Food Safety

Professor Christine Dodd
Division of Food Sciences
Food Safety

- Chemical
- Prions
- Bacterial Disease
- Allergens
- Mycotoxins
- Natural Toxicants
Are you a statistic?

- Show symptoms of diarrhoea &/vomiting
- Go to see GP & f-b disease diagnosed
- Give specimen to GP
- Organism is isolated
- Results reported
- Included in food-borne disease statistics for organism
Estimates are that in the UK in 2007 around a million people suffered a foodborne illness, which led to 20,000 receiving hospital treatment and 500 deaths, at a total annual cost of nearly £1.5 billion.
Foodborne Disease:
Estimated cases, by pathogen, England and Wales 2008

- Norovirus: 201,279
- Campylobacter: 321,179
- Salmonella: 26,962
- Listeria monocytogenes: 358
- E.coli O157: 1,054
- Cl. perfringens: 52,530

Foodborne Disease:
Estimated deaths, by pathogen, England and Wales 2008

- Norovirus: 32
- Campylobacter: 76
- Salmonella: 77
- Cl. perfringens: 55
- E.coli O157: 23
- Listeria monocytogenes: 126
Campylobacter

Intestinal flora of a wide range of warm-blooded wild and domestic animals and birds

Pigs, cattle, pets, poultry and wild birds - asymptomatic
Young pets with diarrhoea
Surface waters 10-15 d 4°C
Main food source undercooked chicken

- 11 foodborne outbreaks of *Campylobacter* in England reported to the HPA in 2009.
- 9 (82%) linked to poultry liver parfait or pâté consumption (8 from prepared from chicken livers and 1 from duck livers) at catering premises
- Deliberate undercooking of chicken livers (searing by flash frying) or inadequate cooking of blended duck livers in a bain marie used to make this dish.
- Increasing trend since 2007
- *Campylobacter* outbreaks linked to pâté consumption also reported in Scotland
- “inappropriate culinary practices”
Campylobacter

Illness follows ingestion of ~500 cells of the live bacterium

Campylobacteriosis - severe diarrhoea and abdominal pain 2 to 5 days after ingestion

Two serious auto immune diseases Guillain-Barré Syndrome and Miller-Fisher Syndrome can follow in rare cases
Campylobacter

Salmonella

• Disease association – salmonellosis
• Requires ingestion of about $10^5$ cells
  – diarrhoea, vomiting, fever
  – typically 12-48h incubation
  – duration 1-7d
  – mortality ~ 0.1%
• Even when symptoms stop can be carried asymptomatically and shed in faeces for ~5 weeks.
Salmonella in poultry
Poultry vaccination as part of national control programme for *Salmonella*
Other food sources for *Salmonella*

Pigs are a major carrier of *Salmonella*

Pork and pork products (~4.2% carcasses)
Other food sources for *Salmonella*

- Salad vegetables increasingly recognised as a source of salmonellosis
- Currently *Salmonella* Bareilly cases are being linked to the consumption of raw/under-cooked bean sprouts.
- Previously a number of incidents with bagged ready-to-eat salads
- *Salmonella* Typhimurium (multi-antibiotic resistant strain) and *S.* Newport
**Listeria monocytogenes**

- Although relatively rare, causes more deaths each year in UK than *Salmonella* and *E. coli* O157:H7 combined
- Around one third of cases result in death
- Number of cases doubled in the last 9 years
Listeriosis

- Primarily infects immuno-compromised groups
  - Trans-placental spread in pregnant women
  - Neonatal infection results from bacteria crossing the placenta
  - Causes: abortion or still birth
    - bacteraemia
    - meningitis

- Other “At Risk” Groups:
  - young (including neonates) & elderly
  - medically immuno-compromised patients
  - patients with underlying disease
  - typical symptoms bacteraemia and meningitis
Changes in Epidemiology

Typing data do not indicate a single strain or common source; not an outbreak or cluster

Clinical presentation also changed

• more cases presenting with bacteraemia
• absence of CNS involvement.
Characteristics of *Listeria*

- Unlike most other food borne pathogens *Listeria* grows at refrigeration temperatures
  - prevalent in damp, cool conditions
  - e.g. meat and dairy chill rooms
- Tolerant of low pH and low water activity
- Resistant to desiccation
- Attachment to variety of food processing surfaces known
- Only need to ingest 100 cells
Food Sources

• Ready cooked meats including pate
• Mould ripened soft cheeses
• Cook chill foods
  – Ready to Eat foods that sustain growth – absence in 25g
• Outbreaks 2003-8
  – Associated with sandwiches sold in hospitals
  – All patients were immunocompromised
  – 4 were pregnant women and foetus also affected
Research in Microbiology and Food Safety in Food Sciences
Control of pathogens in the food supply

• Use of bacteriophage to control *Campylobacter* carriage in chickens and pigs

• Use of probiotics to improve pig health and productivity and to control enteric pathogens
Impact of weaning and antibiotic treatment

Sample A & B (day 0)

Sample A & B (day 4) stool “loose”

Colistin and Tiamulin
Impact of weaning and antibiotic treatment on gut flora

- Drop in species number from 854 to 633
- Gram negative species have declined dramatically including the pathogens *Salmonella, Campylobacter* and *E.coli* (the targets of Colistin)
Examining the effectiveness of factory operations

Food Standards Agency Project M01040
Bacterial responses to environmental conditions including food environments

Stress resistance in *Salmonella, Listeria monocytogenes, E. coli*
temperature stress, metal resistance, aw, persistence in food environments

Recovery of *L. monocytogenes* after heating (line) and after heating plus cold storage (line)
Improved/novel decontamination strategies

- Biopreservation using lactic acid bacteria
- Decontamination of sprouting seeds
- Cold atmospheric gas plasma inactivation

Counts (log cfu/g) of *Listeria monocytogenes* during storage of *tsire* at 30°C
That’s all folks
Enjoy your lunch!