

Bacillus cereus

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| DESCRIPTION OF ORGANISM : | Large Gram-positive, rod shaped, aerobic, spore former, capable of growth under anaerobic conditions. |
| RESERVOIRS OF INFECTION : | Soil, dust, cereals, spices, vegetables and dairy products. |
| TEMPERATURE RANGE : | Min. 4°C. Optimum 30 - 35°C. Max. 48 - 50°C (mesophiles). Max. 43°C (psychrophiles). |
| pH RANGE : | 4.9 - 9.3. |
| a_w : | Min. 0.92. |
| SURVIVAL (freezing/drying) : | Spores survive freezing/drying. |
| IONISING RADIATION : | 1.6 - 4 kGy. |
| THERMAL RESISTANCE : | D- value of 0.02 - 0.06 min. at 121°C. D- value of 0.3 - 27 min. at 100°C. z=10°C. |
| INFECTIVE DOSE : | Toxin produced at 100 cells/g. |
| MAIN SYMPTOMS (in humans) : | Diarrhoeal syndrome: 12 - 24h. Abdominal pain, diarrhoea and nausea. Vomiting syndrome: 6 - 36h. Nausea, vomiting, sometimes followed by diarrhoea. |
| MODE OF TRANSMISSION : | Growth of bacteria in food with subsequent production of enterotoxin OR ingestion of large numbers of spores followed by their germination and enterotoxin production in the ileum. |
| INCUBATION PERIOD : | Diarrhoeal syndrome: 4 - 16h. Vomiting syndrome: 1 - 14h. |
| TREATMENT : | Self - limiting. |
| RAW FOOD MATERIALS : | Cereals, dry vegetables, potatoes, milk and cream, rice, spices. |
| PROCESSED FOODS : | Roast/fried meat products, soups, dry and liquidised egg yolk, custard rice meals |

Campylobacter

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| DESCRIPTION OF ORGANISM : | <i>Campylobacter jejuni</i> is a Gram-negative slender, curved, motile rod. It is a microaerophilic organism, requiring 3 - 5% oxygen and 2 - 10% carbon dioxide for optimal growth. |
| RESERVOIRS OF INFECTION : | Chickens, turkeys and raw milk are the main sources of campylobacter. Healthy pigs, cattle, dogs, cats and wild birds are also sources. Surface waters can be contaminated, and inadequately chlorinated water supplies have been known to cause widespread outbreaks of campylobacteriosis. |
| TEMPERATURE RANGE : | The campylobacters that are pathogenic for man will not grow below 30°C, so they will not multiply on chilled food or on ambient stable foods stored below 30°C. The optimum growth temperature is 42°C and the maximum 47°C. |
| pH RANGE : | Campylobacters are acid sensitive, having a pH optimum around 7.0 and a pH range of 5.0 to 9.0. |
| a_w : | 0.987. |
| SURVIVAL (freezing/drying) : | Campylobacters survive freezing for several months in frozen minced meat and poultry. They are very sensitive to drying. |
| IONISING RADIATION : | 08 - 31 kGy. |
| THERMAL RESISTANCE : | Campylobacters are heat sensitive. The D -value at 60°C is approximately 6 seconds. |
| INFECTIVE DOSE : | 500 - 1000 cells. |
| MAIN SYMPTOMS (in humans) : | Symptoms vary from mild (with few signs of illness even though campylobacter is present in the stool) to severe (with bloody diarrhoea as the most characteristic symptom). Other symptoms are fever, nausea, abdominal cramps and (seldom) vomiting. The duration of the illness is from 2 days to 2 weeks. Complications are relatively rare, but infections have been associated with reactive arthritis, and haemolytic uremic syndrome. Infections of nearly every organ have been associated with cases involving septicaemia. The estimated case/fatality ratio for all <i>C. jejuni</i> is one death per 1,000 cases. Children under 5 years and young adults (15 - 29) are more frequently afflicted than other age groups. |
| MODE OF TRANSMISSION : | Bowel-to-mouth transmission via contaminated food or water. |
| INCUBATION PERIOD : | 2 - 5 days. |
| TREATMENT : | The disease is usually self-limiting; antibiotic treatment is not recommended except for severe cases. |
| RAW FOOD MATERIALS : | Chicken, turkey and other poultry; less commonly pork and beef . Raw milk. |

