

Outbreak report

A HOTEL-BASED OUTBREAK OF *SALMONELLA* ENTERICA SUBSP. ENTERICA SEROVAR ENTERITIDIS (*SALMONELLA* ENTERITIDIS) IN THE UNITED KINGDOM, 2006

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An outbreak of food-borne *Salmonella* Enteritidis PT4 occurred in Cumbria, in north-west England, in the summer of 2006. Fifteen people, all with positive stool samples, met the case definition; three of these were admitted to hospital, including one patient who died. Preliminary investigations suggested a link to a meal served at a local hotel. A case control study was implemented, together with microbiological and environmental investigations. Fifteen microbiologically confirmed cases and 27 unmatched controls were included in the study, controls being randomly selected from people who had eaten at the hotel on the same day. The epidemiological evidence indicated a very strong association between infection and consumption of tiramisu made with raw shell eggs, although none were available for microbiological investigation. These results are in line with other salmonellosis outbreaks that have been associated with the use of raw shell eggs in food manufacturing and production. This paper highlights the continuing need for a greater awareness by those who work in the food industry of the health risks associated with the consumption of raw shell eggs.

Introduction

Salmonella Enteritidis is a bacterium found in the gut of many wild and domesticated animals. It can cause human illness if ingested with contaminated food, the incubation period ranging from six hours to three days. Symptoms include diarrhoea, nausea and vomiting, abdominal pains, fever and headache. The infection often clears without treatment within seven days, although some people may remain infectious for more than 10 weeks [1]. Since 2000, several outbreaks of salmonellosis have been associated with eggs and egg-derived products, poultry and pork in the United Kingdom (UK) [2].

This paper describes an outbreak of *Salmonella* Enteritidis PT4 gastroenteritis associated with a hotel in Cumbria. A case was defined as a microbiologically-confirmed case of *S. Enteritidis* PT4 gastroenteritis who ate lunch at the hotel on 2 July 2006 and who had an onset of symptoms on or after that date. Fifteen cases met the case definition. Of these, there were three hospitalisations, including one fatality. The patients admitted to hospital were elderly; the fatality was 98 years old, and the others were 71 and 65 years old.

All patients had eaten lunch at the hotel on 2 July and onset dates ranged from later that day to two days afterwards. Enhanced surveillance and active case ascertainment did not reveal any further cases. A case-control study showed a highly

significant and strong association between consumption of tiramisu and being ill.

Method

Two cases of gastroenteritis were reported to the Cumbria and Lancashire Health Protection Unit (CLHPU) by a General Practitioner. The cases appeared to be associated with a local hotel: those affected had symptoms including abdominal pain and diarrhoea and had visited the hotel for lunch four days previously.

Allerdale Borough Council and North Cumbria Acute Hospitals Laboratory were informed by the Health Protection Unit of the cases and an investigation of the potential outbreak was launched. It became apparent that members of other parties, in addition to the two linked cases initially reported, had also suffered gastrointestinal symptoms. Environmental Health Officers were informed that the tiramisu had been made with raw eggs. All cases were asked for a stool sample. On the same day, a party of around 50 people had attended a Christening celebration and a number of people attended the hotel for dinner, but enquiries by Environmental Health Officers did not detect any illness among these people. An e-mail to General Practices and the out-of-hours deputising service also failed to detect any linked cases.

Epidemiological investigations

A nested case control study was undertaken using face-to-face interviews with a structured questionnaire based on the menu from the hotel. These interviews were conducted by Allerdale Environmental Health Officers, Health Protection Unit staff and a Primary Care Trust Public Health Trainee. Fifteen microbiologically-confirmed cases and 27 unmatched controls were included in the study. Controls were randomly selected from people who had eaten lunch at the hotel in the same sitting as the cases.

A univariate analysis of the data was carried out using Epi-Info version 3.2.2 [3]. The age and sex distributions of cases and controls were similar. Odds ratios and confidence limits were calculated for exposure to the items of food listed on the menu.

Microbiological investigations

Stool samples were requested and obtained from all 15 cases. Three food-handlers who were involved in preparing desserts at the hotel (including the worker who prepared the tiramisu eaten on 2 July) were also asked to submit stool samples. Stool samples were tested for enteric pathogens using standard laboratory methods. These include direct inoculation of one in 10 suspension

of the faeces onto Xylose Lysine Deoxycholate (XLD Oxoid number P00164A) and enrichment using Selenite F Broth (Oxoid number EB0354E), which was then inoculated onto XLD after 24 hours' incubation. Suspected salmonellas were identified biochemically and serologically using 'O' and 'H' antisera before being sent to the Laboratory of Enteric Pathogens, Health Protection Agency, Centre for Infections for confirmation and further serotyping.

