

Isolations of salmonellas from humans and foods in the Manchester area: 1981-1985

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SUMMARY

Isolations of salmonellas from humans and food products are recorded for the period 1981-5 and an attempt has been made to investigate the relationship between serotypes isolated from humans and those from meat products.

The predominant serotypes isolated from humans were *Salmonella typhimurium*, *S. enteritidis* and *S. virchow*. *S. typhimurium* was commonly isolated from a range of meat products. *S. derby* was one of the most common serotypes isolated from tripe and sausages but was relatively uncommon in humans.

Salmonellas were found in $\leq 0.5\%$ of most cooked meat products apart from tripe and udder (3.2%) and pet foods (12.4%). Isolations from raw meats ranged from 3% for pork to 28% for poultry.

Incidents of salmonella infection in humans in Manchester increased between 1981 and 1984 but decreased during 1985.

INTRODUCTION

Salmonellas continue to be a major source of food poisoning in England and Wales and were responsible for 86% of cases of bacterial food poisoning reported by laboratories in 1981-83 (based on Communicable Disease Surveillance Centre, 1982, 1984, 1985). Sources of foodborne salmonella incidents in which the vehicle of infection was identified were: 51% due to poultry, 24% to other meats and 15% to unpasteurized milk. The commonest salmonellas found were *Salmonella typhimurium*, *S. enteritidis* and *S. virchow*.

The present paper attempts to bring together isolations of salmonellas from humans and foods in the Manchester area based on specimens analysed at the Public Health Laboratory during the period 1981-5 and supplements a previous study covering the period 1976-80 (Barrell, 1982).

MATERIALS AND METHODS

Specimens

Faecal specimens were submitted to the Public Health Laboratory by patients with diarrhoeal disease, contacts and food handlers. Cultures of salmonella from other hospitals were also submitted to this laboratory for further identification. These were mainly from faecal specimens and are included in this study.

Food specimens were obtained from shops, canteens, restaurants, hotels, food manufacturing premises and in connection with food poisoning outbreaks. Also included are uncooked fish and crustacea sampled in connection with import control.

Microbiological methods

Methods for faeces examination were as described before (Barrell, 1982) although during the period of the present study a change was made to the use of desoxycholate citrate agar (DCA) in which sucrose was omitted to permit the detection of sucrose fermenting salmonellas.

During the earlier part of this study food specimens were enriched in 100–200 ml Rolfe's tetrathionate 'A' broth (Rolfe, 1946) incubated at 42 °C and subcultured on DCA as above and Brilliant Green agar (modified) (Oxoid) after 1 and 2 days. A change was made to pre-enrichment of a 1 in 10 homogenate of food in buffered peptone water (Edel & Kampelmacher, 1973) incubated overnight at 37 °C and subcultured into tetrathionate broth. The method finally adopted was to subculture 1 ml of pre-enrichment culture to 10 ml tetrathionate broth followed by incubation at 42 °C and subculture on to selective agars as described above. Most isolates were identified at the Public Health Laboratory, Manchester. Phage typing of *S. typhimurium* and identification of some isolates was carried out at the Division of Enteric Pathogens, Central Public Health Laboratory, Colindale, London.

Epidemiological data

The data for human isolations were expressed as incidents and not as total cases in an attempt to correlate them with isolations from foods. Three types of incident were recognized as follows:

- (1) Sporadic cases: an isolated individual with no known infected contacts.
- (2) Family outbreaks.
- (3) Institutional and community outbreaks.

Patients with a record of travel outside the Manchester area were omitted as the intention was to find associations between humans and foods.

RESULTS

The numbers of sporadic incidents, family outbreaks and institutional and community outbreaks per annum are shown in Fig. 1. There was a decrease in sporadic incidents and family outbreaks between 1984 and 1985. The ten salmonellas most frequently isolated from human sources are shown in Table 1 and numbers of isolates per annum for the five most common serotypes in Fig. 2. Family outbreaks and institutional and community outbreaks comprised 17% and 2.8% respectively of total incidents.

Two large outbreaks each affecting over 80 people occurred at receptions, on each occasion salmonellas were isolated from a variety of foods. *S. hadar* and *S. saint-paul* were the causative organisms in one outbreak and *S. anatum* in the other. These results are not included in Table 3 as a range of meats was contaminated from a common source which could not be confirmed.