Clostridium botulinum

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| DESCRIPTION OF ORGANISM : | Gram-positive, anaerobic spore former. 7 types based on antigenic structure of toxin (A - G); only A, B, E and F are known to cause foodborne botulism in man. The organism can be divided into two physiologically distinct groups: proteolytic (A, B, F) and non-proteolytic (B, E, F). |
| RESERVOIRS OF INFECTION : | Proteolytic: Predominantly soil borne; found on raw vegetables; sometimes found in raw meat. Non - proteolytic: Found in both fresh and coastal waters and mud, and hence in fish and shellfish. |
| TEMPERATURE RANGE : | Min. Max. Proteolytic : 12.5°C 48°C Non-proteolytic : 3.5°C 48°C. |
| pH RANGE : | C. botulinum does not grow below pH 4.6 in foods; growth has been demonstrated at pH 4.0 after prolonged incubation at ambient temperatures. |
| a_w : | Minimum a _w for growth at 30-40°C, pH 7.0 : Proteolytic: 0.93 - 0.95. Non-proteolytic: 0.97. |
| SURVIVAL :(freezing/drying) | Spores survive freezing and drying. |
| IONISING RADIATION : | 1.2 - 6.8 kGy. |
| THERMAL RESISTANCE : | Spores : Proteolytic: D -value of 0.2 min. at 121°C. z=10°C. Non - proteolytic: D -value varies widely, approx. 1 min. at 80°C z=10°C. An F ₀ of 3 min. at 121°C is estimated to kill at least 10 ¹² spores of this organism and is considered a satisfactory heat process. Toxins : Treatment at 80°C rapidly denatures toxin, e.g. 1000-fold reduction of types A or B toxin in 1 min. |
| TOXIC DOSE : | Disease occurs only when toxin is preformed in the food; this is thought to be when cell concentrations reach 10 ³ . |
| MAIN SYMPTOMS (in humans) : | Relaxation of muscles, particularly in eyes (causes blurred vision) and around lungs (causes breathing difficulties). |
| MODE OF TRANSMISSION : | Ingestion of food with preformed toxin. |
| INCUBATION PERIOD : | Dose related; varies from a few hours to about 8 days. |
| TREATMENT : | Treatment with antitoxins and respiratory support. |
| RAW FOOD MATERIALS : | Low numbers of spores of C. botulinum should be anticipated on all raw materials. |
| PROCESSED FOODS : | Many low acid foods support growth of C. botulinum , e.g. fish, meat, vegetables. Under-processed or recontaminated canned foods have been implicated. |

Clostridium perfringens

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| DESCRIPTION OF ORGANISM : | <i>Clostridium perfringens</i> is an anaerobic, Gram-positive, sporeforming rod. |
| RESERVOIRS OF INFECTION : | It is widely distributed in the environment and frequently occurs in the intestines of humans and many domestic and feral animals. Spores of the organism persist in soil, sediments, and areas subject to human or animal faecal pollution. |
| TEMPERATURE RANGE : | 12° - 50°C (optimum 43° - 47°). |
| pH RANGE : | 5.5 - 9 (optimum 7.2). |
| a_w | 0.95. |
| SURVIVAL (freezing/drying) : | Sensitive to freezing, can survive in dehydrated foods. |
| IONISING RADIATION : | 1.2 - 3.4 kGy. |
| THERMAL RESISTANCE : | Wide variation depending on the heating medium but 6-.13 minutes at 100°C destroys vegetative cells and spores. |
| INFECTIVE DOSE : | Greater than 10 ⁶ vegetative cells. Toxin production in the digestive tract is associated with sporulation. |
| MAIN SYMPTOMS (in humans) : | The common form of perfringens poisoning is characterised by intense abdominal cramps and diarrhoea. The illness is usually over within 24 hours but less severe symptoms may persist in some individuals for 1 or 2 weeks. A few deaths have been reported as a result of dehydration and other complications. |
| MODE OF TRANSMISSION : | Eating foods highly contaminated with <i>C.perfringens</i> . |
| INCUBATION PERIOD : | 8 - 22 hours. |
| TREATMENT : | Self - limiting. |
| RAW FOOD MATERIALS : | Raw meat, poultry, dish, vegetables. |
| PROCESSED FOODS : | In most instances, the actual of poisoning by <i>C. perfringens</i> is temperature abuse of prepared foods. Often, small numbers of the organisms survive cooking and multiply to food poisoning levels during cooling and storage. Meats, meat products, and gravy are the foods most frequently implicated. |

