Outbreak of *Salmonella* Manhattan associated with a ready-to-eat pork product in Denmark in 1998

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Abstract

*Salmonella* Manhattan is rarely found in Denmark. Since 1980, only 0-3 human cases have been registered annually. However, in the first 4 weeks of 1998, 19 cases of this serotype were noted indicating an outbreak (Figure 1). Cases, which were predominantly adults, were spread throughout the country. Isolates from the first occurring cases were typed by pulsed-field gel electrophoresis (PFGE) (1). Of 15 isolates, 12 were identical and the remaining 3 were only slightly different. In contrast, 3 human isolates from the summer of 1997 were clearly different from the outbreak strain. These results were strongly indicative of an outbreak caused by a common source.

In an attempt to identify the source, isolates of *S.* Manhattan collected as a part of the routine surveillance of domestic animals and food were typed by PFGE. A total of 17 *S.* Manhattan strains of Danish broilers and pork as well as imported poultry proved to be different from the outbreak type, whereas 6 isolates of *S.* Manhattan from pigs imported from an internationally operating pig-production company were indistinguishable from the outbreak strain. This suggested a link to pork products, but it was impossible to make inferences about specific products or slaughterhouses as a cause of the outbreak. Consequently, we decided to carry out a case-control investigation.

Introduction

*Salmonella* Manhattan is a type of diarrhea-causing *Salmonella* rarely found in Denmark. Since 1980, only 0-3 human cases have been registered annually. However, in the
Materials and Methods

The design of the epidemiological investigation was an individual matched case-control study (2). Patients with culture-confirmed S. Manhattan infection, whose stool samples or cultures were received by the diagnostic laboratory on the 14th January 1998 or later, were eligible as potential cases and contacted for telephone-interview. People who had been abroad the week before symptom onset, or people with a history of chronic bowel disease or intermittent diarrhea before disease onset, were excluded. Three controls per case were randomly selected from the Danish Civil Registry (CPR) and matched by age (birthday), sex and residence (municipality). Controls with diarrhea and/or abdominal pain and fever within the last month prior to the diagnosis of the case, controls with a history of salmonella-infection, and those who had been abroad during the last week before interview, were excluded and a new control was selected from the CPR.

Cases and controls were asked about symptoms, travel abroad and food consumption during the 72 hours prior to onset of the illness (cases) or interview (controls). Even though pork or pork products were suspected of being the source, information was also collected about other food items (beef, poultry, vegetables, fruit, eggs and egg-products). Finally, the interviewer enquired about the names of retail outlets, where meat or meat-products eaten during the 72 hours before illness/interview were purchased. This also included questions about the type of brand. Information on suppliers of retail outlets in the previous three months was collected from the food inspection authorities and linked to the information of outlets given by the respondents. The questionnaire data were entered in EPI-Info 6, version 6.02 (3) and analyzed by conditional logistic regression using SAS 6.12 (the PHREG-procedure) (2, 4).

Results

Sixteen cases entered the study, of which 9 were male. The median age was 49 years. They had been taken ill between the 2nd to 30th January. Interviews were carried out over 4 days (7th to 10th February). The median interval from the onset of symptoms to receipt of sample or culture at the diagnostic laboratory was 6.5 days and the median interval from onset to interview was 22 days. The median duration of illness was 8 days (range 4-33 days). Three were still ill at the time of interview. All cases had suffered from diarrhea, and 15 (94%) reported abdominal pain, 13 (81%) weight loss, 11 (69%) fever, 7 (44%) vomiting and 6 (38%) blood in the stools as symptoms. Weight loss ranged from 3 to 8 kg. Four patients had been admitted to hospital.

Ten of the 16 patients had eaten sliced smoked fillet of pork, whereas this only applied to 4 of 45 controls (odds ratio (OR) 7.1, p<0.0001). Further, 10 of 16 patients had eaten sliced ham, while 12 of 45 controls had eaten this type of cold meat (OR 4.6; p<0.0157). In the case of sliced ham the linkage was not so strong compared to the smoked fillet, but still statistically significant. The smoked fillet of pork was thus considered to be the most likely source of the outbreak, although the sliced ham could not be excluded.

The subsequent comparison of the information given by the respondents and the food-inspection authorities regarding retail outlets, brands and suppliers of smoked fillet of pork, pointed to a particular meat-slicing plant as the most probable source of the outbreak. In total, 7 of 10 patients stated that they had bought smoked fillet of pork from shops supplied with this product by the meat processor in question. In addition, 3 of these 7 patients had smoked fillet of pork of this brand in their refrigerator at the time of interview and remembered having eaten this brand before they were taken ill. The meat processor also produced sliced ham.
Discussion

The case-control study suggested that sliced smoked fillet of pork was the most likely cause of the outbreak. In addition, the investigation pointed to a particular meat-slicing plant as the most probable source. The geographical distribution and duration of the outbreak, as well as the relatively small number of cases, further supported the conclusion that the smoked fillet of pork was the primary source of the outbreak. This product has a relatively long shelf life (30-35 days) and is supplied ready-wrapped to a large number of retail outlets in most parts of the country. Moreover, the product is only slightly cured (approx. 4 g NaCl per 100 g.) and is not subject to the same degree of heat-treatment (45-50°C in 10-15h) as, e.g. the ham product (boiled).

On the basis of the result of the case-control study, the authority banned the production and sale of meat by the meat-slicing plant at the 17th of February and the product was withdrawn from the market. Subsequently, the human incidence of S. Manhattan declined to the low pre-epidemic level (Figure 1). The 3rd of March, S. Manhattan of the outbreak type was isolated from a packet of smoked fillet belonging to a patient.

The outbreak revealed that ready-to-eat products, that are slightly cured, moderately heat-treated and have a relatively long shelf life, can constitute a risk to the consumers. To improve the safety of such products, producers need to either use raw materials of good microbiological quality or optimize the processing to ensure the elimination of human pathogens.

References


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