Presence of *Salmonella* spp. in retail pork in Northern Ireland

Spence*(1)*, S., Naughton, P.J.(3,4), Egan, D.(3) and Madden, R.H.(1,2)

*(1)*Food Science Department, Queen's University of Belfast, Belfast, Northern Ireland.
*(2)*Food Microbiology Branch, AFBI, Belfast, Northern Ireland.
*(3)*Northern Ireland Centre for Food and Health, University of Ulster, Coleraine, Northern Ireland.
*(4)*Microbial Biotechnology Group, University of Ulster, Coleraine, Northern Ireland.

*Corresponding author: sspence04@qub.ac.uk*

**Abstract**

As part of an investigation into the potential hazard presented to the population of Northern Ireland by *Salmonella* spp. in raw pork products a survey was designed and conducted. Two geographical locations were chosen for the purchase of samples; Belfast and Coleraine. At both locations on each sampling day ten sample consisting of retail packs of fresh, chilled pork products were purchased. At both sites three supermarkets were sampled plus two butchers shops. Two different products were purchased at each premises. Where possible one sample of organically produced meat was obtained. Samples were taken immediately to the laboratory and analyses commenced within two hours of purchasing the samples. Analysis was according to ISO 6579:2002: Microbiology of food and animal feeding stuffs- Horizontal method for the detection of *Salmonella* spp.. Following enrichment samples were plated onto brilliant green agar and xylose lysine desoxycholate agar. Isolated salmonellas were serotyped by the UKAS accredited *Salmonella* reference laboratory, AFBI, Belfast. Overall two hundred samples were analyzed with 5.5% of samples being positive, indicating a relatively low prevalence of this pathogen. Since there is a UK-wide scheme aimed at reducing the incidence of salmonellas in pigs i.e. the Zoonoses Action Plan or ZAP scheme, the results imply that such measures are having a beneficial effect. Working in conjunction with abattoir HACCP schemes such measures appear to significantly reduce potential for the transfer of salmonellas from pigs to retail pork.

**Introduction**

Salmonellosis in the human population of Northern Ireland (NI) reached peak numbers in 1999 but has since fallen with the figure for 2005 being 26% that of the 199 peak (Anon. 2006a. This is largely due to the control measures on poultry reducing the incidence of *Salmonella* Enteritidis. However, studies on pigs at slaughter in Great Britain (Davies et al. 2004) found that 23% of animals (n=2509) carried *Salmonella* spp. hence raw pork could be contaminated with these pathogens. Giovannaci et al. (2001) noted that pork slaughter and cutting plants could give rise to cross-contamination of meat with salmonellas and found that the French abattoirs they studies were receiving pigs, 65% of which (n=89) carried salmonellas. Further, they noted that 32% of cutting room samples carried salmonellas (n=32%). Thus a significant proportion of the meat leaving the plants would carry salmonellas. Previous salmonellosis outbreaks due to contaminated pork have been reported (Maguire et al.1993, Smerdon et al. 2001).

In order to determine the potential threat presented to the human population of NI by raw pork carrying *Salmonella* spp. a survey of retail pork was conducted. The survey was based on sampling based at two population centres, the city of Belfast and the town of Coleraine. Sampling took place at supermarkets and butchers shops.

**Materials and methods**

Retail pork meat samples (200) were purchased over a 3 month period to establish the prevalence of *Salmonella* positive packs in Northern Ireland. Half of the samples were obtained in the vicinity of the city of Belfast and half in the vicinity of the town of Coleraine. The sampling locations were approximately 90km apart. Raw pork was purchased prepacked in supermarkets and from open trays in butchers shops. To ensure as wide a range of meat sources as possible samples were
purchased with different ‘use by’ dates and comprised a variety meat cuts. Testing of the samples commenced less than 2 hours after leaving the retailer.

All media were obtained from Oxoid (Basingstoke, UK).

The presence and confirmation of salmonellas was determined using ISO method (ISO 6579:2002) with S. Nottingham NCTC 7832 and Yersinia enterocolitica NCTC 10460 being used as positive and negative controls, respectively.

