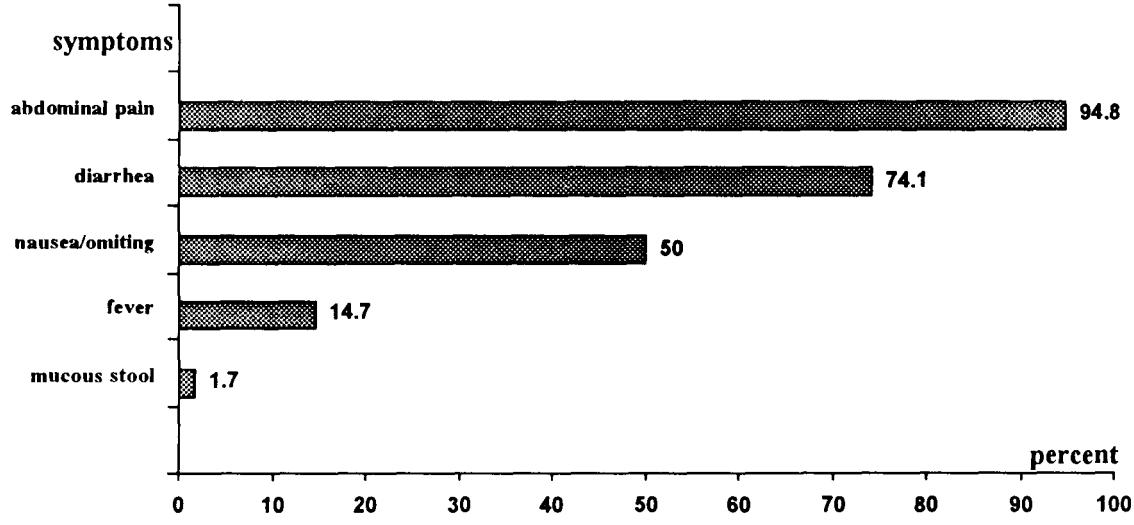

Fig. 2. Symptoms of cases at the boarding school, 9th – 11th February 1998.

meal was likely to be the lunch they had together on the 9th February.

There were 132 suspect cases, of which the attack rate in teachers was 9.7 per cent (4/41), 16.7 per cent (1/6) in the food handlers and 15.7 per cent (127/810) in the students. There were no cases in other personnel. In the students, the attack rate in male and female students was 13 per cent and 18 per cent respectively. The highest attack rate was in grade 8 about 23 per cent (26/90). The lowest attack rate was 2 per cent (2/76) in grade 9 followed by grade 1 (3/70) about 4 per cent. Grade 9 was the last group of students who had lunch and grade 1 was the first. One hundred and sixteen suspect cases reported the symptoms of abdominal pain (94.8%), diarrhea (74.1%), nausea/vomiting (50%), fever

(14.7%) and mucous stool (1.7%) (Fig. 2). Most of the symptoms were lower gastrointestinal symptoms.

There were six food handlers, all of them were interviewed and rectal swab cultures were analyzed. One developed the symptoms and rectal swab culture yielded *Vibrio parahaemolyticus*. The others were normal for physical examination on the day we visited and they reported no history of being ill for the last 7 days prior to this outbreak. The rectal swab cultures of these people were also negative.

Environmental study

Almost all of the students lived in 2 buildings, one for girls and one for boys. All of them ate their meals in the cafeteria on the ground floor of the boys' building. Food was prepared freshly for each meal in the boarding school kitchen before being sent to the cafeteria. The plan of the kitchen was in accordance with standard school kitchen regulations and the sanitation of the kitchen appeared to have a similar standard of hygiene as in the cafeteria.

The food handlers started preparing lunch noodles at around 9 a.m. on the 9th February. The components were noodles, fish-balls, sliced pork, squid and vegetables. For dinner, the food handlers prepared fish-ball curry and fried cabbage with pork. The fish-balls were inadequately cooked because the water was only part-boiled before being mixed with the noodles. The fish-balls for both meals came from a shop in Sri Bangkruai market. The fish-balls sold at this shop came from Bang Kun Tien factory and had been sent to the shop at 4 a.m., the same morning. The factory did not have a certificate to manufacture fish-balls.

Usually, the boarding school uses water from the Chao Praya River for bathing and cleaning. The water is filtered before use but at the time of this outbreak, the filtering machine was out of order. Also the sea water had increased and the tap water was not sufficient.

Analytic study

Crude odds ratio

A total of 64 cases and 55 controls met the definition. Table 1 shows that those who ate lunch noodles were 6 times more likely to become ill than those who did not. Similarly, those who ate fish-ball curry, fried cabbage and chicken soup were 4.7 times, 3.9 times and 3.6 times respectively, more likely to become ill than those who did not. From the details of food components (Table 2), those who ate fish-balls in curry were 6 times more likely to become ill than those who did not.

