

## A foodborne outbreak of *Salmonella* infection due to overproduction of egg-containing foods for a festival

N. CAMPS<sup>1</sup>, A. DOMÍNGUEZ<sup>2,3\*</sup>, M. COMPANY<sup>1</sup>, M. PÉREZ<sup>4</sup>, J. PARDOS<sup>1</sup>,  
T. LLOBET<sup>5</sup>, M. A. USERA<sup>6</sup>, L. SALLERAS<sup>2,3</sup> and the Working Group for the  
Investigation of the Outbreak of Salmonellosis in Torroella de Montgrí†

<sup>1</sup> Territorial Services of Gerona, Department of Health, Gerona, Spain

<sup>2</sup> Directorate of Public Health, Department of Health, Barcelona, Spain

<sup>3</sup> Department of Public Health, University of Barcelona, Barcelona, Spain

<sup>4</sup> Primary Health Care Center of Torroella de Montgrí, Gerona, Spain

<sup>5</sup> Microbiology Laboratory, Hospital of Sant Pau, Barcelona, Spain

<sup>6</sup> Microbiology Laboratory, Centro Nacional de Microbiología, Instituto Carlos III, Majadahonda, Madrid, Spain

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### SUMMARY

A large outbreak of gastroenteritis occurred in Catalonia in June 2002 with 1435 cases and 117 hospitalizations. Consumption of a hard pastry with vanilla cream was strongly associated with illness. Stool samples from cases and food-handlers were analysed. The premises of the food manufacturer were inspected and food samples were taken for microbiological analysis. *Salmonella* serotype Enteritidis was isolated from 154 cases, three food-handlers and nine food samples. Outbreak-associated strains showed a coincident phage type, antibiotype and pulse-field gel electrophoresis pattern. Inadequate handling of foods containing eggs occurred because the establishment exceeded its safe food production capacity to meet demand for the pastry, which was consumed on the day of a traditional festival. Excessive production of foods for holidays or special events represents a potential public health threat.

### INTRODUCTION

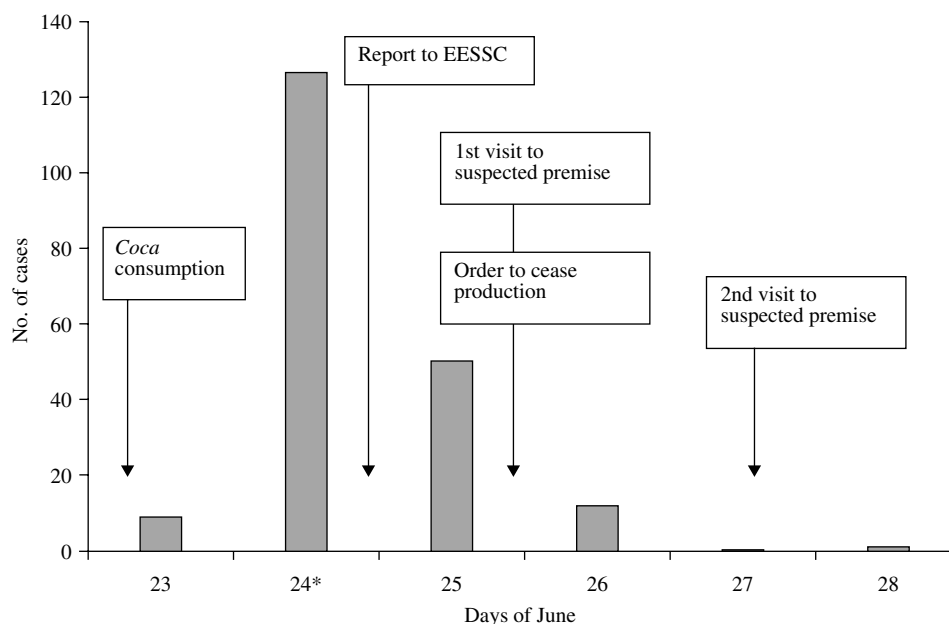
*Salmonella* is a common cause of foodborne diseases, both in developed and developing countries [1–8]. From 1997 to 2001, a total of 615 outbreaks of foodborne disease were reported in Catalonia (range 100–149 per year), of which 373 (60·6%) were caused by *Salmonella enterica*. The incidence rate of salmonellosis transmitted by food during this period was reported to be 17·2/100 000 persons-year [9–11].

During 2002, a total of 162 outbreaks of foodborne disease were reported [12], with *Salmonella enterica* serotype Enteritidis being the causative agent in 39%. In the province of Gerona, a particularly large outbreak affected 1435 persons who had consumed *coca de crema* (a hard pastry with vanilla cream) made by a specific bakery.

