

# An outbreak of salmonellosis among Filipinos in a private camp, Saudi Arabia

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فاشية من داء السلمونيلا بين الفلبينيين في مخيم خاص بالمملكة العربية السعودية  
صلاح ثابت العويضي ور. أ. فوتين

خلاصة في تشرين الأول / أكتوبر ١٩٩٤ أدخل المستشفى تسعة عشر فلبينيا من المهنيين العاملين بشركة كبيرة في مدينة الدمام ، وكانوا يشكون من التهاب حاد في المعدة والأمعاء مع ارتفاع بدرجة الحرارة . لقد تناول هؤلاء جميعا وجباتهم اليومية الثلاث في مقصف الشركة . وبدئ في إجراء استقصاء للحالات مقابل مجموعة شاهدة لمعرفة سبب الفاشية . وتم تفتيش المجمع السكني بحثاً عن أي ساكن مصاب بالإسهال . وتم سؤال الحالات والشواهد جميعاً أين ومتى تناولوا طعاماً خلال الأيام الثلاثة السابقة لبدء الفاشية . وتم زرع براز جميع المرضى وعمال المطبخ الخمسة والعشرين . كما تمت مراجعة عمليات طهي الطعام وتداوله وحفظه .

**ABSTRACT** In October 1994, 19 Filipino professional staff of a large company in Damman city were hospitalized with acute febrile gastroenteritis. All ate three daily meals at the company cafeteria. A case-control investigation was begun to determine the cause of the outbreak. We searched the compound for any resident with a diarrhoeal illness. Both cases and controls were asked where and when foods were eaten during the three days before onset. Stool cultures were done for all patients and all 25 kitchen employees. Food cooking, handling and storage procedures were reviewed.

## Flambée épidémique de salmonellose chez des Philippins dans un camp privé en l'Arabie saoudite

**RESUME** En octobre 1994, 19 professionnels de nationalité philippine travaillant dans une grande entreprise à Damman ont été hospitalisés pour une gastro-entérite fébrile aiguë. Tous avaient pris les trois repas de la journée à la cafétéria de l'entreprise. Une enquête cas-témoins a été mise en route pour déterminer la cause de cette flambée épidémique. On a fait des recherches dans l'enceinte pour trouver tout résident ayant une maladie diarrhéique. On a interrogé aussi bien les cas que les témoins sur l'endroit et le moment où ils avaient mangé pendant les trois jours qui précédaient le début de l'épisode. Des coprocultures ont été effectuées pour tous les malades et pour l'ensemble des 25 employés de cuisine. On a examiné les procédés de cuisson, de manipulation et de conservation des aliments.

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## Introduction

Foodborne nontyphoidal salmonellosis outbreaks are an increasing public health problem in Saudi Arabia. Although the reasons for such an increase are not yet completely clear, many of these outbreaks are related to contaminated poultry or eggs. Although there have been reports published about nontyphoidal salmonellosis in Eastern Province, Saudi Arabia [1-4], none of these was specifically concerned with the investigation of food poisoning in relation to salmonella species. Here, we report the results of a nontyphoidal salmonellosis outbreak among Filipino employees of a large company and discuss possible modes of transmission and the general implications for control of foodborne disease.

On 14 October 1994, a private hospital notified the preventive health department in the city of Damman of 11 Filipino professionals with acute gastroenteritis with fever. All worked in the same company, lived in the same housing compound and ate daily meals from the company cafeteria. An investigation was begun to determine the extent of the outbreak and to find out the cause thereof.

Among the 204 professionals staff, 22 cases of diarrhoea were identified (attack rate [AR] = 11% among professionals). Salmonella group D was isolated from stool of all 22 cases. None of the kitchen staff was sick or had salmonella in their stool. Illness was associated with eating dinner after 9 p.m. on 12 October ( $P < 0.001$ , Kruskal-Wallis test) and with eating one dish, chicken adobo, for dinner on 12 October (odds ratio [OR] =  $\infty$ ; 95% confidence interval [CI] = 3.9- $\infty$ ). The median period from eating the chicken to the onset of illness was 38 hours. The chicken was cooked between 2 p.m. and 4 p.m. on the stovetop in two pots, each of which held 105 kilograms of

chicken. The same utensils and containers used for handling uncooked chicken were also used for serving. After cooking, the chicken was held at room temperature (35-40 °C) and served between 5 p.m. and 10 p.m. Chicken adobo was the most probable vehicle of transmission. The inadequate cooking conditions or cross-contamination after cooking probably allowed salmonella in the raw chicken to survive. After cooking, the time till serving and temperature of the chicken were ideal for salmonella to multiply and to reach an infective dose before consumption.