Table 1. The predominant salmonella serotypes isolated from human sources, 1981–85

Serotype	Total incidents	Family outbreaks (% of total)	Institutional and community outbreaks (% of total)
<i>S. typhimurium</i>	689	18	3.5
<i>S. enteritidis</i>	119	10	0.8
<i>S. virchow</i>	116	19	0.8
<i>S. hadar</i>	53	23	5.7
<i>S. saint-paul</i>	49	14	2.0
<i>S. newport</i>	45	18	*
<i>S. infantis</i>	44	16	*
<i>S. montevideo</i>	43	7	*
<i>S. panama</i>	35	9	2.9
<i>S. agona</i>	31	13	*
Other serotypes	241	16	3.7
Total	1465	17	2.7

* No outbreaks reported.

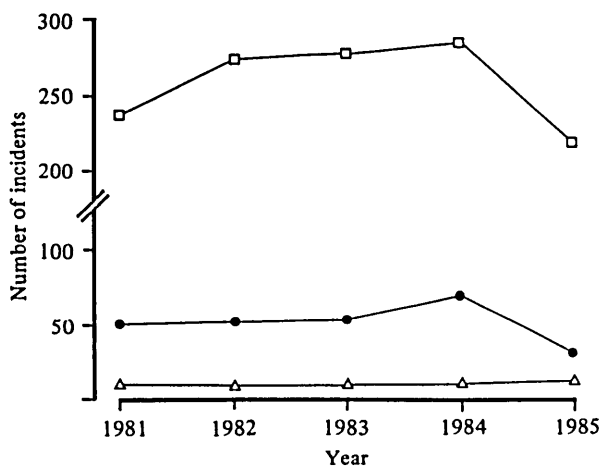


Fig. 1. Annual numbers of sporadic salmonella incidents (□), family outbreaks (●), and institutional and community outbreaks (△).

Several community outbreaks were reported in which locally produced food was implicated. *S. bovis morbificans* was isolated from roast beef in an outbreak affecting over 60 people. *S. typhimurium* phage type 193 was isolated from an employee at a butcher's shop and from seven customers who had consumed roast pork. Tripe was implicated in an outbreak caused by *S. typhimurium* phage type 170. At least 20 people were ill and 4 elderly people died, although the organism was not isolated from the implicated food. Outbreaks due to raw milk included two caused by *S. typhimurium* phage type 18. In one outbreak, one person with a pre-existing illness died and in the other the milk was supplied to a pre-school playgroup where *S. typhimurium* was isolated from three children.

Nationally distributed food was associated with three countrywide outbreaks

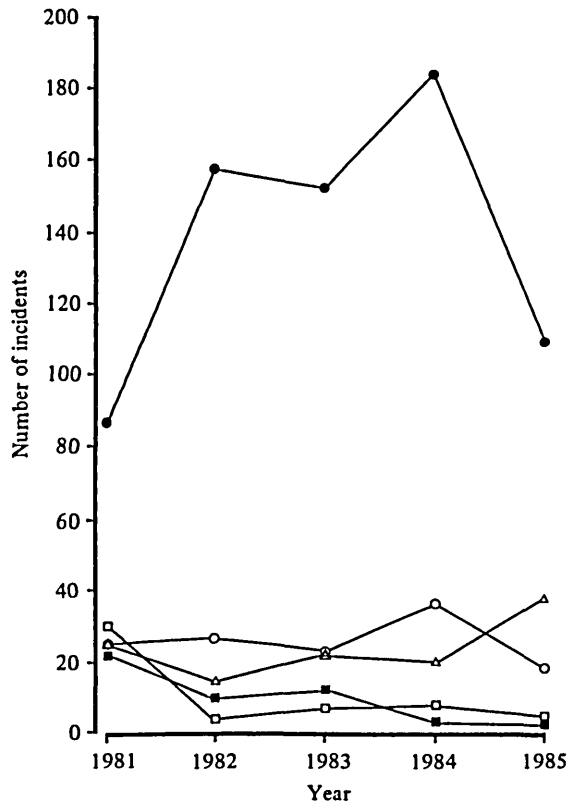


Fig. 2. The numbers of salmonella incidents in humans caused by *S. typhimurium* (●), *S. enteritidis* (△), *S. virchow* (○), *S. hadar* (□) and *S. saint-paul* (■) from 1981-85.

