

## Types of bacterial food poisoning\*

Mechanism	Location	Illness	Stool M/E	Examples
Non-inflammatory (enterotoxin)	Proximal small intestine	Watery diarrhoea	No faecal leukocytes	<i>Vibrio cholerae</i> , <i>ETEC</i> , <i>EAggEC</i> , <i>Cl. perfringens</i> , <i>Bacillus cereus</i> , <i>Staph aureus</i> , <i>rotavirus</i> , <i>norovirus</i> , <i>enteric adenoviruses</i> , <i>Giardia lamblia</i> , <i>Cryptosporidium</i> , <i>Cyclospora</i> , <i>Microsporidia</i>
Inflammatory (invasion / cytotoxin)	Colon / distal small intestine	Dysentery / inflammatory diarrhoea	PMN faecal leukocytes	<i>Shigella</i> , <i>Salmonella</i> , <i>C. jejuni</i> , <i>EHEC</i> , <i>EIEC</i> , <i>Y. enterocolitica</i> , <i>Vibrio parahaemolyticus</i> , <i>Cl. difficile</i> , <i>E. histolytica</i>
Penetrating	Distal small intestine	Enteric fever	Mono-nuclear faecal leukocytes	<i>Salmonella typhi</i> , <i>Y. enterocolitica</i> , <i>Campylobacter fetus</i>

## Bacterial food poisoning\*

Incubation Period	Cause	Symptoms	Common foods
1-6 hours	<i>Staph aureus</i>	Nausea, Vomiting, Diarrhoea	Ham, poultry, potato / egg salad, mayonnaise, cream pastries
	<i>Bacillus cereus</i>	Nausea, Vomiting, Diarrhoea	Fried rice
8-16 hours	<i>Cl. perfringens</i>	Abdominal cramps, diarrhoea (vomiting rare)	Beef, poultry, legumes, gravies
	<i>B. cereus</i>		Meats, vegetables, dried beans, cereals
>16 hours	<i>Vibrio cholerae</i>	Watery diarrhoea	Shell-fish
	ETEC	Watery diarrhoea	Salad, cheese, meats, water
	EHEC	Bloody diarrhoea	Beef, salami, raw milk / vegetables, apple juice
	<i>Salmonella sp</i>	Inflammatory diarrhoea	Beef, poultry, eggs, dairy products
	<i>Campylobacter jejuni</i>	Inflammatory diarrhoea	Poultry, raw milk
	<i>Shigella sp</i>	Dysentery	Potato / egg salad, lettuce, raw eggs
	<i>V. parahaemolyticus</i>	Dysentery	Sea food - Molluscs, crustaceans

## Some important food-borne pathogens\*

<b>Bacteria</b>			
<i>Aeromonas hydrophila</i>	Enterotoxigenic <i>E. coli</i> (ETEC)	<i>Salmonella</i> (non Typhi) sps	<i>Bacillus cereus</i>
<i>Brucella</i> spp	Enteropathogenic <i>E. coli</i> (EPEC)	<i>Shigella</i> spp	<i>Staphylococcus aureus</i>
<i>Campylobacter</i> spp	Enterohaemorrhagic <i>E. coli</i> (EHEC)	<i>Vibrio cholerae</i> O1 and O139	<i>Clostridium botulinum</i>
<i>Salmonella typhi</i>			<i>S. paratyphi</i>
<i>Clostridium perfringens</i>	Enteroinvasive <i>E. coli</i> (EIEC)	<i>Vibrio parahaemolyticus</i>	<i>Yersinia enterocolitica</i>
<i>Escherichia coli</i> spp	<i>Listeria monocytogenes</i>	<i>Vibrio vulnificus</i>	
<b>Viruses</b>			
Hepatitis A virus	Norovirus	Rotavirus	Hepatitis E virus
Poliovirus			
<b>Protozoa</b>			
<i>Cryptosporidium</i> spp	<i>Entamoeba histolytica</i>	<i>Toxoplasma gondii</i>	<i>Cyclospora cayetanensis</i>
<i>Giardia lamblia</i>			
<b>Trematodes</b>			
<i>Clonorchis sinensis</i>	<i>Fasciolopsis buski</i>	<i>Opisthorchis viverrin</i>	<i>Fasciola hepatica</i>
<i>Opisthorchis felinus</i>	<i>Paragonimus westermani</i>		
<b>Cestodes</b>			
<i>Diphyllobothrium</i> spp	<i>Echinococcus</i> spp	<i>Hymenolepis nana</i>	<i>Taenia solium / saginata</i>
<b>Nematodes</b>			
<i>Anisakis</i> spp	<i>Ascaris lumbricoides</i>	<i>Trichinella spiralis</i>	<i>Trichuris trichiura</i>

\* WHO, 2016. Burden of foodborne diseases in the South-East Asia Region.

