

SALMONELLA TYPHI

THE ORGANISM/TOXIN

This is the causal organism of typhoid (or enteric) fever, representing a more serious form of *Salmonella* infection than the other salmonellae.

GROWTH AND ITS CONTROL

The characteristics of this species are essentially those of other non-heat resistant *Salmonella*. Full details are given on the sheet "non-typhoid salmonellae". An abridged version appears here, with *S. Typhi*-specific data given where available.

Growth:

Temperature: Minimum 7°C, growth greatly reduced at <15°C. Maximum 45°C. Optimum 35-37°C.

Water activity: Minimum 0.94, optimum 0.99 maximum >0.99.

pH: Minimum 3.8, optimum, 7-7.5, maximum 9.5. The minimum pH is influenced by other factors such as the acid present, and the presence of nitrite etc.

Atmosphere: Can grow in the presence or absence of air. Growth under nitrogen is only slightly less than that under air.

Grows at 8-11°C in the presence of 20-50% CO₂.

Survival:

Temperature: Survival can be quite good, for example the organism was viable for 190 days when inoculated onto chocolate biscuits, and for 230 days on sweets.

S. Typhi can survive for 4 days in shellfish stored at 10-13°C, and in ice for in excess of 90 days.

Viable but Non-Culturable (VNC) Cells: This organism is thought to undergo transition to the VNC state in water.

Inactivation (CCPs and Hurdles):

Water activity: Inactivated within 1 day when exposed to 30% NaCl.

Sanitisers/Disinfectants: (These products must be used as advised by the manufacturer).

Treatment of *S. Typhi* contaminated bean sprouts with 200 mg/l sodium hypochlorite or 100 mg/l "Citricidal" only reduced the count by 1.5 log cycles (i.e. ineffective).

(N.B. The absence of a sanitiser/disinfectant from this section does not necessarily imply that it is ineffective).

THE ILLNESS

Incubation: 7-28 days (average 14)

Symptoms: Fever, malaise, anorexia, spots on trunk. These occur commonly with pea-like diarrhoea or constipation. Patients may become delirious. Recovery is slow, taking from 1 to 8 weeks. Hospitalisation rate estimated at 75%, case fatality

rate 0.4%.

Condition: Typhoid, or enteric, fever.

Toxins: Toxins are not produced in foods.

At Risk Groups: In non-endemic areas children between 0-5 years are at the greatest risk.

NZ Incidence: Incidence as at October 2000, 0.5 cases/100,000. The incidence was 0.3 cases per 100,000 in the previous year.

A case reported in 1996 was not associated with overseas travel, and appeared to have been caused by the consumption of raw non-commercially harvested mussels growing in the Wellington region.

Treatment: Quinolone and cephalosporin antibiotics may be used. Vaccines are available.

SOURCES

Human: Humans are the sole reservoir of this organism. Carriers may harbour the organism in their gal bladders.

Animal: Does not infect animals.

Food: Foods may become contaminated from food handlers or via the use of contaminated water during processing. Shellfish grown in polluted waters may also accumulate the organism within their tissue.

Environment: Water that has been contaminated by human faecal pollution is a transmission route. Survival in seawater for up to 9 days, and in sewage for weeks have been recorded. Survival in groundwater was better than in pond, stream or lake water and this was attributed to less grazing pressure by protozoa.

Transmission Routes: Mainly from water or from human carriers.

OUTBREAKS AND INCIDENTS

Overseas Outbreaks:

Sandwiches: 32 cases. Control measure failure: Contamination by food handler.

Milk: >400 cases. Control point failure: Cows milked by carrier.

Chicken and rice: 27 cases. Control point failure: Not identified.

Orange juice: 43 confirmed and 24 probable cases. Control point failure: Contamination by asymptomatic food handler.

Pork products: 13 cases. Control point failure: probable contamination by food handler.

Epidemiological studies. A case control study in a non-endemic area showed that most cases had travelled overseas (although 10% had not). Another study in Singapore identified food as the major vehicle of transmission, and that as time progressed a greater proportion of cases was imported.

ADEQUATE PROCESSING GUIDELINES

N.B. These guidelines have been derived from published information. Industry is advised to ensure that processing steps they are using are adequate to meet their particular food safety objectives.

| Cook meats to: | Internal temperature reached | Time |
|---|---|---------------|
| Minced meats (beef, veal, lamb, pork) + pork cuts | 71°C | 15 sec |
| Minced poultry | 74°C | " |
| Meat cuts (beef, veal, lamb), fish, seafood | 63°C | " |
| Poultry, breast | 77°C | " |
| Poultry, whole | 82°C | " |
| Hold foods at | $\leq 5^{\circ}\text{C}$ or $\geq 60^{\circ}\text{C}$ | |
| Reheat cooked foods to | 74°C | Instantaneous |
| Acidify foods to pH 3.8 or below | | |
| Avoid direct handling of food by infected food handlers | | |

REFERENCES

- Jay, S., Grau, F.H., Smith, K., Lightfoot, D., Murray, C. and Davey, G.R. (1997) *Salmonella* pp 169-232 In: Foodborne microorganisms of public health importance, 5th Edition. AIFST (NSW Branch), Sydney, Australia
- The International Commission on Microbiological Specifications for Foods (1996) *Salmonella*. In Microorganisms in Foods 5 Microbiological Specifications of Food Pathogens, pp 217-264. Blackie Academic and Professional, London.

