

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

D_{55°C} = ~ 2 min,

D_{60°C} = ~ 0.5 min,

D_{65°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.
- Less common: septicaemia, visceral abscesses, skin infections, pneumonia, endocarditis, osteomyelitis, peritonitis, meningitis and eye infections. (Robins-Browne, 2007).

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.

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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.

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