Pathogenic *Escherichia coli*

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| ORGANISM : | <p><i>Escherichia coli</i> is part of the normal gut microflora. Most strains are harmless but some are pathogenic and cause distinct diarrhoeal diseases. There are four categories:</p> <p>Enteropathogenic <i>E. coli</i> (EPEC). Enteroinvasive <i>E. coli</i> (EIEC). Enterotoxigenic <i>E. coli</i> (ETEC). Enterohaemorrhagic <i>E. coli</i> (EHEC) (see <i>E.coli</i> O157;H7).</p> |
| DESCRIPTION OF ORGANISM : | Gram negative; straight, round ended rods. Occur singly or in pairs. Mostly motile. Anaerobic/aerobic. |
| RESERVOIRS OF INFECTION : | Intestinal tract of man and animals. Infected food handlers with poor personal hygiene or water contaminated by human sewage are likely sources of food contamination. |
| TEMPERATURE RANGE : | Minimum: 10°C. Optimum: 37°C. Maximum: 48°C. |
| pH RANGE : | 4.4 - 8.5. |
| a_w : | 0.93. |
| SURVIVAL (freezing / drying) : | Survives well in frozen state. Can survive drying. |
| IONISING RADIATION : | 0.24 - 0.3 kGy. |
| THERMAL RESISTANCE : | D -value of 0.0008 - 0.0017 min. at 77°C. z=5°C. |
| INFECTIVE DOSE : | Probably very low for EHEC. For other pathogenic strains of <i>E. coli</i> , the minimal infective dose for adults is probably 10 ⁶ per gram. |
| MAIN SYMPTOMS (in humans) : | <p>EPEC: Infant diarrhoea - typical of young children. Rarely foodborne.</p> <p>EIEC: Dysentery - like syndrome.</p> <p>ETEC: Travellers' diarrhoea - a cholera-like heat labile or stable toxin.</p> <p>EHEC: Bloody-diarrhoea syndrome, HUS in 0.5 % of infected children.</p> |
| MODE OF TRANSMISSION : | Bowel to mouth, via contaminated food or water. |
| INCUBATION PERIOD | <p>EPEC: 17-72h.</p> <p>EIEC: 8-24h.</p> <p>ETEC: 8-44h.</p> <p>EHEC: 3-9 days.</p> |
| TREATMENT | The diseases are usually self-limiting. Electrolyte replacement therapy may be necessary. |
| RAW FOOD MATERIALS : | Raw meat and fish, vegetables, raw milk, polluted water. |
| PROCESSED FOODS | Proper cooking readily destroys <i>E. coli</i> . Improper handling can recontaminate any food. |

***Escherichia coli* 0157:H7**

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| DESCRIPTION OF ORGANISM : | Gram negative; straight, round ended rods. Occur singly or in pairs. Mostly motile. Anaerobic/aerobic. It belongs to the EHEC, VTEC or STEC type of <i>E.coli</i> . |
| RESERVOIRS OF INFECTION : | Intestinal tract of man and animals. |
| TEMPERATURE RANGE : | 8° - 44°C (Optimum 37°C). |
| pH RANGE : | 4 - 9. |
| a_w : | 0.95. |
| SURVIVAL (freezing/drying) : | The organism survives well in ground beef in frozen storage, and is more acid tolerant than many other strains of <i>E.coli</i> . |
| IONISING RADIATION : | 0.24 -0.3 kGy. |
| THERMAL RESISTANCE : | The organism is heat-sensitive (D-value at 63°C of 0.5 min.) and is destroyed by the recommended heating regime for infectious pathogens of 70°C for 2 min. Pasteurisation of milk (72°C/16.2s) will kill more than 10 ⁴ <i>E. coli</i> 0157 per ml. |
| INFECTIVE DOSE : | The infective dose is not known but is thought to be low. |
| MAIN SYMPTOMS (in humans) : | Acute bloody diarrhoea that develops into haemolytic uraemic syndrome (HUS) in 2-7% of cases. Symptoms of HUS include acute renal failure and haemolytic anaemia. There is some evidence that secondary infections such as appendicitis occasionally develop. Verotoxigenic <i>E. coli</i> is the leading cause of acute renal failure in children, which can be fatal. However, illness caused by the organism can also take the form of mild diarrhoea. |
| MODE OF TRANSMISSION : | Via contaminated food and water; person to person transmission has also been implicated in some outbreaks. |
| INCUBATION PERIOD : | 3-9 days. |
| TREATMENT : | The illness is self-limiting and antimicrobial therapy is not thought to have any effect on the progression of the illness. |
| RAW FOOD MATERIALS : | Undercooked beef, raw milk, sprouts. |
| PROCESSED FOODS : | Proper cooking readily destroys <i>E. coli</i> . |

