International outbreak of *Salmonella* Senftenberg in 2007

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Since the beginning of 2007, the Health Protection Agency (HPA) Laboratory of Enteric Pathogens (LEP) has reported on 51 human isolates of *Salmonella* Senftenberg in England and Wales. This represents a significant rise compared to less than 10 in the same time period in 2006 and 2005. Of the 51 isolates, 35 (69%) have been received since 8 April (Week 15).

Fresh basil, sampled in May as part of a United Kingdom wide survey of fresh herbs on retail sale, was found to be contaminated with *S*. Senftenberg. The HPA launched microbiological and epidemiological investigations to elucidate the causes of this outbreak.

**Molecular microbiology**

All presumptive isolates of *S*. Senftenberg were confirmed by the Laboratory of Enteric Pathogens and were further examined using plasmid profiling and pulsed field gel electrophoresis (PFGE). The strains of *S*. Senftenberg found on the basil samples and predominating human infections in England and Wales since week 15 had the PFGE profile of SSFTXB.0014.

**Epidemiology**

For the purpose of investigating this outbreak, a case was defined as a resident of England and Wales infected with a confirmed or provisionally confirmed isolate of fully sensitive *S*. Senftenberg received by LEP on or after the 8 April 2007. Cases reporting foreign travel or close contact with a person with gastrointestinal disease symptoms in the five days prior to the onset of disease were excluded from this definition.

Thirty patients reported from all HPA regions in England and Wales, fulfilled the case definition. Dates of onset of illness were available for 23 cases, ranging from 5 March to 12 May 2007 (Figure 1). Females (60%) were overrepresented compared to males (40%). Most of the cases were adults (Figure 2).
PFGE results are available for 29 of the 30 primary cases. With the exception of one, all are the outbreak strain. The non-outbreak strain isolate was isolated from a three-month old infant with a diet restricted to formula milk.
Three cases were admitted to hospital as a result of their infection. Another four reported serious underlying illnesses and antimicrobial treatment and were admitted to hospital but not as a result of their infection. To date, three of the hospitalized patients are known to have recovered and two of them have been interviewed. For one, exposure was likely to have occurred prior to hospital admission and for the other, the diet was extremely restricted but may have included food purchased outside the hospital. One patient died but this is not thought to be as a result of salmonellosis.

In Scotland, three cases were reported in April 2007, all of which shared the same plasmid and PFGE profile as the cases in England and Wales. One of these patients reported travel to Tenerife.

Altogether, 20 out of 30 cases in England and Wales were interviewed using a standardised questionnaire. Basil consumption was not reported frequently. Consumption of poultry, eggs, milk cheeses, desserts, salads, fruits and confectionery were reported by 60% or more of the cases however, no particular food product was identified. Thirty percent of the interviewees reported having consumed fresh herbs in the three days before the onset of illness; 40% reported consumption of bagged salad.

In addition, five travel-associated cases of S. Senftenberg have been identified in England and Wales. One patient who reported visiting Morocco presented with the same outbreak strain. Three isolates from the remaining travel-associated cases were distinct from the outbreak strain and the result for one is pending.

Food microbiology
A UK study of the microbiological quality of retail fresh herbs carried out by the HPA Centre for Infections (CfI), the HPA Regional Microbiology Network (RMN) and the Local Authorities Coordinators of Regulatory Services (LACORS) commenced in May 2007. To date, seven samples of pre-packed fresh basil, grown in Israel, have tested positive for S. Senftenberg by HPA Regional Microbiology Network Food, Water and Environmental Laboratories in Newcastle, London, Bristol, and a NPHS-Wales Microbiology laboratory in Carmarthen.

In addition, fresh basil purchased from a supermarket in the Shetland Islands which was the subject of a customer complaint was also found to be contaminated with the outbreak strain of S. Senftenberg.

International dimension
On 25 May 2007, an enquiry was sent to Enter-net (the international surveillance network for the enteric infections Salmonella, VTEC O157 and Campylobacter – see http://www.hpa.org.uk/hpa/inter/enter-net_menu.htm), asking whether other countries had observed cases or products with the same characteristics.

An increase in cases of S. Senftenberg was reported from Denmark, with a total of 11 cases in 2007 compared to none in the first six months of 2006. The PFGE profiles for three of these cases matched those of the UK cases. Of these, two reported that their exposure probably occurred whilst visiting the USA, Poland or the UK.

Two cases of S. Senftenberg infection were reported in the Netherlands in January and three in May 2007. Of these five cases, two matched with the outbreak profile. One patient diagnosed in May reported eating a mixed pasta salad, possibly mixed with fresh basil in the week before symptom onset. The other case matching the outbreak-strain was diagnosed early in January and is awaiting interview.

The United States also reported recent human isolates of S. Senftenberg with the same PFGE profile as the outbreak strain and are conducting an investigation. Cases of S. Senftenberg have also been reported in Israel, and are currently under investigation.

Action
The UK Food Standards Agency (FSA) issued a public statement on 25 May 2007 warning consumers not to eat basil from the same batches that were found to be contaminated at the time [1] and this was accompanied by a withdrawal of potentially affected product from the shelves of
three UK supermarket chains. An information notice was posted on the Rapid Alert System for Food and Feed (RASFF) operated by the European Commission on 25 May 2007 and updated on 1 June. A Health Protection Report on the investigation was published on 1 June 2007 [2] and information on the outbreak was posted on the EU Early Warning and Response System on 1 June 2007. Investigations by the FSA and the UK retailers are ongoing. [3].

**Discussion**
The production of ready-to-eat vegetables on sale in the UK and elsewhere is closely controlled using the principles of Hazard Analysis and Critical Control Point (HACCP), together with good practice industry guides, which places less emphasis on end product testing. However, this incident highlights the role of targeted microbiological food surveillance in identifying food safety incidents thus providing an opportunity to review and inform HACCP procedures. In addition, the use of analytical epidemiology in isolation to investigate outbreaks such as these may be restricted by the number of people affected, complex distribution of products through different outlets or the widespread use of a contaminated product as an ingredient in a variety of foods which inevitably affects recall. Our investigations have confirmed that *S. Senftenberg* of an indistinguishable plasmid and PFGE profile has been identified from fresh basil grown in Israel and from human infections in the UK and Scotland as well as in individuals who report travel to Tenerife and Morocco. *S. Senftenberg* with an indistinguishable PFGE pattern has been reported by Denmark, the Netherlands and the United States of America. A combination of food surveillance, molecular microbiology and epidemiology communicated through established national and international networks means that information has been gathered quickly and communicated effectively.

**References:**