Environmental Health Officers visited the hotel and took spongicle swabs in broth within the dessert preparation area. Swabs were taken from the dessert refrigerator door (hand contact surface), wash hand basin taps, egg storage trays, food mixers and preparation table. The swabs were examined for salmonella only, using Food and Environmental Microbiological Services North West (FEMSNW) Standard Operating Procedure FM10. Raw shell eggs were sampled from the hotel. The eggs were examined using FEMSNW Standard Operating Procedure FM10.

Environmental investigations

Environmental Health Officers carried out a thorough examination and assessment of kitchen facilities and procedures. Environmental investigations revealed that two registered wholesalers supplied eggs to the business on a weekly basis. The wholesalers sourced eggs from four hatcheries. In this case, the specific supplier of the eggs used in the dessert could not be identified.

Results

Descriptive epidemiology

The epidemic curve for this outbreak and a summary of key events in the investigation are shown in the figure (see overleaf).

Case control study

The odds ratios (with 95% confidence limits) for the food items consumed at the meal are summarised in the table. The age and sex distribution of cases and controls were not statistically significantly different.

Microbiology

Fifteen stool samples submitted from cases were positive for *S. Enteritidis* PT4 and one of the three samples submitted by staff members was also positive for *S. Enteritidis* PT4.

Environmental samples from the dessert preparation area were all found to be negative for salmonella and no salmonellas were detected in any of the raw shell eggs sampled from the hotel.

Environmental investigations

Investigations by Environmental Health Officers of the hotel's two egg suppliers showed that these companies were sourcing eggs from several suppliers within the UK. However, further investigations identified that all eggs used by the hotel were sourced from chickens vaccinated against salmonella and there was no evidence to suggest that the hotel was obtaining eggs from any other supplier.

The Environmental Health Officers also reported that the hotel kitchen had been upgraded over the years and complied with relevant legal requirements. General standards of food hygiene and cleanliness had been reported as good during routine inspections, at which time Environmental Health staff graded the hotel as having reasonable confidence in food safety management.