Listeria monocytogenes

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| DESCRIPTION OF ORGANISM : | Gram positive, motile by means of flagella. Anaerobic/aerobic. |
| RESERVOIRS OF INFECTION : | Some studies suggest that 1-10% of humans may be intestinal carriers of <i>L. monocytogenes</i> . It has been found in at least 37 mammalian species, both domestic and feral, as well as at least 17 species of birds and possibly some species of fish and shellfish. It can be isolated from soil, silage, and other environmental sources. |
| TEMPERATURE RANGE : | c. 0° - 45°C (optimum 37). |
| pH RANGE : | 4.6 - 9.2 (optimum 7). |
| a_w : | 0.92. |
| SURVIVAL (freezing/drying) : | <i>L. monocytogenes</i> is quite hardy and resists the deleterious effects of freezing and drying. |
| IONISING RADIATION : | 0.2 - 1 kGy. |
| THERMAL RESISTANCE : | Normally killed by pasteurisation treatment (71°C for 15 seconds). |
| INFECTIVE DOSE : | Most persons can tolerate 1,000 organisms without ill effect. Higher intakes may cause illness in susceptible persons such as the very young, the very old, diseased persons and persons with a compromised immune system. |
| MAIN SYMPTOMS (in humans) : | The manifestations of listeriosis include septicaemia, meningitis (or meningoencephalitis), encephalitis, and intrauterine or cervical infections in pregnant women, which may result in spontaneous abortion (2nd/3rd trimester) or stillbirth. The onset of the aforementioned disorders is usually preceded by influenza-like symptoms including persistent fever. It was reported that gastrointestinal symptoms such as nausea, vomiting, and diarrhoea may precede more serious forms of listeriosis or may be the only symptoms expressed. |
| MODE OF TRANSMISSION : | Eating contaminated food. |
| INCUBATION PERIOD : | The onset time to serious forms of listeriosis is unknown but may range from a few days to three weeks. The onset time to gastrointestinal symptoms is unknown but is probably greater than 12 hours. |
| TREATMENT : | Antibiotics. When infection occurs during pregnancy, antibiotics given promptly to the pregnant woman can often prevent infection of the foetus or new-born. |
| RAW FOOD MATERIALS : | Raw milk, raw vegetables fermented raw-meat sausages, raw meats, and raw and smoked fish. |
| PROCESSED FOODS : | <i>L. monocytogenes</i> has been associated with such foods as cheeses (particularly soft-ripened varieties), paté and meat products. Its ability to grow at temperatures as low as 3°C permits it to multiply in refrigerated foods. |

