YERSINIA ENTEROCOLITICA

THE ORGANISM/TOXIN

Yersinia enterocolitica and Yersinia pseudotuberculosis are bacteria known to cause foodborne gastroenteritis in humans.

In New Zealand, cases of human illness and laboratory detection of either organism are notified to ESR and Y. enterocolitica is more commonly reported than Y. pseudotuberculosis. A seasonal pattern is apparent from the data, with more cases reported in the months of October, November and January (Pirie, 2008). A large proportion of cases are believed to be attributable to food. This datasheet focuses on Y. enterocolitica.

The pathogen can cause diarrhoea and pain that may be mistaken for appendicitis. More invasive illness occasionally occurs, and post-infection arthritis may occur in a small proportion of cases.

Not all Y. enterocolitica strains can cause human illness. Six biotypes can be differentiated using biochemical tests, and this forms a useful investigative tool for determining pathogenicity. Pathogenic biotypes are 1B, 2, 3, 4 and 5. In New Zealand biotype 4 (serotype O:3) has been commonly isolated from yersiniosis cases (Pirie et al, 2008).

Foodborne yersiniosis can be avoided by following standard food safety and hygiene advice.

GROWTH AND CONTROL

Note: Isolation of Y. enterocolitica is notoriously difficult; no single method is suitable for all serotypes. Y. enterocolitica is thought to compete poorly with spoilage organisms.

Growth

Temperature
- Optimum 25 - 37°C
- Range -1.3 - 42°C

pH
- Optimum 7.2
- Minimum 4.2 - 4.8 depending on temperature and acidulant. Maximum 9.6-10

Atmosphere
Facultative anaerobe
100% N₂ and CO₂/N₂ gas mixes inhibitory (more so at refrigeration temperatures).

Water activity
Minimum 0.96 a_w. Growth in 5% salt, not in 7% salt.

Inactivation

Temperature
Pasteurisation effective
D₅₅°C = ~ 2 min,
D₆₀°C = ~ 0.5 min,
D₆₅°C = ~ 2 sec.

pH
Below pH min, bactericidal activity order is:
Acetic acid > lactic acid > citric acid > sulphuric acid.

Water activity
0.945 a_w (7% NaCl) was bactericidal on all of 4 strains tested, when incubated at 3°C but at 25°C both bactericidal and bacteriostatic effects were observed. At 9% NaCl and 25°C, all 4 strains were killed (Stern et al., 1980).

Preservatives
Growth is retarded by potassium sorbate up to 5000 ppm at pH 6.5 in a dose-dependent manner. At pH 5.5 concentrations above 1000 ppm virtually eliminate growth or cause inactivation depending on dose. Sodium nitrite at a concentration of 150 ppm retarded growth on bologna.

Disinfectants / Sanitisers
Treatments with ozone (1.4 and 1.9 ppm) and with ozonated water (1 min exposure) reduce pathogen loading (Selma et al., 2006).
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CLINICAL PICTURE

Incubation: Approximately 7 days, range 1-11 days.
Symptoms: Usually manifests as a self limiting gastrointestinal infection. Symptoms generally last 2-3 days but duration may extend to 3 weeks (Robins-Browne, 2007). More serious illness occurs less commonly. Common symptoms include:
- Diarrhoea (watery/mucoid in young children), enterocolitis
- Pseudoappendicitis syndrome in 5 yrs – adolescents, particularly with more virulent strains. Caused by acute inflammation of the terminal ileum or mesenteric lymph nodes in right lower quadrant, with little or no diarrhoea
- Pharyngitis
- Post infection autoimmune sequelae.

Condition: Yersiniosis.
Dose: Insufficient data are available to ascertain dose response.

At Risk Groups:
- Highest notification rates for <5 age group, followed by >60 age group, more common in males than females (Pirie et al., 2008).
- Immunosuppression, blood disorders, malnutrition, chronic renal failure, cirrhosis, alcoholism, diabetes mellitus and acute/chronic iron overload states. Are predisposing factors for septicaemia.

Long Term Effects: Enterocolitis may persist for several months. Acute inflammatory, arthritic syndromes may develop 7-21 days after infection. Other symptoms, e.g. urethritis and skin lesions, can occur in adults.

Treatment: Antibiotics do not reduce severity or duration of gastrointestinal illness, but are of use in more serious manifestations of the disease.

SOURCES

Infections are zoonotic, those sub-types that occur in humans also occur in domestic animals.

Human: Person-to-person transmission can occur.

Animal: Isolated from mammals, birds, frogs, flies, fleas, crabs and oysters (Robins-Browne, 2007). Associated with pigs, especially the tongue and tonsil area. Pigs are the only animal from which Y. enterocolitica biotype 4 and serotype O:3 are frequently isolated and this is the group commonly associated with human illness (Robins-Browne, 2007). Serotype O:3 is common in pigs globally and may also be carried by companion animals.

Food: Foodborne transmission appears to be the primary route for infection, estimated at between 41.5 and 71% of New Zealand cases (Cressey and Lake, 2005). Y. enterocolitica may be associated with pork, beef, lamb and poultry and has also been isolated from fruit, vegetables, tofu, pastries, sandwiches and pasteurised milk.

Environment: Terrestrial and freshwater ecosystems harbour the pathogen, including soils, vegetation, lakes, rivers, wells and streams. Extended survival periods at low temperatures.

OUTBREAKS AND INCIDENTS

NZ Incidence (all yersiniosis): 10.0 cases/100,000 in 2009 (10.4 cases /100,000 male; 9.4/100,000 females). The hospitalisation status was recorded for 214 cases and 38 (17.8%) were hospitalised (ESR, 2010b). Two outbreaks in 2009 involving 15 cases, causes not identified (ESR, 2010a).

Overseas Outbreaks
Y. enterocolitica:
- Pasteurised milk: Vermont, USA, 1995; 10 cases, 3 hospitalised, 1 appendectomy. Control measure failure: likely post pasteurisation contamination.
- Pork chops and pork brawn: Norway, 2006; 11 cases, 4 hospitalised, 2 died. Control measure failure: Unidentified.
- Chitterlings (boiled pig intestine): Chicago, USA, 2002. 9 cases. 6 hospitalisations. Control measure failure: Probably poor handling practices in the home.
Epidemiological studies

**New Zealand:** Cases were more likely to live in households with unreticulated sewage or to have ingested pork, vegetables and fruits, or food from a sandwich bar (Satterthwaite et al., 1999).

**Overseas:** Ingestion of raw or undercooked pork is considered to be a major risk factor. Yersiniosis has been associated with consumption of pork products (including intestines), sausages, eating raw food or food cooked rare, and the consumption of untreated water.

REFERENCES