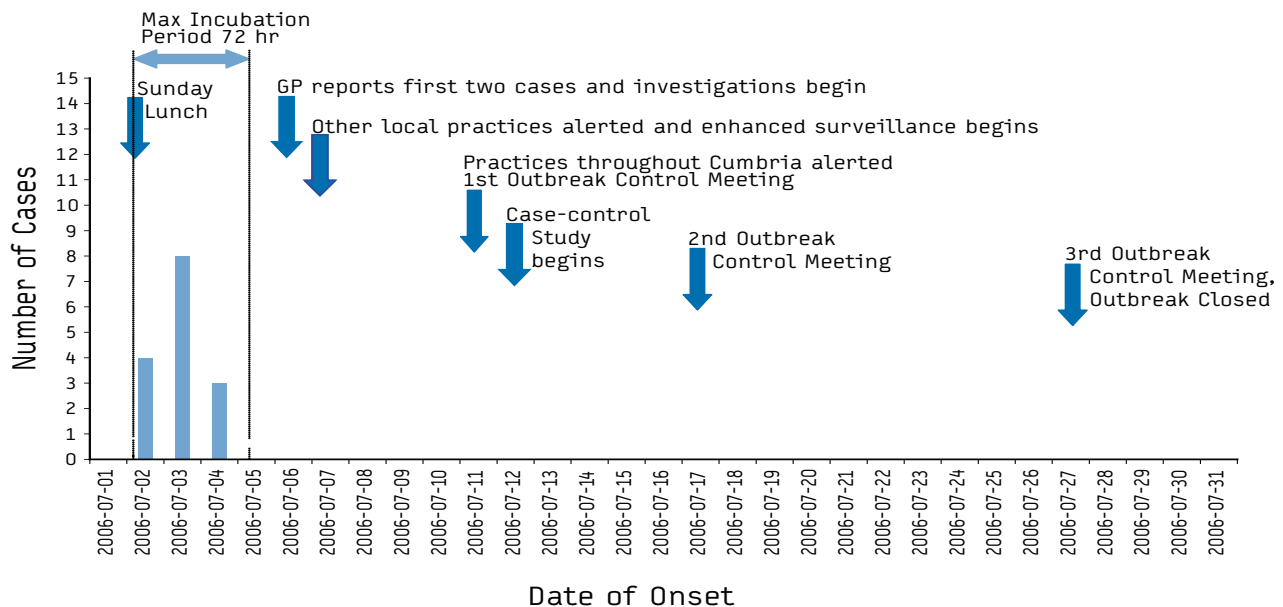
TABLE

Odds ratios (with 95% confidence levels) for items on the menu

Food item	Odds ratio	95% confidence limits	Significant (95% confidence limits)
Starters			
Homemade vegetable soup	1.15	0.23 – 5.65	No
Smooth paté with Cumberland sauce and Melba toast	1.67	0.37 – 7.48	No
Chilled melon cocktail topped with Fresh fruit	0.38	0.07 – 2.10	No
Egg mayonnaise with crisp salad	1.09	0.26 – 4.55	No
Main courses			
Roast topside of beef with Yorkshire pudding	0.83	0.22 – 3.03	No
Roast pork	1.28	0.18 – 8.66	No
Roast breast of chicken with stuffing	0.92	0.07 – 11.16	No
Poached salmon in creamy seafood sauce	1.5	0.28 – 7.80	No
Homemade vegetable bake	0.92	0.07 – 11.16	No
Desserts			
Chocolate roulade	0.92	0.07 – 11.16	No
Sherry trifle	An odds ratio cannot be calculated as no cases had eaten this item		
Strawberry Pavlova	0.92	0.07 – 11.16	No
Orange cheesecake	An odds ratio cannot be calculated as no cases had eaten this item		
Lemon cheesecake	0.42	0.04 – 4.122	No
Tiramisu	00	Fisher exact p = 0.0000000009	Yes
Apple crumble	An odds ratio cannot be calculated as no cases had eaten this item		

FIGURE

Epidemic curve and key events



Discussion

This was a point-source outbreak in which, although there was no microbiological evidence available, the epidemiological evidence strongly supported the hypothesis that tiramisu was responsible. The outbreak is notable because of the striking epidemiology, both in the high attack rate of the tiramisu and the odds ratio of infinity associating consumption of the tiramisu with illness.

Since the tiramisu was made with raw eggs, it is likely that one or more eggs were contaminated with salmonella. There have been previous outbreaks reported where this has been the route of infection [4,5,6]. Indeed, in the 1980s laboratory reports of salmonellosis doubled in the UK in line with many countries in western Europe. The increase was almost entirely due to *S. Enteritidis* PT4, the strain associated with poultry and eggs [7]. However, the epidemiology of infections due to *S. Enteritidis* in England in Wales has changed over recent years in that the incidence of *S. Enteritidis* PT4 infection has declined rapidly (from 10,056 cases in 1998 to 2,693 cases in 2003), whereas the incidence of *S. Enteritidis* non-PT4 infection has almost doubled (from 3,548 cases in 2000 to 7,065 cases in 2003 [8]).

In the UK, the Chief Medical Officer's advice to the public is to avoid eating raw eggs or uncooked foods made from them such as home-made mayonnaise, mousse or ice-cream and advises caterers to use pasteurised egg for these foods [9]. The UK's Food Standards Agency goes further, advising caterers to use pasteurised egg for all foods that will not be cooked or will be only lightly cooked and recommends that the safest option for caterers preparing food for more vulnerable people is always to use pasteurised eggs, even for those foods that are cooked [10]. This outbreak highlights the importance of that advice.

One food handler who had been involved in the preparation of the tiramisu at the hotel tested positive for *S. Enteritidis* but

was symptom-free. Food handlers with positive stool cultures for *S. Enteritidis* have been implicated in outbreaks [11] and an alternative hypothesis could be that the infection was spread by the food handler. However, in previous outbreaks food handlers have themselves become infected from contaminated foodstuffs [12] and the evidence fails to implicate asymptomatic food handlers with formed stools as sources of outbreaks of food-borne salmonellosis [13]. In most food poisoning outbreaks, food handlers are victims, not sources, and become infected either from contact with contaminated raw food, from tasting during preparation or from eating left over food [12].

Had these cases been due to a human carrier rather than a single contaminated ingredient, it is likely that a number of items on the menu would have been implicated. Cases would also have been expected among people attending other functions and sittings at the hotel. Furthermore, the attack rate from the tiramisu was very high, suggesting heavy contamination. A more likely hypothesis is therefore that the positive food handler was infected from contaminated ingredients – probably eggs.

The local authority investigated the supply of eggs to the hotel: although they appeared to be obtained from salmonella-vaccinated sources, it was not possible to trace which suppliers eggs had been used in the tiramisu. Enhanced surveillance of gastroenteritis for a period of three weeks after we became aware of the outbreak did not reveal any secondary cases of infection. This underlines the effectiveness and importance of giving advice to cases and close contacts about hand hygiene.

This outbreak shows that despite advice from the Chief Medical Officer and the UK Food Standards Agency, the consumption of raw or lightly-cooked shell eggs continues. Aside from our outbreak, shell eggs were implicated as a food vehicle in 11 outbreaks during Autumn 2002 [5] and statistical evidence linked an outbreak of

S. Enteritidis PT1 in Cambridge in 2005 to a restaurant where 24 people became ill after eating tiramisu made with raw egg [11]. We recommend that the dangers of raw shell eggs are once again highlighted to the catering industry and the public.

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