Table 2. Isolations from raw meats of serotypes common in human infection

Serotype	Poultry	Pork	Lamb	Beef	Sausage/ sausage meat	Pet foods
<i>S. typhimurium</i>	3	0	2	8	18	1
<i>S. enteritidis</i>	0	0	0	0	1	0
<i>S. virchow</i>	1	0	0	1	2	0
<i>S. hadar</i>	0	0	0	0	1	0
<i>S. saint-paul</i>	2	0	0	1	3	0
<i>S. newport</i>	5	0	0	1	0	1
<i>S. infantis</i>	0	0	0	1	2	0
<i>S. montevideo</i>	0	0	0	0	2	1
<i>S. panama</i>	0	1	0	2	2	1
<i>S. agona</i>	0	0	0	0	1	2
Other serotypes	11	1	2	12	78	4
Total	22	2	4	26	110	10
Estimated total specimens	78	69	22	283	921	38
Percentage from which salmonellas were isolated	28	3	18	9	12	24

Table 3. Isolations from cooked and smoked meats of serotypes common in human infection

Serotype	Poultry	Pork/ham	Beef	Tripe/ udder	Pet foods
<i>S. typhimurium</i>	1	2	1	17	1
<i>S. enteritidis</i>	0	0	0	0	0
<i>S. virchow</i>	0	1	1	1	1
<i>S. hadar</i>	0	0	0	0	0
<i>S. saint-paul</i>	1	1	0	0	0
<i>S. newport</i>	0	0	0	0	0
<i>S. infantis</i>	0	0	0	0	0
<i>S. montevideo</i>	0	0	0	0	0
<i>S. panama</i>	0	5*	0	1	0
<i>S. agona</i>	0	0	0	1	1
Other serotypes	1	4	2	16	18
Total	3	13	4	36	21
Estimated total specimens	1013	2420	1548	1119	176
Percentage in which salmonellas were isolated	0.3	0.5	0.25	3.2	12.4

* Four from same batch.

and some patients and foods were examined in the course of investigations. *S. gold coast* was isolated from the glaze from imported pâté and from five persons who were known to have consumed the pâté. *S. napoli* was isolated from imported chocolate and from one person and *S. ealing* from four babies at the end of 1985 and from dried milk baby feed in early 1986.

Serotypes common in human infection were isolated from raw meats (Table 2) and cooked and smoked meats (Table 3). *S. typhimurium* was isolated from all types of raw and cooked meat examined. *S. enteritidis* and *S. hadar* were each found in one specimen of raw sausage and *S. hadar* in a range of foods from the wedding reception outbreak described earlier. *S. enteritidis* was also isolated from samples taken from a poultry processing plant. As the product was subsequently canned it was not considered to be a risk to human infection and the results are not included in this study. *S. virchow* was found in raw poultry, beef, sausages and in cooked pork, beef, tripe and pet foods. Four isolations of *S. panama* were made from cooked and smoked sausages from the same producer and one person was known to have suffered from *S. panama* food poisoning after consuming one of the products. *S. typhimurium* phage type 12 was later isolated from a cold smoked sausage from this producer. Salmonellas were isolated from 12.4% of cooked pet foods and *S. arizoniae* from one cooked pet food.

S. senftenberg was isolated from a consignment of imported cooked mussels during routine sampling from a market stall. Isolations from consignments of uncooked imported fish and crustacea included *S. goeteborg* from prawns, *S. bareilly* from shrimps and *S. singapore* from striped catfish. *S. anatum* and *S. isangi* were isolated from specimens of pâté taken from shops.

The commonest phage types of *S. typhimurium* isolated from humans were 12, 10, 170, 204 and 193. Phage type 12 was also the most common phage type isolated

from tripe and udder (8 specimens) and sausages (4 specimens). *S. derby* was relatively uncommon in humans but was found in sausages (19 specimens), tripe (7 specimens), cooked pork (2 specimens) and cooked beef (1 specimen).

DISCUSSION

The pattern of salmonella infections in humans in the Manchester area during 1981–85 was similar to that observed nationally during a similar period (Communicable Disease Surveillance Centre 1984, 1985). The decrease in incidents during 1985 could have been due to a relatively cool summer.