Prevention of institutional foodborne disease outbreaks in Saudi Arabia, and in the Eastern Mediterranean Region would be greatly enhanced by the application of the hazard analysis critical control point (HACCP) guidelines to routine inspections of commercial kitchens and to investigation procedures of possible foodborne diseases.

## Materials and methods

The housing compound has 1333 residents; 887 are Filipino and the rest are of other nationalities, mainly Indian. The compound has 59 cabins, a cafeteria with a kitchen and a small canteen. Professional staff (204) live in eight class A cabins, while labourers (1129) live in 51 class B cabins. The only time when professionals and labourers meet is at mealtimes in the cafeteria. The camp has no private health clinic; employees who become ill are given a voucher to go to a private hospital. Employees have complained of diarrhoea outbreaks approximately every two months.

The kitchen prepares two types of food, Filipino and Indian, and each type has its own chef. All nationalities eat in the same dining hall. The piped municipal water used in the kitchen is brackish, although chlori-

nated and monitored for faecal coliforms by the municipality. Breakfast is prepared from 4:00 a.m. to 6:00 a.m. and served from 5:00 a.m. to 7:30 a.m. Lunch is prepared from 8:00 a.m. to noon and served from noon to 1:00 p.m. Supper is prepared from 2:00 p.m. to 4:00 p.m. and served from 5:00 p.m. to 10:00 p.m. All labourers are in camp by 5:00 p.m. to eat supper, but some professional staff do not return to camp to eat until after 9:00 p.m.

### Case definition

An outbreak-associated salmonellosis case was defined as a camp resident who developed diarrhoea (> 3 loose stools/24 hours) and fever with abdominal cramps, nausea or vomiting between 11 and 16 October 1994. *Salmonella* was subsequently isolated from a stool specimen.

### Case finding

The hospital and the compound were asked for daily reports for 15 and 16 October 1994 of any camp resident with diarrhoeal illness. Persons in all 59 cabins were asked about diarrhoeal illness between 11 and 16 October 1994. Each person with diarrhoea was questioned about symptoms and the date and time of onset.

### Case-control study

For each case, an employee from the same cabin without diarrhoea was selected at random as a control. Each case-employee and control-employee was asked about specific food items, dates and times eaten at the compound dining hall, the compound canteen and external restaurants. All cases and controls were interviewed either in the hospital or at the compound.

### Statistical method

Data for cases and controls were tabulated using *Epi-Info* software version 5.02. Fish-

er's exact test was used to assess the statistical significance of differences in proportions [5]. For the case-control study, odds ratios and 95% confidence intervals were calculated using the method described by Mantel and Haenszel [6,7]. Differences in medians were assessed for statistical significance using the Kruskal-Wallis test. A *P* value < 0.05 was considered statistically significant.

### Laboratory investigation

Stool cultures were done for all diarrhoea patients, and salmonella isolates were serogrouped at the hospital laboratory. *Salmonella* isolates were tested for sensitivity to ampicillin, chloramphenicol, tetracycline and co-trimoxazole by the Kirby-Bauer method. Rectal swabs were taken from the 25 kitchen personnel and cultured for enteric pathogens including salmonella at the Damman public health laboratory.

### Environmental investigations

We visited the compound, including the cabins, kitchen, dining hall and food storage areas. Kitchen staff were asked about food storage, handling, preparation and serving. Air temperatures were measured in the compound cafeteria, the refrigeration unit and the kitchen. Samples were taken from frozen and fresh chicken and beef, raw eggs, water from the sink and all foods left in the refrigerator. These were cultured for salmonella. Residual chlorine was determined in the water.

## Results

### Descriptive epidemiology of outbreak

We identified 22 camp residents with diarrhoea between 11 and 16 October 1994 (attack rate [AR] = 17 per 1000 in the camp).

Stools from all 22 yielded salmonella group D sensitive to all antibiotics tested. Symptoms included diarrhoea (100%), fever (100%; median body temperature was 38.7 °C), abdominal cramps (100%), vomiting (91%) and nausea (55%). Eighteen (82%) of the patients were hospitalized. The median duration of illness was 5 days (range 3–6 days).

Onset of symptoms was 14 October for 21 cases and 15 October for one case. All patients were male Filipino professionals aged from 24 to 46 years from category A cabins. There were no cases among the 526 Indian labourers or 68 professionals who did not eat Filipino food. Professionals often ate supper late while labourers of class B cabins ate between 5:00 p.m. and 6:00 p.m. None of the kitchen staff had diarrhoea.

