

# CRYPTOSPORIDIUM PARVUM

## THE ORGANISM/TOXIN

This organism is a protozoan parasite that produces gastrointestinal symptoms when ingested by humans. The organism is most likely to be present as an oocyst, a resting stage equivalent to a bacterial spore.

## GROWTH AND ITS CONTROL

**Growth:** The organism does not grow outside of the animal reservoir so controls designed to restrict the growth of bacteria will be ineffective in controlling this organism.

### Survival:

**Temperature:** Oocysts survived heating to 60°C for 1 min.

**Water Activity:** Survival for 176 days in river and drinking water has been reported (1-11% survived). Oocysts survive on stainless steel if kept wet but die rapidly on air-drying.

Infectivity decreases in oocysts present in calf faeces which is allowed to dry out at ambient temperatures.

### Inactivation (CCPs and Hurdles):

**Temperature:** Milk pasteurisation is sufficient to inactivate oocysts (e.g. >99.9999% inactivation after 5 sec at 71.7°C).

Exposure to temperatures above 73°C renders the oocysts non-infectious.

Can survive at low levels for 24 hours at -20°C in water, but is inactivated in commercial ice cream freezing. Freezing at -15°C or below results in eventual die off (e.g. >99.99% inactivation at -15°C for 7 days).

**pH:** Acid conditions (pH 4.0) result in some loss of viability of oocysts.

**Water activity:** Oocysts are sensitive to drying with 97% destruction after 2 hours of air drying at room temperature. Oocysts (>99.9%) became non-infectious after 24 hours and 1 week when stored at an  $a_w$  of 0.85 at 28 and 7°C respectively. When stored at an  $a_w$  of 0.95 similar loss of infectivity was recorded after 1 and 2 weeks.

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

Exposure to 5% ammonia or 10% formol saline for 18 hours inactivates oocysts, while exposure to 4% iodophore, 5% cresylic acid, 3% sodium hypochlorite, 10% benzylkonium chloride or 0.02% sodium hydroxide for the same period did not.

10 vol hydrogen peroxide will inactivate oocysts.

Oocysts are extremely resistant to chlorine, one experiment noting survival in 50,000 ppm chlorine for 2 hours exposure. 1.3 ppm chlorine dioxide gave a 90% inactivation after 1 hour exposure, as did 1 ppm ozone after 5 min.

$C_t$  values chlorine 7,200, chloramine 7,200, chlorine dioxide 78, ozone 5 to 10.

0.35% peracetic acid inactivated all oocysts after 5 min exposure.

Effective are methyl bromide and ethylene oxide.

Not effective are phenol, formaldehyde, ethanol, isopropanol and lysol.

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

**Radiation:** Sensitive to UV in sunlight.  $C_t$  for UV 19 mJ cm<sup>-2</sup>.

## THE ILLNESS

**Incubation:** 3-11 days.

**Symptoms:** Watery diarrhoea, vomiting, anorexia, malaise, cramping, and weight loss. Usually self-limiting, lasting 2-4 days.

May also infect the respiratory system.

Immunodeficient people may become infected for life.

Attack rate was 55% in the waterborne Milwaukee outbreak affecting 403,000 people. Hospitalisation rate estimated at 15%, case fatality rate 0.5%.

**Condition:** Cryptosporidiosis.

**Toxins:** Toxins are not produced in foods.

**At Risk Groups:** Can infect anyone, but children under 5 years of age, and the immunodeficient are most prone to disease.

**Long Term Effects:** Is the most common enteropathogen affecting AIDS patients and results in the death of a significant number of them (one study recorded 55%). Invasion of the respiratory system may also be fatal.

**Dose:** Less than 10, and possibly 1 oocyst. This can be much higher and may be strain dependent.

**NZ Incidence:** The annual rate was 21.2 cases per 100,000 as at November 2000. Most cases occur in the spring and autumn. Cryptosporidiosis rates were higher than the national average in South Canterbury, Rotorua, the Waikato and Southland.

**Treatment:** No effective treatment.

## SOURCES

**Human:** There is evidence that one subtype of *C. parvum* is restricted to humans. Person-to-person secondary transmission occurs. Infectious oocysts can be excreted for up to 5 weeks after the cessation of symptoms. More than 10<sup>8</sup> oocysts can be excreted daily in human faeces.

**Animal:** *C. parvum* is carried by livestock and causes disease in calves. Domestic animals may also harbour human pathogenic strains.

Oocysts are bioaccumulated by benthic clams, and have been detected in American oysters destined for human consumption.

**Food:** Oocysts have been detected in raw milk and meat, as well as raw fruits and vegetables. Foods suspected as acting as vehicles of disease include salad, raw milk, sausage, and tripe.

If contaminated milk is used to make yoghurt the oocysts may survive, but hardening of ice cream results in their inactivation.

**Environment:** Oocysts are found in waters which have been faecally polluted.

**Transmission Routes:** Primarily by contaminated water, contact with animals and person-to-person spread.

## OUTBREAKS AND INCIDENTS

**Outbreaks:** Few well documented outbreaks have been reported..

**Chicken salad:** 15 ill, 2 confirmed. Control measure failure: Contamination by food handler (changed nappies).

**Apple cider:** 20 confirmed cases, 11 suspected. Control measure failures: washed in contaminated water.

**Apple cider:** 160 cases. Control measure failures: Contamination by calf faeces.

**Fermented milk drink (kefir):** 6 cases. Control point failure: Milk contaminated on farm.

**Green onions (?):** 54 cases. Control point failure: Contamination by food handler, vegetables not washed.

Epidemiological studies. Work in Tasmania linked cryptosporidiosis with the consumption of raw milk or contact with animals. 2.4% of diarrhoeal specimens examined contained oocysts. Many cases were in people <5 years of age. An equivalent study carried out in Taranaki found 4.2% of samples were positive.

## 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	"
Reheat cooked foods to	74°C	Instantaneous
Avoid cross contamination from raw to ready-to-eat foods		
Thoroughly wash all fruit and vegetables		
Avoid direct handling of food by infected food handlers		
Boil, filter or chemically treat non-potable drinking water		

## REFERENCES

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