Mycotoxins

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| DESCRIPTION OF ORGANISM : | The primary mycotoxin is aflatoxin produced by <i>Aspergillus flavus</i> . This fungus can grow on the ears of corn and cottonseed and as a saprophyte on peanuts, nuts, spices and other agricultural products. Other mycotoxins can be produced by <i>Fusarium</i> species (several toxins) <i>Penicillium verrucosum</i> and <i>A. ochraceus</i> (nephrotic ochratoxin A in feed and slaughter pigs and chickens). |
| TEMPERATURE RANGE | 10° - 40°C (optimum 33°C). |
| pH RANGE | 2 -11 (5.-.8 optimal). |
| a_w | 0.80 - 0.99. |
| SURVIVAL (freezing/drying) | Mycotoxins need a warm, damp environment to grow. |
| IONISING RADIATION | Irradiation will not usually degrade the toxin. |
| THERMAL RESISTANCE : | Many mycotoxins are not very heat sensitive and often are only partly broken down by or sterilisation. |
| INFECTIVE DOSE | Not known. Concern is with their carcinogenic effects. |
| MAIN SYMPTOMS (in humans) : | Mycotoxins have a range of toxic effects and can cause damage to kidneys, liver, skin as well as carcinogenic and haemorrhagic effects. Only aflatoxin and ergot alkaloids are reported as a cause of illness. Aflatoxin has been reported as a cause of acute hepatitis in many African and Asian countries. Aflatoxins have also been associated with cancer of the liver in Africa and Southeast Asia. Incidences of ergotism have occurred in Ethiopia and India. |
| MODE OF TRANSMISSION : | Mycotoxin-induced illness is mainly caused by alimentary exposure to contaminated foodstuffs; other routes may include airborne exposure to mycotoxin-containing spores and mycelial fragments. |
| INCUBATION | Not known. |
| TREATMENT | Not known. |
| RAW FOOD MATERIALS : | Agricultural products, e.g. cereals, rice, peanuts. Milk and poultry can also be contaminated if feed contains mycotoxins. Reports from Indonesia indicate that more than 80% of local corn-based poultry feeds are contaminated with aflatoxins. Fungal growth and mycotoxin contamination are common because the main harvest months of January and February occur during the rainy season and only sun drying is used to reduce moisture content prior to wholesale packing. |

Salmonellae

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| DESCRIPTION OF ORGANISM : | Salmonella is a rod-shaped, motile bacterium (nonmotile exceptions S. gallinarum and S. pullorum), nonsporeforming and Gram-negative. Anaerobic/aerobic. |
| RESERVOIRS OF INFECTION : | Contaminated poultry, eggs and meat provide a source of infection for Salmonella , which are nurtured through intensive farming and improper food handling. In addition, inedible parts of animals are often processed for livestock feeds, resulting in the presence of viable salmonellae in feeds. |
| TEMPERATURE RANGE : | Minimum 5°C - 7°C. Optimum 35°C - 37°C. Maximum 47°C. |
| pH RANGE : | 4.5 - 9.0, optimum 6.5 - 7.5. |
| a_w : | 0.92. |
| SURVIVAL (freezing/drying) : | Salmonella may survive for extended periods in dried foods, depending on the relative humidity and storage atmosphere. In low moisture foods, the bacterium may remain alive for years. Although freezing reduces levels of the pathogen, Salmonella remains viable for a long time in frozen meat and poultry. |
| IONISING RADIATION : | 0.1 - 4.8 kGy (depends on strain and food). |
| THERMAL RESISTANCE : | D-value of S. enteritidis at 55°C is approximately 8.2 min. and that of S. typhimurium 3.3 min. Specific strains of S. senftenberg are more heat resistant with a D-value of approximately 31 min. at 57°C or 1 - 2 seconds at 71.7°C. The minimum thermal process to achieve a 6 log reduction in numbers is 70°C / 2 min., moist heat. |
| INFECTIVE DOSE : | Depends on serotype, the characteristics of the consumer and the food. For healthy adults, a dose of 10 ³ bacteria per g in the food is usually required, but for susceptible individuals, the dose may be less than 10 cells. Fatty foods such as hamburgers, cheese and chocolate protect the organisms from gastric juices, thus lowering the infective dose. |
| MAIN SYMPTOMS (in humans) : | Diarrhoea, abdominal cramps, vomiting and fever. Long term non-gastrointestinal complications such as arthritis may arise. Susceptible victims may die (0.1 - 1 %). |
| MODE OF TRANSMISSION : | Via contaminated food, particularly poultry, meat, milk, eggs and egg products, but also raw vegetables. Person-to-person transmission can occur in areas where hygiene is poor. |
| INCUBATION PERIOD : | Usually 12 - 36 h but can be as long as 6 - 7 days. Fever may last up to 7 days. |
| TREATMENT : | Self-limiting. Rehydration may be necessary. |
| RAW FOOD MATERIALS : | Poultry and eggs, raw milk, vegetables, shellfish, spices and herbs. Raw meat. |
| PROCESSED FOODS : | Sauces and salad dressing, cake mixes, cream-filled desserts and toppings, dried gelatine, peanut butter, cocoa, chocolate. |