### Case-control study

Salmonellosis was not associated with eating any cafeteria meals from 11 to 13 October. However, all case-employees and control-employees had eaten dinner on 11 and 12 October. All 22 case-employees had eaten chicken adobo on 12 October compared with 11 of the 22 control-employees (OR = ∞; 95% CI = 3.9–∞) (Table 1). Eating fish for dinner on 11 October was also associated with salmonellosis, but four case-patients did not eat fish. Moreover, if we restrict the comparison to the 22 case-employees and 11 control-employees who ate chicken adobo, the association with fish is no longer statistically significant (OR = 5.6; 95% CI = 0.8–39.0). Case-employees ate dinner later on Wednesday (range 8:30 p.m. to 10:00 p.m., median 9:30 p.m.) than control-employees (range 5:30 p.m. to 8:00 p.m., median 6:30 p.m.;  $P < 0.0001$ , Kruskal–Wallis) (Figure 1). No other specific food items eaten on these three days, including snacks from the canteen, were associated with salmonellosis.

### Investigation of food preparation

Preparation of chicken adobo began when whole chickens with a total weight of 210 kilograms were shifted from the walk-in freezer (temperature = -10°C) to the refrigerator (2 °C) by early morning on 11 October. At about 8:00 a.m., the chicken was placed in a container of hot water to thaw for two hours. At 10:00 a.m., the chicken was cut into pieces on a surface where all food preparation takes place, rinsed in tap water, put into aluminium containers and placed back in the refrigerator (2 °C) overnight. On 12 October at about 2:00 p.m., the chicken was removed from the refrigerator, sauced, divided into two equal amounts (105 kilograms) and then placed into two large pots for cooking on the stovetop.

At 4.00 p.m. the chicken adobo was removed from the stovetop and kept at room temperature (35–40 °C) until 5:00 p.m. serving time. With the same spoon used to transfer the uncooked chicken, kitchen workers transferred chicken as needed from the cooking pots into the same containers in which the defrosted chicken had been refrigerated and sauced. These containers were placed on the serving table. The serving table had a continuous warmer, but it was out of order. Chicken adobo remained in the cooking pots for at least six hours at room temperature (35–40 °C), while the chicken was gradually transferred to the serving containers and then eaten.

There was no history of interrupted electrical service or of any problems with the refrigerator or freezer. The condition of the kitchen is good and clean; it has tiled floors and walls. The only time when the kitchen is cleaned completely is in the evening, after supper is prepared. Cultures of rectal swabs from all 25 asymptomatic kitchen staff were negative for salmonella. Kitchen tap water and selected food, including raw and frozen

Table 1 Exposure to risk food items by meal, 11–13 October 1994, Damman, Saudi Arabia

Food item eaten	Cases (n = 22)	Controls (n = 22)	OR	95% CI	Pvalue*
<i>Lunch, 11 October</i>					
Chicken afritada	16	16	1	0.2– 4.6	NS
Tinola soup	8	10	0.69	0.2– 2.7	NS
Rice	17	15	1.59	0.3– 7.6	NS
<i>Supper, 11 October</i>					
Fish	18	9	6.5	1.4– 33	0.01
Egg soup	12	8	2.1	0.5– 8.6	NS
Rice	8	10	0.7	0.2– 2.7	NS
<i>Lunch, 12 October</i>					
Steak	19	16	2.38	0.4– 14.9	NS
Macaroni soup	7	7	1	0.2– 4.3	NS
Custard cake	9	11	0.69	0.2– 2.7	NS
Rice	18	21	0.3	0.01– 3.6	NS
<i>Supper, 12 October</i>					
Chicken adobo	22	11	∞	3.9– ∞	0.0005
Cabbage saute	10	6	2.22	0.6– 1.5	NS
Vegetable	5	1	6.2	0.6– 154	NS
Rice	15	12	1.8	0.4– 7.3	NS
<i>Lunch, 13 October</i>					
Fish pesa	17	17	1	0.2– 5	NS
Tinola soup	2	8	0.17	0.02– 1.1	NS
Rice	9	10	0.83	0.2– 3.3	NS
<i>Supper, 13 October</i>					
Oxtail caldereta	10	8	1.46	0.4– 6.	NS
Chicken soup	0	5	0	0.0– 1.1	NS
Rice	5	10	0.35	0.1– 1.5	NS

\*  $\chi^2$  with Yates correction

OR = odds ratio. CI = confidence interval. NS = not significant

chicken, failed to grow salmonella. Residual chlorine in the tap water was 0.7 ppm.

