

## International outbreak of staphylococcal food poisoning caused by contaminated lasagne

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### SUMMARY

An outbreak of staphylococcal food poisoning in Europe caused by contaminated lasagne was detected and monitored by both national and international surveillance systems. The common source was a pasta-producing factory in Italy and high levels of *Staphylococcus aureus* were detected in packets of dried lasagne distributed in Luxembourg, the UK, France and Italy. Forty-seven cases were reported in the UK. Outbreaks of staphylococcal food poisoning attributed to mishandling during the food processing stage are uncommon and pasta as the food vehicle is rare. Prompt recognition of the outbreak and rapid identification of the food vehicle enabled most of the consignment to be withdrawn from the market.

### INTRODUCTION

In England and Wales during the period 1979-82 staphylococcal food poisoning was responsible for about 2% (43) of reported outbreaks and 1.6% (749) of reported cases of food poisoning (Communicable Disease Surveillance Centre 1980, 1981, 1982, 1984). The vehicles most commonly implicated were cooked meats. The mishandling of foods at the service stage (e.g. restaurants, canteens, shops) appears to be the commonest cause of contamination followed by mishandling at home (Roberts, 1982). There are few reports of outbreaks directly attributable to mishandling during initial food-processing operations.

In late January 1984 a family outbreak of acute food poisoning was reported from the province of Florence, Italy. The family had eaten lasagne originating from

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the factory of a producer of pasta products near Parma. During the first week of February reports were received in Luxembourg of six cases of severe staphylococcal food poisoning following the consumption of egg lasagne originating from the same Italian factory (DHSS, 1984*a*). Samples of the prepared dish and unused dried pasta from the same batch were found to be heavily contaminated with *Staphylococcus aureus*. On 3 February the Luxembourg authorities arranged with importers to remove the suspect batches of pasta from sale and informed the Italian authorities of the problem. On 6 February the Department of Health and Social Security (DHSS) was informed of the problem via the EEC 'food warning hot line' from Brussels, and learned that part of the same batch of lasagne implicated in the Luxembourg outbreak had been imported into the UK by two agencies. Subsequent investigation of outbreaks revealed a third importer. In 1983 about 83% (771 tonnes) of the output of lasagne from the factory was exported, 48% (370 tonnes) of this to the UK. After discussion with the DHSS, the importers stopped distribution and provided samples for testing at the Public Health Laboratory Service (PHLS) Food Hygiene Laboratory.

On 9 February the DHSS issued the first public health warning (DHSS, 1984*b*) advising against consumption of one brand of dried Italian egg lasagne. On the same day the first of a number of outbreaks of food poisoning in association with the consumption of lasagne were reported in the UK. A second public health warning was issued on 13 February extending the advice to other implicated brands (DHSS, 1984*c*).

The DHSS was provided with details of the production process and the investigations undertaken at the factory by the manufacturers and the Italian health authorities. From the code number combinations of affected products, it was established that the contaminated lasagne was produced between July 1983 and January 1984. The use of unpasteurized egg was reported as one of the causative factors (DHSS, 1984*d*).

Surveillance of the problem was carried out by the Communicable Disease Surveillance Centre (CDSC). A full epidemiological investigation was undertaken by CDSC of one outbreak at a school in Winchester; this was the largest reported outbreak.

## METHODS

### *Epidemiological investigation*

Reports of outbreaks of food poisoning are received routinely at CDSC from Medical Officers for Environmental Health, Environmental Health Officers and PHLS and hospital laboratories.

All reports of staphylococcal food poisoning linked to the consumption of pasta products were collated and telephone enquiries made to retrieve details where necessary. A questionnaire was completed by 241 girls and staff who had been exposed to the suspected lasagne dish at a school in Winchester. The survey enquired about illness and recorded dietary history in relation to the outbreak. A description of the extent of illness and calculation of food attack rates were then made.

*Laboratory investigations**Foods*

Dry sheets of lasagne from one outbreak, a prepared lasagne dish from a second outbreak and both dry lasagne and a prepared dish from a third outbreak were tested for the presence of *Staph. aureus* and enterotoxin A (SEA) at the Food Hygiene Laboratory, Central Public Health Laboratory. In addition 48 packets of dry lasagne from the suspect factory and 84 packets of 42 different pasta products from the main factory of the same company at Parma were examined for the presence of *Staph. aureus*. Seven of these lasagne samples, containing between  $7 \times 10^4$ /g and  $2 \times 10^8$ /g of *Staph. aureus*, and two other pasta products were tested for the presence of SEA. A further three samples of dry lasagne produced at least 6 months before the incriminated batch and two routine samples of a made-up lasagne dish were also examined for the presence of *Staph. aureus* and SEA.

