**Bacillus Cereus**

**Bacillus Cereus** is an organism occurring naturally in most foods and it can cause two different forms of food poisoning, diarrhoeal and emetic, both caused by toxins produced by the bacteria. The disease is usually mild and short lived, with rapid recovery generally within 12 to 24 hours. It is responsible for less than 5% of reported food poisoning outbreaks in New Zealand with the foods involved usually being, cooked rice or protein rich dishes commonly having been stored at incorrect temperatures.

**What is Bacillus Cereus?**

Bacillus cereus is a bacteria that produces toxin (a poisonous chemical substance produced and released by the bacteria during its normal life and growth) and spores (resting cells formed as a survival strategy in times of stress, such as lack of nutrients and moisture needed for growth, they can withstand adverse conditions such as heat, and disinfectants, and when living conditions become favourable again the spore germinates becoming a normal bacterial cell).

It grows best between 30 and 37°C, with some strains growing at up to 55°C or as low as 4°C. It grows through a pH range of 4.3 to 9.3, has a minimum water activity level of 0.912 and grows best in the presence of oxygen (aerobically), although can also grow well anaerobically.

The bacterial cells are readily killed by heat but the spores are moderately heat resistant. Heat resistance is increased in high fat and oily foods and also in foods with low water activity. Spores are more resistant to dry heat than moist heat and they can survive for long periods in dried foods.

The diarrhoeal illness is caused by a heat and acid unstable enterotoxin, with the emetic illness caused by a highly stable toxin, capable of surviving high temperatures and pH extremes.

**What are the symptoms?**

Symptoms with the diarrhoeal toxin are nausea, cramp-like abdominal pains and watery diarrhoea, beginning 10 to 12 hours after eating and resulting from the bacteria multiplying and producing toxin within the intestine.

With the emetic toxin symptoms are, nausea and vomiting (occasionally followed by diarrhoea) beginning 1 to 6 hours after eating food contaminated with pre-formed toxin.

The diagnosis is confirmed by a laboratory test on a faecal specimen.

All people are believed to be prone to intoxication but the intensity of symptoms may vary between individuals.

**Where does it come from?**

- Major sources are raw foods of plant origin.
- Dried herbs, spices, dehydrated and processed foods such as cereals, and cornflower.
- Foods including turkey, beef, seafood, salads, potatoes, rice, noodles, food mixes (sauces, soups, casseroles), milk powder, various bakery products and desserts especially items with custard and cream.
- Strains producing diarrhoeal toxin grow in a variety of foods from vegetables and salads to meat and casseroles.
- Strains producing emetic toxin grow well in starchy foods like potato, pasta and rice.
- The general environment including soil, air, dust, water and decaying matter.

The widespread distribution of the organism and the ability of spores to survive dried storage along with their thermal resistance, means that most ready to eat foods probably contain Bacillus cereus and will require control measures to prevent its growth.
How long does it last?
Recovery is generally rapid for both forms, usually within 12 to 24 hours.

How is it treated?
Generally no specific treatment is needed except for fluid replacement when diarrhoea and vomiting are severe.

Can I get this infection again?
As yet it is unclear if any resistance is gained against re-infection.

Can it spread to others?
This illness is not spread from person to person.

What about work, school, pre-school and child-care?
Everyone with this infection should stay off work or school while they have symptoms especially those in High Risk groups, occupations or institutions (infants or children in day-care, school pupils, students, food workers, child-care workers, teachers, and health/care workers).

How can it be prevented or the risk reduced?
Bacillus cereus exists in both bacterial and spore forms in foods. While cooking inactivates the bacteria, most food poisoning incidents are the result of the multiplication of spores, or toxin build up in foods that have been cooled slowly and stored incorrectly.
Because cooking often kills competing bacteria and heat activates the Bacillus cereus spores, storing large masses of cooked food between 4 and 60°C can allow the bacteria to multiply.
Bacillus cereus food poisoning is not a notifiable disease in New Zealand so the data obtained concerning illness is from larger outbreaks of specific incidents.
Foods implicated in New Zealand include ~
Fried rice, meat stews, vegetables, takeaway meals, pancakes, and seafood chowder.
Foods implicated in New Zealand include ~
Barbequed pork, chicken fried rice, vanilla sauce, meals-on-wheels.

Preventive measures that can be taken to help avoid the illness include ~

- Ensuring adequate temperatures are reached during cooking of food mixes such as sauces, custards, and soups to inactivate the bacteria.
- Not keeping high-risk foods at room temperature but above 60°C if served hot, 4°C if cold.
- Ensuring the rapid cooling of cooked food by dividing into smaller lots and refrigerating in shallow containers (less than 10 cm deep).
- Storing cold foods at or below 4°C to prevent toxin being produced.
- Avoiding storing protein-containing foods with cooked rice as this stimulates the growth of Bacillus cereus.
- Reheating foods until steaming hot, as flash frying or brief re-warming is not adequate to destroy the toxin. This is very important as the heat stable emetic toxins can survive for up to 90 minutes at 126°C.
- Preventing cross-contamination from raw to cooked or ready-to-eat foods, by using separate preparation areas and equipment or sanitising between processes.
- Thoroughly washing fruit and vegetables with clean water of drinking standard before use.
- Ensuring food handlers have good personal hygiene and adequate food safety training.