## Discussion

The onset of symptoms over 24 hours in a group of workers and one strain of salmonella isolated for all indicated a common-

source outbreak from a single exposure. Chicken adobo was the most likely vehicle of transmission for several reasons: it was the only food that all case-employees had eaten; there was a very strong statistical association of cases with chicken adobo; the median incubation period of 38 hours is consistent with salmonellosis; and cases were limited to people who ate chicken after five

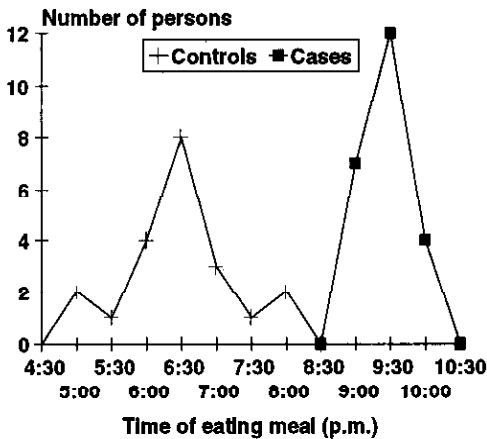


Figure 1 Graph showing employees' mealtimes on 12 October

hours of incorrect storage temperature. Fish eaten for supper on Tuesday, although associated with illness, was a less likely vehicle for transmission. Not all cases had eaten the fish; the association was weaker when the analysis was restricted to employees who ate chicken adobo; and the exposure took place at a more extreme point in the range (62 hours) of possible incubation for salmonellosis. The association with fish probably arose because employees who ate chicken adobo on Wednesday also tended to eat fish on Tuesday.

An inoculum of salmonella  $> 10^3$  organisms is usually needed to cause the disease [8]. In this outbreak, the absence of disease in labourers, all of whom ate chicken adobo before 6:00 p.m. and in the professional control-employees, who ate the chicken before 8:30 p.m., indicates that salmonella was not present in a concentration sufficient to cause infection before about 8:30 p.m. Because the temperature of the cooked chicken was probably optimal for salmonella multiplication from 5:00 p.m. until 10:00 p.m., we suspect that a small inoculum present in or introduced into the chicken

after cooking multiplied to an infective dose by about 8:30 p.m.

The small inoculum of salmonella could have arisen in the cooked chicken adobo in three ways. One possibility, inoculation by a salmonella-infected food-handler, was unlikely. None of the kitchen staff had had recent diarrhoea, and none of their stool cultures grew salmonella. Moreover, food handlers or carriers are rarely the source of foodborne salmonellosis [9]. A second possibility, cross-contamination after cooking, is more likely. The preparation surface, containers and utensils used to prepare raw chicken and other raw foods, including eggs and meat, were only rinsed before manipulating the cooked chicken. Any residual salmonella from these raw foods could have been transferred to the cooked chicken. Another possibility is that salmonella present in the raw chicken survived cooking in low numbers. The internal temperature of food should exceed 75 °C for longer than 12 minutes to kill salmonella [10]. The large (105 kilograms) semisolid mass of cold chicken and sauce in each cooking pot may have prevented uniform distribution of heat throughout the chicken during the two hours of cooking. Temperatures in the centre of the pots may have been inadequate to kill salmonella [11].

Although the ultimate source of the salmonella was not determined, the frozen chicken is a possibility. Raw chicken is often contaminated with salmonella. Salmonella may be cultured from approximately 50% of commercially available chickens in the United States [12-16]. Transovarian transmission can sustain *Salmonella enteritidis* (group D) infection in hen flocks, accounting in part for the high prevalence of salmonella infection of chickens purchased in markets [17]. Two defects in handling the raw chicken may have compounded low-level contamination of the frozen chicken.

Putting multiple frozen chickens (210 kilograms) in a single container of hot water to thaw would allow multiplication and spread of salmonella through the water to the surfaces of all the chickens. Thereafter, putting chicken in large containers may have delayed cooling in the refrigerator to safe temperatures. As a rule, frozen chicken should be thawed in the refrigerator at 4 °C [18].

The danger of foodborne outbreaks is increased in food services that prepare a limited number of food items for large numbers of people. The large quantities of food involved require special care to avoid time and temperature abuses conducive to bacterial growth. Mistakes may result in large numbers of ill persons. The major contributing factors to this outbreak are all listed in the internationally recognized system of quality assurance for food services, the hazard analysis critical control point (HACCP)

system [19,20]. These contributing factors included incorrect time and temperature for holding cooked chicken; using containers too large to allow rapid heat exchange during cooking or cooling; incorrect thawing; and using utensils, containers, and surfaces for both raw and cooked food without thorough cleaning.

Prevention of institutional foodborne disease outbreaks in Saudi Arabia, and in the Eastern Mediterranean Region as a whole, would be greatly enhanced by the application of HACCP guidelines to routine inspections of commercial kitchens and to investigation procedures of possible foodborne disease. Moreover, it would be in the best interest of large employers to prevent foodborne disease by making sure that kitchen managers understand and use a quality assurance system to prevent unnecessary economic loss from employee illness.

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