In Catalonia, various types of cakes called *coca* are consumed on 23 June, the eve of the festival of St John. On 24 June 2002 the Emergency Epidemiological Surveillance System of Catalonia was notified of a possible outbreak of foodborne disease in the town of Torroella de Montgrí. The first cases had contacted health services on the night of 23 June and, at the time of notification of the outbreak, 30–40 cases

\* Author for correspondence: Dr A. Domínguez, Direcció General de Salut Pública, Departament de Salut, Travessera de les Corts, 131-159, 08028 Barcelona, Spain.  
(Email: angela.dominguez@gencat.net)

† The members of the Working Group are given in the Appendix.



**Fig. 1.** Timeline for the outbreak and the investigation. EESSC, Emergency Epidemiological Surveillance System of Catalonia. \* Bank holiday.

had been treated at primary health-care centres and another six at the emergency department of the Hospital of Palamós, where one patient was awaiting hospital admission. All the cases reported eating *coca de crema* bought in the same bakery. By 21:00 hours on 24 June, 210 persons with gastrointestinal symptoms had been treated at primary health-care centres (Fig. 1). The objective of this study was to investigate the origin and circumstances of this outbreak.

## MATERIAL AND METHODS

### Clinical and epidemiological investigation

A survey of health-care teams was carried out to determine the number of persons affected by the outbreak. Primary health-care teams of the county of Baix Empordà were contacted through the management company (Serveis de Salut Integrats del Baix Empordà). Other primary health-care teams in the province of Girona who had reported cases were also contacted and information collected on persons who had been seen with gastroenteritis. Hospitals in the province were contacted to determine the number of patients admitted and the number of persons who had attended emergency departments. A daily follow-up was carried out by Epidemiological Surveillance Units of Catalonia to determine the evolution of cases, new admissions and hospital discharges.

To test the hypothesis that the source of infection was the *coca de crema*, an epidemiological study was carried out. Twenty-seven patients selected from among those treated by primary health-care centres and 20 controls selected from unaffected relatives and friends of cases were asked about the consumption of different foods containing eggs. The data were analysed using the SPSS version 10 statistical package (SPSS Inc., Chicago, IL, USA). The  $\chi^2$  test and Fisher's exact test were used to determine whether the differences between proportions were statistically significant, at  $P \leq 0.05$ .

An outbreak-associated case was defined as any person who presented with gastroenteritis on or after 23 June 2002 and who had eaten *coca de crema* made by the bakery implicated in the outbreak in the 48 h before onset of symptoms.

### Environmental investigation

Technicians from the Food Hygiene Section of the Territorial Delegation of Health of Girona inspected the suspected premises on 25 and 27 June. During the first visit, the kitchen and other areas were inspected, the delivery notes for prime materials were checked, possible risk points in the manufacturing process of the *coca de crema* which could have contributed to the outbreak were studied and samples of *coca*, vanilla filling, sponge roll containing vanilla filling and

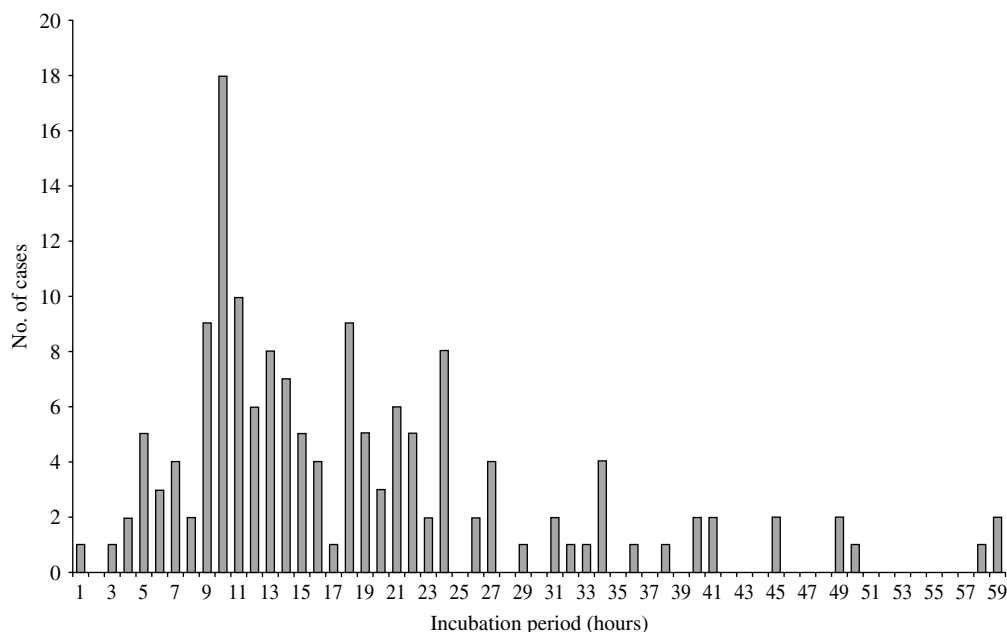


Fig. 2. Time between consumption of *coca* and onset of symptoms.