*Laboratory Methods*

The dry pasta was broken into small pieces and soaked for 30 min in 0.1% peptone water before homogenization. Colony plate counts of *Staph. aureus* were made on blood agar and Baird-Parker medium and isolates of the organism were phage-typed and tested for enterotoxin production (Šimkovičová & Gilbert, 1971; De Saxe, Coe & Wieneke, 1982). The samples were tested for the presence of SEA by a sandwich ELISA procedure (Notermans *et al.* 1983; Wieneke & Gilbert, 1985).

## RESULTS

*Epidemiology*

The first report of illness in the UK was received on 9 February: in Enfield on 4 and 6 February three people had been acutely ill with nausea, vomiting and diarrhoea and required admission to hospital for treatment of shock. They had all eaten a pre-cooked lasagne dish in a local public house. On 4 February, in Swansea, five people suffered acute gastrointestinal illness some 3 h after eating lasagne at the same restaurant. The illness was again severe and two persons required admission to hospital. The lasagne in both outbreaks was prepared by a central cook-freeze catering firm, which had used packets of dried lasagne with egg of the incriminated code. On 8 February, 30 girl boarders at a school in Winchester fell ill after eating lasagne. (Initially, 17 cases had been reported to CDSC: investigation by questionnaire revealed a further 13 cases.) The illness began acutely within 3–4 h of the evening meal and was characterized by nausea (73%), abdominal pain (53%), vomiting (50%), loss of appetite (46%), headache (36%), diarrhoea (33%) and fever (30%). The median duration of symptoms was 4.5 h. Food-specific attack rates strongly implicated the pasta dish (Table 1). Details were also received of a further nine cases of food poisoning in association with lasagne from seven different places. The total number of cases reported was 47 (Table 2). The earliest cases had occurred in Reading on 13 January and no outbreaks were reported as having occurred after 11 February.

Table 1. *Food-specific attack rates – at the meal preceding the school outbreak*

	Ate			Did not eat			$\chi^2$ 1 d.f.
	Ill	Not ill	Attack rate (%)	Ill	Not ill	Attack rate (%)	
Lasagne	30	131	18.6	0	51	0	$P < 0.0005$
Chipsteak	0	27	0	30	154	16.3	$P < 0.05$
Cream potato	8	49	14	21	125	14.4	n.s.
Pears	21	95	18.1	9	84	9.7	n.s.
Bread and jam	8	69	10.4	22	107	17.1	n.s.
Tea	13	60	17.8	17	121	12.3	n.s.

n.s., not significant.

Table 2. *Notified cases of staphylococcal food poisoning associated with eating lasagne*

Date of onset of illness	Place	Number of persons		Site where food was consumed
		Ill	At risk	
13 Jan.	Reading	2	2	Home
4, 6 Feb.	Enfield	3	18+	Pub
4 Feb.	Swansea	5	5	Restaurant
6 Feb.	New Forest	1	1	Home
10 Feb.	New Forest	2	2	Home
11 Feb.	New Forest	1	1	Home
7 Feb.	Solihull	1	1	Home
8 Feb.	Winchester	30	250	School
11 Feb.	London	1	?	Restaurant
?	Liverpool	1	2	Home

### Microbiology

Reports in early February from microbiological testing in Luxembourg had shown certain batch codes of pasta to be heavily contaminated with *Staph. aureus* and the same batch codes were also implicated in Italy. Tests in the UK on similar production codes of egg lasagne showed heavy contamination with *Staph. aureus*. Identical strains of enterotoxin A producing *Staph. aureus*, lysed by phage 85/+ were isolated from 47 (94%) of 50 packets of lasagne examined, 41 of these at levels between  $2 \times 10^4$  and  $2 \times 10^8$ /g. Forty-two other pasta products (two samples of each) produced at the main factory in Parma were also tested and the 'outbreak' strain was isolated from 16 of the packets (19%) at low levels; only four had counts of  $2 \times 10^4$  to  $5 \times 10^5$ /g. The outbreak strains identified in Luxembourg and Italy, were also lysed by phage 85/+.

Samples of dry lasagne from two outbreaks contaminated with the outbreak strain contained small amounts of SEA (Table 3). These samples were not from the packets used in the preparation of the implicated dishes. The outbreak strain was detected in low numbers in two samples of prepared lasagne from two outbreaks. These samples also were not part of the consumed dishes and SEA was not found in them. SEA was detected in six freshly opened packets of lasagne which

Table 3. Detection of staphylococcal enterotoxin A (SEA) in samples of pasta

Sample	Origin	<i>Staphylococcus aureus</i> /g*	Presence of SEA
Dry lasagne	Outbreak 1†	$4 \times 10^6$	+
	Outbreak 2†	$7.5 \times 10^5$	+
Dry lasagne	Unopened packets of the implicated batch	$2 \times 10^8$	+
		$1.2 \times 10^8$	+
		$1.5 \times 10^7$	+
		$1.5 \times 10^6$	+
		$1.5 \times 10^5$	+
		$7 \times 10^4$	-
Dry lasagne	Unopened packets of an earlier batch	Present, < 100	-
		Present, < 100	-
		Not detected	-
Prepared lasagne	Outbreak 2	$1 \times 10^3$	-
	Outbreak 3	$5 \times 10^3$	-
Prepared lasagne	Routine	Not detected	-
		Not detected	-
Other dry pasta products	Unopened packets	Not detected	-
		$6 \times 10^5$	-

\* All strains produced SEA and were lysed by phage 85/ +.