Shigella

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| DESCRIPTION OF ORGANISM : | Shigellae are Gram-negative, nonmotile, nonsporeforming rod-shaped bacteria. Anaerobic/aerobic. |
| RESERVOIRS OF INFECTION : | Humans and the higher primates. |
| TEMPERATURE RANGE : | 6° - 47°C. |
| pH RANGE : | 4.8 - 9.4. |
| a_w : | 0.96. |
| SURVIVAL (freezing/drying) : | Can survive in foods at -20°C, and can survive drying for several weeks. |
| IONISING RADIATION : | 0.2 - 0.4 kGy |
| THERMAL RESISTANCE : | D-value of 10 seconds at 80°C. |
| INFECTIVE DOSE : | As few as 10 cells depending on age and condition of host. |
| MAIN SYMPTOMS (in humans) : | Infections are associated with mucosal ulceration, rectal bleeding and dehydration; fatality may be as high as 10-15% with some strains. Reiter's disease, reactive arthritis, and haemolytic uremic syndrome are possible sequelae that have been reported in the aftermath of shigellosis. |
| MODE OF TRANSMISSION : | Person-to-person via the faecal-oral route, contaminated water and lettuce. |
| INCUBATION PERIOD : | 12 to 50 hours. |
| TREATMENT : | Shigellosis can usually be treated with antibiotics. Unfortunately, some <i>Shigella</i> bacteria have become resistant to antibiotics and using antibiotics can make the germs more resistant in the future. Persons with mild infections will usually recover quickly without antibiotic treatment. |
| RAW FOOD MATERIALS : | Salads (potato, tuna, shrimp, macaroni, and chicken), raw vegetables, milk and dairy products, and poultry. |
| PROCESSED FOODS : | Many processed foods that have not been (re)heated properly have been implicated. |

Staphylococcus aureus

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| DESCRIPTION OF ORGANISM : | Occur as grape-like clusters of cocci. Non-motile, non-spore forming. May produce very heat resistance enterotoxins. (A, B, C, D, E) above 10°C. Anaerobic/aerobic. |
| RESERVOIRS OF INFECTION : | Man: nose, hand, skin infections. Poultry: skin. Raw meat. |
| TEMPERATURE RANGE : | Minimum: 6.5°C. Optimum: 37 - 40°C. Maximum: 48°C. |
| pH RANGE : | 4.0 - 9.8. |
| a_w | 0.83. |
| SALT TOLERANCE : | Survives at up to 15% NaCl. |
| SURVIVAL (freezing / drying) : | Survives very well, especially in the dried state. |
| IONISING RADIATION : | 1 - 10 kGy. |
| THERMAL RESISTANCE : | D-value at 77°C of 0.001 - 0.0105 min. z = 8 - 12°C. |
| INFECTIVE DOSE : | Minimum levels for toxin production is 10 ⁶ cells per g food. |
| MAIN SYMPTOMS (in humans) : | The onset of symptoms is usually rapid and in many cases acute, depending on individual susceptibility, the amount of contaminated food eaten, the amount of toxin in the food ingested, and the general health of the victim. Common symptoms are nausea, vomiting, abdominal cramping, and prostration. In more severe cases, headache, muscle cramping, and transient changes in blood pressure and pulse rate may occur. Recovery generally takes two days. However, it is not unusual for complete recovery to longer in severe cases. |
| MODE OF TRANSMISSION : | Growth of organisms and subsequent toxin production in food. |
| INCUBATION PERIOD : | 1 - 6 h. |
| TREATMENT: | Self-limiting. |
| RAW FOOD MATERIALS : | Raw poultry , sometimes dairy products and meat. |
| PROCESSED FOODS | Cream -filled bakery products; sandwich fillings, and milk and dairy products and extensively "handled" food. |