There were twice as many incidents of *S. typhimurium* infection during this period compared to 1976–80 (Barrell, 1982). Conversely, incidents due to *S. hadar* decreased between 1980 and 1982 and have remained at low numbers. Family outbreaks and institutional and community outbreaks comprised 17% and 2.8% respectively of total incidents compared to 20% and 0.2% in 1976–80. Much of the increase in the proportion of institutional and community outbreaks has been due to *S. typhimurium* which was responsible for 3 outbreaks in 1976–80 and 24 outbreaks in 1981–85. Institutional and community outbreaks due to *S. hadar* decreased from 12 in 1976–80 to 1 in 1981–85.

The specimens analysed in the present study were obtained from 12 local authority areas including the 10 metropolitan boroughs which comprised the former Greater Manchester County. A total of 686 incidents of salmonella infection were recorded for the Greater Manchester County (population 2.6 million) in 1983 (Riordan, personal communication). This figure includes data from specimens not analysed in this laboratory and gives an incident rate of 26.4/100 000 population. The rate for England and Wales based on figures for 1983 (Communicable Disease Surveillance Centre, 1985) and a population of 49.6 million was 23.4/100 000 population.

Percentages of isolations from raw and cooked meats were in general similar to or lower than those reported in 1976–80 (Barrell, 1982). The figure for raw lamb (18%) is higher than expected as samples were taken from shops where cross-contamination with poultry was expected. The figure of 28% for poultry is unexpectedly low. The results do not include a figure of 41% for specimens taken from a poultry processing plant where the product was subsequently canned and unlikely to be a source of human salmonellosis.

Tripe, udder and unpasteurized milk carried a risk of salmonella contamination. Tripe and udder are boiled for several hours, stored in water at ambient temperature for up to 6 days and scrubbed to remove fat. Pinegar & Armstrong (1981) observed that the same scrubbing brushes were sometimes used to scrub both raw and cooked udder and were a possible source of contamination. *S. typhimurium* phage type 12 was one of the commonest phage types found in humans and in tripe and udder. This phage type was also reported to be common in animal incidents at a national level (Communicable Disease Surveillance Centre 1984, 1985).

Unpasteurized milk was implicated in outbreaks of salmonella infection. The observation that one of the outbreaks involved a pre-school playgroup indicates a lack of awareness of the hazards associated with this product. An informal study

was carried out (unpublished data) in which 300 unpasteurized specimens were analysed for salmonellas in approximately 100 ml amounts. *S. hadar* was found in one specimen obtained from cows grazing on a pasture spread with poultry manure. No illness was reported although the organism was recovered from faeces specimens obtained from people living on the farm.

S. typhimurium phage type 12 was isolated from a specimen of cold smoked sausage. This product is smoked at ambient temperature and does not receive heat treatment. An informal study in the laboratory (unpublished) showed that viable counts of *S. indiana* in experimentally contaminated sausage did not change during refrigerated storage for 1 week or storage at room temperature for 3 days. Thus the ingredients of smoked sausage do not appear to inactivate salmonellas.

S. senftenberg was isolated from a routine specimen of frozen cooked mussels. Further sampling revealed widespread contamination of this product which was part of a 30 ton consignment. Although this product had been distributed nationally there was no reported increase in isolation of *S. senftenberg* from humans (Communicable Disease Surveillance Centre, personal communication).

In recent years there have been no reported large-scale outbreaks of salmonellosis from poultry consumed at Christmas. This followed the introduction of a campaign at this time of the year by environmental health departments to educate food handlers in restaurants on the safe cooking and handling of poultry. This has now been extended to the general public by means of posters displayed in shops just before Christmas.

The sources of infection were not known for a large number of sporadic cases. During the period of this study there were occasional unexplained increases in numbers of apparently unrelated cases due to a particular phage type or serotype. These could have been caused by an unidentified food product distributed throughout the area.

In conclusion, *S. typhimurium* continues to be predominant in humans and meat products. *S. derby* was predominant in some meat products but relatively uncommon in humans. Unusual serotypes were isolated from imported products which had been distributed nationally and some of these serotypes were responsible for outbreaks.

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