† Unopened packets of the implicated brand.

contained between  $1.5 \times 10^5$  and  $2 \times 10^8$  *Staph. aureus*/g but not in a sample containing  $7 \times 10^4$  *Staph. aureus*/g.

The four packets with the highest *Staph. aureus* contamination contained 1–10  $\mu$ g of SEA/100 g. SEA was not found in three additional samples from an earlier production batch. Two routine samples of prepared lasagne and two samples of other types of pasta were also negative for the presence of SEA.

#### DISCUSSION

In this international outbreak of staphylococcal food poisoning a pasta product (lasagne) produced by a single company in Italy and distributed to several European countries, was contaminated with high levels of an enterotoxin producing strain of *Staph. aureus*. In 41 of 50 (82%) packets of dry lasagne tested the counts of *Staph. aureus* exceeded  $10^4$ /g. The initial levels of contamination were presumably much higher as a fall in bacterial count with time in the dried product would be expected (Lee, Staples & Olson, 1975). Nine packets were tested for the presence of SEA, four contained 1–10  $\mu$ g/100 g which is the level normally found in food from outbreaks (Gilbert & Wieneke 1973; Wieneke & Gilbert 1985), and four contained very small amounts (< 1  $\mu$ g/100 g).

Lasagne is an unusual vehicle for food poisoning although isolation of salmonella and other food poisoning organisms from dried pasta is well documented. Studies have shown variable levels of *Staph. aureus* contamination in pasta products (Rayman *et al.* 1981; Matejovska, Ticha & Cernovsky, 1972) but despite this they have not previously featured in large outbreaks. Previous reports of staphylococcal

food poisoning in the UK have usually implicated cooked meats such as ham and pork (Communicable Disease Surveillance Centre, 1980, 1981, 1982, 1984).

Lasagne is made from durum wheat and water, often with egg or spinach. The ingredients are formed into a stiff dough, which is extruded or rolled into various shapes and then dried slowly at warm temperatures. In the early stages of mixing and drying, conditions are nearly ideal for growth of *Staph. aureus*. As drying continues and during the storage of the dried product the bacteria die off but not necessarily to extinction (Walsh & Funke, 1975). If the drying stage is improperly handled, the potential exists for extensive growth of micro-organisms. The end product is distributed as dried sheets of pasta. The cook then uses the pasta sheets (which are often first boiled for 6–10 min), as the base for the final dish which is baked at temperatures recommended by the manufacturer.

In this outbreak the source of the contamination was reported as inadequately pasteurized liquid egg. Prolonged holding of unrefrigerated raw pasta dough permitted extensive growth of surviving staphylococci (DHSS, 1984*d*). Improvements in hygiene and quality control have now been introduced at the Italian factory. The egg is adequately pasteurized and initial drying temperatures have been raised.

Considering the extent of the contamination of the lasagne the number of reported cases in the UK was low. Considerable under-reporting might be expected in cases of less severe illness of short duration. Investigation of the school outbreak also demonstrated that the real attack rate was higher than initially reported; the case-finding exercise increased the number of cases by over 75%. The two outbreaks in Enfield and Swansea which reported the most severe illness were due to the consumption of a pre-cooked lasagne dish which had been prepared by a central cook-freeze kitchen in London. This source had distributed pre-cooked dishes to a wide number of outlets in the South of England. Frozen pasta dishes such as lasagne, ravioli and pizza frequently contain *Staph. aureus* and the pasta is one source of the organisms (Elliott, 1980).

The management of the outbreak at both a national and international level clearly demonstrates the importance of effective surveillance in the control of food-borne disease. The early notification to the CDSC and DHSS from the EEC Commission allowed DHSS to consult with the food trade at an early stage. This facilitated early recall and testing of stocks as well as early notification to the wide network of environmental health departments. It also enabled the issue of early public warnings from the DHSS. The investigation of the initial cases in Luxembourg and the UK allowed a prompt link of illness reports to lasagne permitting quick action to limit the outbreak. The first UK warning of the Luxembourg outbreak was received on 6 February 1984 and the last reported case in the UK occurred only 5 days later. The school investigation demonstrated a direct link to contaminated lasagne and highlighted the likely extent of under-reporting.

The contents of this paper represent the view of the authors alone and in no way commit the Department of Health and Social Security.

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