Table 1. Crude and adjusted odds ratio of food items.

Food items	Crude OR (95% CI)	Adjusted OR (95% CI)
chicken soup	3.7 (1.09 - 12.96)	2.3 (0.65 - 8.29)
fish-ball noodles	6.1 (1.12 - 43.42)	3.8 (0.56 - 25.87)
dessert	1.6 (0.49 - 5.26)	0.5 (0.11 - 2.51)
fish-ball curry	4.7 (1.55 - 14.87)	2.3 (0.71 - 7.40)
fried cabbage	3.9 (1.51 - 10.18)	2.2 (0.83 - 5.99)

Table 2. Crude and adjusted odds ratio of food components.

Food components	Crude OR (95% CI)	Adjusted OR (95% CI)
chicken in soup	0.7 (0.02 - 10.18)	
fish-balls in noodles	3.1 (0.75 - 13.26)	1.9 (0.47 - 7.4)
slice pork in noodles	0.2 (0.03 - 1.11)	
vegetables in noodles	0.2 (0.19 - 1.38)	
fish-balls in curry	5.9 (2.00 - 18.67)	3.5 (1.15 - 10.77)
pork in fried cabbage	1.4 (0.29 - 6.93)	

Adjusted odds ratio

There was a significant increase in risk due to 4 items of food and the fish-ball components in the curry. To control for possible confounding factors, a multiple logistic regression by unconditional method was used. Fish-balls in curry was associated with food poisoning with an adjusted odds ratio of 3.5 (95% CI 1.2 - 10.8) (Table 2).

Dose-response relationship

To further assess the associated factors, we assessed the dose-response relationship of fish-balls in noodles and curry. The fish-balls in noodles and curry had a dose response relationship with the χ^2 for trend of noodle equal to 21.17 ($p = 0.00000$) and curry equal to 17.89 ($p = 0.00002$) respectively (Fig. 3).

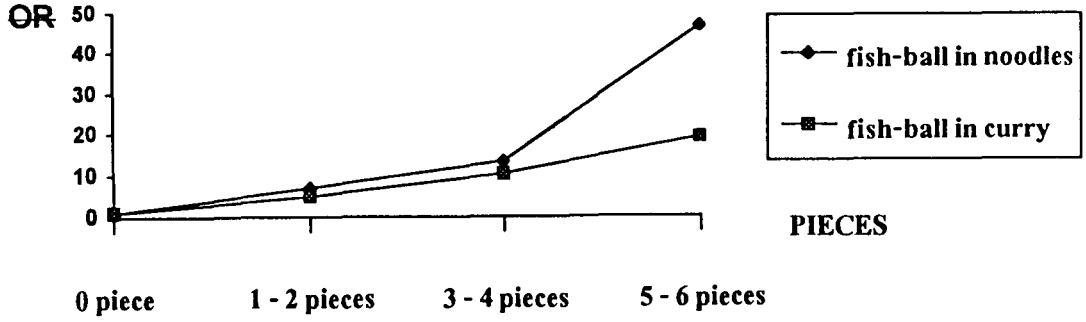

Fig. 3. Dose response relationship of fish-balls in noodles and curry.

Table 3. Rectal swab culture results.

Organism	ill (103)	not ill (67)
1. *Vibrio parahaemolyticus*	31	10
2. *Staphylococcus aureus*	2	2
3. *Vibrio algiolyticus*	1	-
4. *Vibrio fluvianalis*	7	-
5. Dual infection (*Vibrio parahaemolyticus* and *Staphylococcus aureus)*	3	-
6. No growth	59	55

Laboratory results

One hundred and three rectal swab culture specimens from suspected cases and 67 normal persons were sent for culture at the National Institute of Health on 10th February, 1998. The results are shown in Table 3.

Three out of 6 specimens from the cooking utensils were culture positive for *Vibrio.* species which were *V. fluvianalis. Aeromonas cavie* were found in the samples taken from the refrigerators and the big pot. Drinking water and used water yielded *Aeromonas* spp and *V. fluvianalis.* Bacterial culture from 25 grams of the other fish-balls in the shop and in the factory four days later yielded *Vibrio parahaemolyticus.* The fish-ball samples taken from the shop also yielded *V. fluvianalis.*

