

Arcobacter

THE ORGANISM/TOXIN

Arcobacter is a member of the Epsilonbacterales group, which also includes *Campylobacter* and *Helicobacter* spp. It is distinguished from *Campylobacter* by being able to grow in the presence of oxygen (aerotolerant) and at 15°C. There are four species of *Arcobacter* currently recognised, of which two, *Arcobacter butzleri* and *Arcobacter cryaerophilus*, have been associated with human disease. *A. butzleri* may be the primary human pathogen. *Arcobacter* spp. are gram-negative, curved, s-shaped or helical non-spore-forming rods that are 0.2-0.9 µm wide and 1-3 µm long. They are motile with a single polar unsheathed flagellum. Most strains are non-haemolytic.

GROWTH AND ITS CONTROL

Growth:

Temperature: Optimum and range depends on the isolate and atmosphere. Optimum probably between 25 and 35°C, range 15 to 37°C, though some isolates may grow at 42°C.

pH: Optimum 6.0 to 7.0 (*A. butzleri*), 7.0 to 7.5 (*A. cryaerophilus*), range 5.0 to 8.5

Atmosphere: Can grow in microaerobic conditions, but can also grow in fully aerobic conditions.

Water activity: Inhibited below a_w 0.980 (adjusted with NaCl, glycerol or sucrose).

Survival:

Temperature: Survives under cold storage (4°C) with only a gradual decrease over time. Freezing (-20°C) causes an initial reduction in numbers, followed by little change in cell viability. Cells in the exponential phase are more cold sensitive.

Atmosphere: Survives in aerobic and anaerobic conditions.

Inactivation (CCPs and Hurdles):

Temperature: Rapidly inactivated by heating to 55°C and above. D-values in liquid at 50°C = 5.12-5.81 min; 55°C = 0.38-0.76 min; 60°C = 0.07-0.12 min. D-values in pork were 18.51 min at 50°C, 2.18 min at 55°C. Mild heat (50°C) followed by cold shock (4 or 8°C) is more lethal than either treatment alone. *A. butzleri* is more heat sensitive at a lower pH or during stationary phase.

pH: Growth inhibited below pH 5.0. Upper pH tolerance not known (perhaps greater than pH 9).

Water activity: Inhibited below a_w 0.980.

Preservatives: Able to grow in the presence of 3.5% NaCl, some strains can grow at 4% NaCl, and survival of some strains has been observed at 5% NaCl. *A. cryaerophilus* is more sensitive than *A.*

butzleri to NaCl. Inhibited by citric acid and lactic acid at 0.2%, and by 0.5% trisodium citrate.

Sanitisers/Disinfectants: Sensitive to chlorine (inactivation within 60 seconds at 0.46 mg/L free chlorine, 0.61 mg/L total chlorine).

Radiation: Sensitive to γ irradiation, though more tolerant than *C. jejuni*. Reduced 10-fold in ground pork by 0.27 kGy (0.18 kGy for *C. jejuni*). Irradiation doses of 0.3 to 1.0 kGy (FDA-approved for pork) would reduce *Arcobacter* spp. by up to 3.7 log units, and probably eliminate it.

Antibiotics: Nisin alone is not significantly inhibitory, but enhances inhibition in the presence of organic acids. Vary in sensitivity to antibiotics; most are sensitive to fluoroquinolones (but resistance is emerging) and imipenem and amikacin. High level of resistance to penicillins and others such as vancomycin and methicillin.

THE ILLNESS

A. butzleri is more commonly associated with human disease, and serotypes 1 and 5 are primarily associated with human infection.

Incubation: Not known.

Symptoms: Patients can be asymptomatic. The most common symptom is acute watery diarrhoea lasting for 3-15 days, sometimes being persistent or recurrent for greater than 2 weeks or even as long as 2 months. Often accompanied by abdominal pain and nausea. Some patients also experience bodily weakness, fever, chills and vomiting. Coinfection with another enteric pathogen has been observed, as has infection by *Arcobacter* in patients with other conditions such as diabetes. Hospitalisation can occur.

Condition: Usually gastroenteritis, but occasionally septicaemia.

Toxins: Produces chemicals that are toxic to some cells, but no information on toxin production in foods.

At Risk Groups: Can affect any age group, though highest prevalence is in very young children. One Belgian study indicated that slightly more females were infected than males.

Long Term Effects: Not known.

Dose: Not known.

NZ Incidence: Not known.

Treatment: Typically none, as recovery usually occurs with conservative management (e.g. administering fluids). Some cases are treated with antibiotics such as amoxicillin+clavulanate, erythromycin and ciprofloxacin, although some strains may be resistant to these antibiotics.

SOURCES

Human: *A. butzleri* is most commonly isolated from humans, and *A. cryaerophilus* more rarely. They are not normally found in the human intestine, and have been isolated from patients with bacteraemia, endocarditis, peritonitis and diarrhoea. Likely transmission route between people is faecal-oral.

Animal: *A. butzleri*, *A. cryaerophilus* and a third species *Arcobacter skirrowii*, are associated with diarrhoea and abortion in animals. The primary reservoirs are cattle, sheep and pigs, although horses may also be important. *Arcobacter* have been isolated from the intestine, placenta and foetus of these animals, and also cultured from raw milk during mastitis outbreaks in cattle and the faeces of chickens. *A. cryaerophilus* has been isolated from the preputial washings of New Zealand bulls. Internationally, *Arcobacter* have also been isolated from large numbers of clinically healthy animals.

Food: *Arcobacter* spp. have been detected on food of animal origin such as beef, lamb, pork and poultry. Higher prevalence has been found in chicken and pork products. Chicken carcasses are often contaminated with *Arcobacter* spp., and unlike *Campylobacter*, *Arcobacter* are rarely found in intestinal contents (possibly transient), but are recoverable from throughout poultry processing plants and are present on birds prior to

evisceration. Genetic clustering of *Arcobacter* isolates with retail establishments is also evident, suggesting that *in situ* contamination may be important. Distribution in other foods is not known.

Water: *Arcobacter* spp. have been detected in drinking water reservoirs and treatment plants, and can adhere to water distribution pipe surfaces.

Environment: Excreta from infected animals may contaminate soil or water. *Arcobacter* spp. have been found in river and canal waters, but their ability to survive in the environment is not known.

Transmission Routes: Contaminated foods of animal origin (particularly poultry and pork) and consumption of contaminated water are likely to be the most important transmission routes to humans.

OUTBREAKS AND INCIDENTS

The number of outbreaks and incidents attributable to *Arcobacter* infection is unknown as this organism is not usually included in routine clinical investigations. There are no records of *Arcobacter* infection in New Zealanders. Internationally, reported incidents and outbreaks associated with *Arcobacter* are also rare. Recurrent abdominal cramps in 10 children from a school in Italy were caused by *Arcobacter* infection. *Arcobacter* were also isolated from many Thai children suffering from diarrhoea.

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