Pre-enrichment. A 25 ±0.5g sample of pork was excised and carved into pieces aseptically using sterile disposable forceps and sterile, disposable scalpels (Swann-Morton, Sheffield, UK). The excised region was weighed, transferred into a sterile stomacher bag (Seward, Worthing, UK) and blended (Seward 400) for 30s with 225 ml of buffered peptone water (BPW, ISO: Oxoid CM 1049). The contents of the stomacher bag were transferred to a 300ml sterile plastic jar, and incubated at 37± 1°C for 18 ± 2 h.

Following incubation, BPW (0.1 ml) was transferred to 10ml Rappaport Vassiliadis soya broth (RVS, Oxoid, CM 0866) and incubated at 42±1°C for 24±3h and 1ml of BPW transferred to 10ml Muller-Kaufmann tetraphionate/novobiocin broth (MKTTn broth, ISO: Oxoid CM 1048). The enriched samples were streaked onto brilliant green agar (BGA: Oxoid CM 0329) and xylose lysine deoxycholate agar (XLD, ISO: Oxoid CM0469), which were incubated for 24±3 hrs at 37°C. A minimum of 3 presumptive Salmonella colonies per plate were selected and streaked to purity on nutrient agar, for subsequent confirmatory tests.

Biochemical confirmatory tests included growth on MacConkey broth, triple sugar iron and SLUMS (sucrose, lactose, urea, mannitol and salicin) media. Colonies were streaked onto nutrient and MacConkey agar to confirm purity, and incubated at 37°C for 20-24hrs. In addition API 20E strips (Biomerieux, UK) were inoculated to ensure an accurate identification.

Poly O and Poly H antisera (Pro lab, Neston, South Wirral, UK) were used to confirm isolates as Salmonella spp, before full serological testing was carried out to determine the Salmonella serovar. All confirmed Salmonella spp. were serotyped by The Northern Ireland Reference Laboratory for Salmonella in Belfast, United Kingdom Accreditation Service (UKAS) accredited.

Results

A total of 200 retail pork products were examined for the presence of Salmonella; 120 prepacked supermarket retail samples and 80 butcher samples. The range of pork products investigated included mince, loin, chop, escalope, medallion, diced, and fillet depending on what was available on the day of sampling at the particular retailer.

Overall the prevalence of Salmonella spp in retail pork was found to be 5.5% i.e. eleven samples were positive. Six packs contained Salmonella Kentucky and five contained Salmonella Typhimurium. Of the 11 positive samples, three were obtained from butchers shops and eight were prepacked supermarket products.

Discussion

A major survey of the level of Salmonella contamination in retail pork obtained across the U.S. showed that 9.6% of samples were positive (n=384) (Duffy et al. 2001) whilst a survey limited to the Greater Washington D.C. Area found only 3% of samples (n=209) positive (Zhao et al. 2001).

In Edmonton, Canada Bohaychuk et al. (2006) examined 100 samples of retail raw pork and found that none contained salmonellas. Thus a considerable variation was seen in the U.S. with prevalences varying from almost double the rate found in NI to almost half whilst Canadian samples appeared to be Salmonella-free. A small survey conducted in Ireland (Duffy et al. 1999) found 10% of 22 samples to be positive whilst studies in Italy (Busani et al.) noted that 4.9% of 3182 samples were positive, similar to the incidence found in this study. Thus it appears that raw pork on retail sale is not commonly contaminated with salmonellas, and the level found in NI is unexceptional.

Considering the serovars found in NI, S. Typhimurium is frequently associated with pigs and pork (Botteldoorn et al. 2003, Davies et al. 2004, Giovannacci et al. 2001) and also human illness (Anon. 2006b). It is regarded as a virulent zoonotic organism (Davies et al. 2004) hence should be absent from foodstuffs. S. Kentucky can also cause human illness although it is rarely isolated from
patients in Northern Ireland (Anon. 2004). Thus both serovars found in retail pork in NI capable of infecting man. Further study will be required to assess the hazard presented to consumers by raw pork products since in NI they now have higher frequency of salmonella contamination than that of 1.5% found in raw poultry (Soults et al. 2003).

Conclusions

The prevalence of Salmonella spp. in retail packs of raw pork in Northern Ireland was found to be similar to that noted in Italy. Only two serovars were isolated from the samples but both Salmonella Kentucky and Salmonella Typhimurium are zoonotic pathogens

References


Anonymous. 2006a. Laboratory reports of Salmonella sp (all specimen types). Available at: http://www.cdscni.org.uk/surveillance/Gastro/Salmonella_sp.htm