DISCUSSION

The clinical symptoms of watery diarrhea and abdominal cramps in the majority of cases and sometimes with nausea/vomiting and fever were compatible with *Vibrio parahaemolyticus*(1). Ten cases occurred more than 30 hours after lunch which was more than the longest incubation period for *Vibrio parahaemolyticus* (4-30 hours). This suggested that the food consumed at dinner might be contaminated and was a cause of the food poisoning. The most likely vehicle was the fish-balls which were used in both the lunch time and dinner time meals. Hence, in the results of the analytic epidemiological study, there was a dose response relationship in the fish-balls in both food items and the adjusted odds ratio of fish-balls in curry was 3.5 (95% CI 1.2 - 10.8). Although the fish-balls in the lunch noodles had no significance, it may be because the case and the control groups had eaten the same kind of food and the number of cases was too small. Unfortunately, we could not collect specimens of the fish-balls on the same day as the outbreak. However, samples of 25 grams of fish-balls taken from the shop and a factory 4 days after the outbreak yielded *Vibrio parahaemolyticus.*

Rectal swab culture results yielded *Staphylococcus aureus* in 4 persons, *Vibrio algiolyticus* in one person, *Vibrio fluvianalis* in 7 persons and dual infection (*Vibrio parahaemolyticus* and *Staphylococcus aureus*) in 3 persons. The source of *Vibrio fluvianalis* were from the refrigerators, the big pot, drinking water, used water and the fish-balls from the shop. The potential sources of *Staphylococcus aureus* were not confirmed.

CONCLUSION AND RECOMMENDATION

The fish-balls in this outbreak were not classified as a prepared meal(5). From an unmatched

case control study, the fish-balls in the noodles and curry were identified as the implicated food, which was contaminated with *V. parahaemolyticus*, although we had no laboratory results confirmed from the fish-balls on the same day as the outbreak. The modes of contamination were uncooked food, cooking utensils and the food handlers who cooked the food. To prevent food poisoning outbreaks from fish-balls, all meals containing fish-balls must be boiled for at least 5 minutes or more(6).

The Food and Drug Administration closed the factory in February 1998 because of this outbreak and also the factory did not have a certificate to operate. The school changed the machine for filtering water from the Chao Praya river. The Environment Health Center Region 1 recommended that the school should further improve the quality of water from the Chao Praya river by using 1 teaspoon of 60 per cent chlorine per 20 liters of water for two minutes to eliminate foodborne bacteria(7) and suggested that the quality of the permanent tap water from the Chao Praya river should be improved.

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อาหารเป็นพิษจากลูกชิ้นปลาที่ปนเปื้อน

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9 กุมภาพันธ์ 2541 เกิดการระบาดของโรคอาหารเป็นพิษที่โรงเรียน A ซึ่งเป็นโรงเรียนประจำสำหรับเด็กด้อยโอกาส การสอบสวนโรคได้ดำเนินการเพื่อหาสาเหตุของการระบาด และให้คำแนะนำในการป้องกันการระบาดของโรคอาหารเป็นพิษ การศึกษาใช้วิธี unmatched case-control และได้ทำการสำรวจสิ่งแวดล้อม พร้อมทั้งส่งตัวอย่างอุจจาระ ลูกชิ้นปลา น้ำ และป้ายอุปกรณ์ในการประกอบอาหารส่งตรวจทางห้องปฏิบัติการ พบผู้ป่วยสงสัย 132 คน อัตราป่วยในกลุ่มอาจารย์ เป็น ร้อยละ 9.8 (4/41) ร้อยละ 16.7 (1/6) ในกลุ่มแม่ครัวและร้อยละ 15.7 (127/810) ในกลุ่มนักเรียน ระยะฟักตัวเฉลี่ย เท่ากับ 18 ชั่วโมง ผลการวิเคราะห์ข้อมูลการรับประทานอาหาร พบว่าผู้ที่รับประทานก๋วยเตี๋ยวในมื้อกลางวันมีความเสี่ยงสูงที่สุด เมื่อพิจารณาส่วนประกอบของอาหารพบว่าผู้ที่รับประทานลูกชิ้นปลาในแกง มีโอกาสป่วยมากกว่าผู้ที่ไม่ได้รับประทาน 3.5 เท่า (95% CI 1.2 – 10.8) ความสัมพันธ์ระหว่างการป่วยกับปริมาณลูกชิ้นปลาในก๋วยเตี๋ยวและในแกง มีความสัมพันธ์เพิ่มขึ้นตามระดับของลูกชิ้นปลาที่รับประทาน ตรวจพบเชื้อ ในลูกชิ้นปลา 25 กรัม ลูกชิ้นปลาในก๋วยเตี๋ยวและแกงเป็นอาหารที่ถูกระบุว่าเป็นสาเหตุ ลูกชิ้นปลาซึ่งสุกแล้วอาจถูกปนเปื้อนจากอาหารที่ยังไม่สุก ภาชนะบรรจุอาหาร และแม่ครัวผู้ปรุงอาหาร โรงงานผลิตลูกชิ้นปลาลักษณะทางสุขาภิบาลไม่ถูกสุขลักษณะ และไม่ได้รับใบอนุญาตให้ดำเนินการผลิตถูกปิดโดยคณะกรรมการอาหารและยา

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