pasteurized egg yolk were taken. During the second visit, the manufacturing process was reinvestigated, focusing on the time taken to cook and cool the dough and vanilla filling, and samples of pine nuts were taken.

### Microbiological investigation

A total of 23 stool samples from cases were analysed by the Microbiology Laboratory of the Hospital of Sant Pau of Barcelona; the samples of foods collected were analysed in the Laboratory of the Territorial Health Delegation of Gerona and the samples taken from food handlers in the Laboratory of the Hospital Dr Josep Trueta of Gerona following standard procedures [13]. Sensitivity tests were carried out in the Microbiology Laboratory of the Hospital of Sant Pau according to NCCLS guidelines [14]. The study of the phage type and the pulsed-field electrophoresis pattern using the *Xba*I restriction enzyme was carried out in the National Laboratory of Microbiology of Majadahonda [15, 16].

## RESULTS

### Clinical and epidemiological investigation

A total of 1435 persons were treated at 52 health centres, with 117 being hospitalized in 29 centres in Catalonia and one outside Catalonia. The onset of symptoms was determined in 201 cases (Fig. 2).

Table 1. Distribution of cases surveyed by age and gender

Age group (years)	Male	Female	Total (%)
1–4	21	20	41 (4.1)
5–14	50	58	108 (10.9)
15–24	67	41	108 (10.9)
25–44	165	181	346 (34.8)
45–64	92	133	225 (22.7)
>64	76	89	165 (16.6)
Total	471	522	993 (100)

The age and sex was determined for 993 cases (Table 1). Of these, 571 (58%) were 25–64 years of age, and 522 (53%) were female. The clinical symptoms presented were diarrhoea (92%), fever (78%), headache (77%), abdominal pain (73%), nausea (48%), and vomiting (42%). Cases with fever had an average temperature of 38.7 °C (range 38–39.5 °C). The evolution was favourable in all cases. A total of 74% of the cases were resident in Gerona (32% in Torroella de Montgrí), 13% in other places in Catalonia, 1.5% in other regions of Spain and 3.6% were foreign residents.

All 27 cases enrolled in the case-control study (100%) consumed *coca de crema* compared with only four (20%) out of 20 controls ( $P < 0.00001$ ) (Table 2). No significant differences were observed for the other foods analysed. The median time between

Table 2. Association between exposure to different foods and illness

Food	Frequency of exposure		OR (95% CI)	P
	Ill	Not ill		
<i>Coca de crema</i>	27/31 (87.1%)	0/16 (0%)	n.c.*	<0.00001
<i>Coca</i> without vanilla filling	0/2 (0%)	27/45 (60%)	n.c.	0.17
Meat fried in batter	4/5 (80%)	23/42 (54.8%)	3.3 (0.3–170.9)	0.28
Potato omelette	4/5 (80%)	23/42 (54.8%)	3.3 (0.3–170.9)	0.28
Egg omelette	4/7 (57.1%)	23/40 (57.5%)	0.9 (0.1–7.6)	0.65

\* n.c., Not calculable.

consumption of the *coca* and the onset of symptoms for 201 cases with known incubation periods was 15 h (interquartile range 10–23 h). It was determined that the bakery had made 471 large and 320 small *cocas*. The large *coca* was sufficient for 10–12 people and the small one for six. Thus, assuming that all the *coca* was eaten and that all was contaminated, the maximum number of exposed persons was between 6500 and 7500. If the figure of 6500 is assumed, the attack rate would be 22%.

#### Environmental investigation

The inspection revealed substantial deficiencies in hygiene. The vanilla filling was cooked in large containers (more than 12 l) in ovens with peripheral heat sources. During cooking, there was no temperature control. The vanilla filling was cooled on the same work surface that was used to make the dough of the *coca*, which included fresh eggs. According to the manager of the bakery, the work surface was cleaned between the two operations and kitchen cloths were used to dry the surface after cleaning.

As the number of *cocas* manufactured (791) was above the capacity of the workroom, part of the warehouse had to be used to cook the majority of the vanilla filling produced.