Vibrio cholerae

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| DESCRIPTION OF ORGANISM : | These are Gram-negative, non-sporing, non-acid fast rods that may be straight or curved. Anaerobic/aerobic. |
| RESERVOIRS OF INFECTION : | The <i>V.cholera</i> is often found as part of the normal flora of brackish waters and estuaries. The numbers of organisms here are normally very low, but build up when sewage from infected persons pollutes the water. Fish and shellfish caught in polluted waters have a high probability of causing cholera if they are eaten either raw or without adequate cooking. The epidemic in Peru appears to have been spread by the staple diet or ceviche (raw fish “marinated” in lemon juice). |
| TEMPERATURE RANGE : | 15° - 42°C. |
| pH RANGE : | 6 - 10. |
| a_w | 0.97. |
| SURVIVAL (freezing/drying) : | The vibrio is sensitive to drying, so dried foods are unlikely to cause disease. Freezing below -20°C will reduce, but may not completely eliminate cholera organisms from food. |
| IONISING RADIATION : | 10 kGy . |
| THERMAL RESISTANCE : | The <i>V.cholera</i> is sensitive to heat so the heating regime of 70°C for 2 minutes (which is recommended to destroy all other infectious pathogens) will also destroy the <i>V.cholera</i> . |
| INFECTIVE DOSE : | It is believed that millions of vibrios (e.g. 10 ⁶ - 10 ⁸) are needed to infect a person who has normal gastric acidity, but only about 1000 cells if gastric acidity is low. |
| MAIN SYMPTOMS (in humans) : | Profuse, watery diarrhoea with vomiting and muscle cramps lasting for a few days; dehydration and salt imbalance may follow. Onset is usually rapid and patients may dehydrate within hours if not treated. Mild diarrhoea is also common and symptoms resemble those of traveller’s diarrhoea. |
| MODE OF TRANSMISSION : | Via contaminated food or water; person to person spread occurs only where personal hygiene and sanitation are poor. |
| INCUBATION PERIOD : | 1-5 days. |
| TREATMENT : | With proper oral and/or intravenous rehydration therapy, treatment is simple and effective; case fatality rates are <1%. Antibiotics are not usually needed. |
| RAW FOOD MATERIALS : | Raw fish and shellfish harvested from polluted waters. Vegetables and fruit irrigated or washed with polluted water or iced with polluted ice. |
| PROCESSED FOODS : | The only manufactured product known to have been the source of infection was mineral water unhygienically bottled in Portugal in 1974. However fresh foods prepared by caterers and served in restaurants or on aircraft have caused serious incidents. |

Yersinia enterocolitica

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| DESCRIPTION OF ORGANISM : | Small rod-shaped, Gram-negative bacterium. Anaerobic/aerobic. |
| RESERVOIRS OF INFECTION : | Strains of <i>Y. enterocolitica</i> can be found in meats (pork, beef, lamb, etc.), oysters, fish, and raw milk. Pigs seem to be the main reservoir. |
| TEMPERATURE RANGE : | 0° - 44°C. |
| pH RANGE : | 4.6 - 9.0. |
| a_w : | 0.945. |
| SURVIVAL (freezing/drying) : | Resistant to freezing (can survive several months in frozen meat). |
| IONISING RADIATION : | 38 kGy. |
| THERMAL RESISTANCE : | D-value 1 minute at 60°C. |
| INFECTIVE DOSE : | Unknown. |
| MAIN SYMPTOMS (in humans) : | Yersiniosis is frequently characterised by symptoms such as gastro-enteritis with diarrhoea and/or vomiting; however, fever and abdominal pain are the hallmark symptoms. <i>Yersinia</i> infections mimic appendicitis and mesenteric lymphadenitis, but the bacteria may also cause infections of other sites such as wounds, joints and the urinary tract. |
| MODE OF TRANSMISSION : | Human-to-human, animal-to-human, or via environmental sources such as food and water. |
| INCUBATION PERIOD : | 24 - 48 hours. |
| TREATMENT : | Infection usually passes quickly without antibiotic treatment. |
| RAW FOOD MATERIALS : | Raw pork. |
| PROCESSED FOODS : | Dairy products, sausages. |