#### Microbiological investigation

*Salmonella enterica* serotype Enteritidis was isolated in stool cultures from 154 patients in 23 laboratories and the three food handlers of the bakery who had eaten either *coca* or the vanilla filling. In addition, *Salmonella* Enteritidis was isolated from samples of vanilla filling, egg products, pasteurized egg yolk in an open container, pine nuts, *coca* manufactured on both 23 and 24 June and from samples of half-eaten *coca* supplied by affected persons and in another type of cake, a sponge roll containing vanilla filling.

The phage type of the 10 strains of *Salmonella enterica* serotype Enteritidis isolated from foods and of nine strains isolated from cases and food handlers was phage type 6. All were sensitive to cefotaxime, chloramphenicol, cotrimoxazole and ciprofloxacin and resistant to nalidixic acid and had the same pulse-field gel electrophoresis pattern using the *Xba*I restriction enzyme.

#### DISCUSSION

The results of the clinical, epidemiological, environmental and microbiological investigations demonstrate that this large outbreak of foodborne disease was caused by consumption of *coca de crema* manufactured in a specific bakery, which was contaminated by *Salmonella enterica* serotype Enteritidis. The median and interquartile range of the incubation period of the illness were quite short, suggesting a substantial inoculum of *Salmonella* in the contaminated foods [17, 18]. In fact, in samples of *coca* provided by consumers, the concentration of *Salmonella* was  $10^7$  c.f.u./ml.

*Salmonella* was isolated from samples of vanilla filling, *coca* and some of its ingredients, and from stool samples taken from food handlers of the bakery and from cases. All three food handlers had consumed *coca* or vanilla filling and two were ill. Typing of the strains isolated from foods, cases and food handlers showed *Salmonella enterica* serotype Enteritidis, PT6, which is not common, either in Spain or in other countries [19–23]. All the strains investigated showed the same pattern of sensitivity and the same pulsed-field pattern.

In the outbreak reported here, the vanilla filling was made with pasteurized liquid egg, but the dough of the *coca* was made with fresh egg. The fact that the vanilla filling was cooled using the work surface employed to make the dough suggests a high risk of

cross-contamination. Furthermore, the *coca* may have stayed at temperatures sufficient to allow bacterial multiplication for long enough to account for the mass infection. The result was the largest outbreak of foodborne disease due to *Salmonella* in Catalonia to date and one of the largest reported worldwide.

There are two important features of this outbreak that may be useful in the future. First, it was a large outbreak that resulted in a sudden demand for medical services. Thus, the response to the outbreak provides a useful model for possible interventions in events concerning contamination or food bioterrorism, where rapidity in reporting and beginning the investigation and control is essential [24]. In this outbreak, the rapid reporting and response was clear. On 25 June, one day after the first cases were reported, the bakery was ordered to cease production, and this probably avoided more cases. In addition, all affected persons who worked as food handlers were also ordered to cease work, until recovery and microbiological clearance.

Second, the outbreak clearly occurred due to overproduction of *coca* in a facility that was not designed for this use. The cross-contamination resulting from the overproduction was probably the main contributory factor of the outbreak. Foodborne illness due to *Salmonella* may be caused by any breakdown in the many steps from egg production on the farm until the product reaches the table [25–29]. Preventive measures include programmes of control in farms, selling the eggs as quickly as possible, refrigerating eggs at <7.2 °C, training of both food handlers and consumers in the correct preparation of foods and adequate surveillance mechanisms [20, 30, 31]. In Catalonia, establishments are required to use pasteurized eggs to make foods whose temperature does not reach at least 75 °C in the centre [32]. Likewise, the amount of activity should always be proportional to the capacity of the establishment making the foods. Otherwise, the risk of cross-contamination increases substantially. Excessive production of foods for holidays or special events represents a potential public health threat.

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#### APPENDIX. The Working Group for the Investigation of the Outbreak of Salmonellosis in Torroella de Montgrí

N. Camps, M. Company, M. Danés, N. Follia, J. Pardos, J. Terrades, J. Ullate (Territorial Delegation of Health of Girona); M. Pérez (CAP Torroella de Montgrí); M. Bou, M. Figuerola (Hospital of Palamós); J. Batlle, M. Mutjé (Microbiology Laboratory of the Hospital Josep Trueta); T. Llobet (Microbiology Laboratory of the Hospital of Sant Pau); M. A. Usera (Microbiology Laboratory of Majadahonda); A. Domínguez, N. Torner, L. Salleras (General Directorate of Public Health of the Department of Health and Social Security).

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