## Some important food-borne toxins and chemicals\*

<b>Toxins</b>			
Marine biotoxins	Tetrodotoxin (pufferfish)	Pyrrolizidine alka	Ciguatera poisoning
Mushroom toxins	Phytohaemagglutinin (red kidney bean poisoning)	Shellfish toxins (paralytic, neurotoxic, diarrhoeal, amnesic)	Mycotoxins (e.g. aflatoxins)
Grayanotoxin (honey)	Scombroid poisoning/histamine		Plant toxicants
<b>Chemicals</b>			
Toxic metals (cadmium, copper, lead, mercury, tin)	Pesticides (organophosphates, Radionuclides)	Nitrites (food preservatives)	Polychlorinated biphenyls
	Fluoride	Sodium hydroxide	Monosodium glutamate
			Zinc

## Major Food-borne Hazards: Clinical Features & Samples\*

(WHO. Foodborne disease outbreaks: guidelines for investigation and control. Geneva; 2008)

Time to onset of symptoms	Predominant symptoms	Associated organism or toxin	Samples from cases (and food-handlers)
<b>Upper gastrointestinal tract symptoms (nausea, vomiting) occur first or predominate</b>			
<1 hour	Nausea, vomiting, unusual taste, burning of mouth.	Metallic salts	Vomit, urine, blood, stool
1–2 hours	Nausea, vomiting, cyanosis, headache, dizziness, dyspnoea, trembling, weakness, loss of consciousness	Nitrites	Blood
1–6 (mean 2–4) hours	Nausea, vomiting, retching, diarrhoea, abdominal pain, prostration	<i>Staphylococcus aureus</i> and its enterotoxins	Stool, vomit (swabs from nostril, skin lesions)
8–16 hours (2–4 hours if emesis predominant)	Vomiting, abdominal cramps, diarrhoea, nausea	<i>Bacillus cereus</i>	Rectal swab, stool
6–24 hours	Nausea, vomiting, diarrhoea, thirst, dilation of pupils, collapse, coma	Mycotoxins ( <i>Amanita</i> sp. Fungi)	Urine, blood (SGOT, SGPT), vomit
12–48 (median 36 hours)	Nausea, vomiting, watery non-bloody diarrhoea, dehydration	Norovirus	Stool
<b>Lower gastrointestinal tract symptoms (abdominal cramps, diarrhoea) occur first or predominate</b>			
2–36 (mean 6–12) hours	Abdominal cramps, diarrhoea (putrefactive diarrhoea - <i>Clostridium perfringens</i> ), sometimes nausea and vomiting	<i>Clostridium perfringens</i> , <i>Bacillus cereus</i>	Rectal swabs, stool
6–96 hours (usually 1–3 days)	Fever, abdominal cramps, diarrhoea, vomiting, headache	<i>Salmonella</i> spp, <i>Shigella</i> , <i>Aeromonas</i> , <i>Enteropathogenic E. coli</i>	Rectal swabs, stool
6 hours to 5 days	Abdominal cramps, diarrhoea, vomiting, fever, malaise, nausea, headache, dehydration (sometimes bloody or mucoid diarrhoea, cutaneous lesions associated with <i>Vibrio vulnificus</i> )	<i>Vibrio cholerae</i> (O1 and non-O1), <i>V. vulnificus</i> , <i>V. fluvialis</i> , <i>V. parahaemolyticus</i>	Stool
1–10 (median 3–4) days	Diarrhoea (often bloody), abdominal pain, nausea, vomiting, malaise, fever (uncommon with <i>E. coli</i> O157)	<i>Enterohaemorrhagic E. coli</i> (including <i>E. coli</i> O157), <i>Campylobacter</i>	Stool, rectal swabs
3–5 days	Fever, vomiting, watery non-inflammatory diarrhoea	<i>Rotavirus</i> , <i>astrovirus</i> , <i>enteric adenoviruses</i>	Stool, vomit
3–7 days	Fever, diarrhoea, abdominal pain (can mimic acute appendicitis)	<i>Yersinia enterocolitica</i>	Stool
1–6 weeks	Mucoid diarrhoea (fatty stools) abdominal pain, flatulence, weight loss	<i>Giardia lamblia</i>	Stool
1 to several weeks	Abdominal pain, diarrhoea, constipation, headache, drowsiness, ulcers, variable – often asymptomatic	<i>Entamoeba histolytica</i>	Stool
3–6 months	Nervousness, insomnia, hunger pains, anorexia, weight loss, abdominal pain, sometimes gastroenteritis	<i>Taenia saginata</i> , <i>T. solium</i>	Stool, rectal swab

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Time to onset of symptoms	Predominant symptoms	Associated organism or toxin	Samples from cases (and food-handlers)
<b>Neurological symptoms (visual disturbances, vertigo, tingling, paralysis)</b>			
Less than 1 hour	Neurological and/or gastrointestinal symptoms	Shellfish toxin	Gastric washing
	Gastroenteritis, nervousness, blurred vision, chest pain, cyanosis, twitching, convulsions	Organic phosphate	Blood, urine, fat biopsy
	Excessive salivation, perspiration, gastroenteritis, irregular pulse, pupils constricted, asthmatic breathing	Muscaria-type mushrooms	Vomit
1-6 hours	Tingling, numbness, gastroenteritis (GE), temperature reversal, dizziness, dry mouth, muscular aches, dilated pupils, blurred vision, paralysis	Ciguatera toxin	
	Nausea, vomiting, tingling, dizziness, weakness, anorexia, weight loss, confusion	Chlorinated hydrocarbons (insecticides, pesticides)	Blood, urine, stool, gastric washing
2 hours to 6 days, usually 12-36 hours	Vertigo, double / blurred vision, loss of light reflex, difficulty in swallowing, speaking & breathing, dry mouth, weakness - descending, bilateral flaccid paralysis (respiratory paralysis), with preserved sensorium	<i>Clostridium botulinum</i> and its neurotoxins	Blood, stool, gastric washing
> 72 hours	Numbness, weakness of legs, spastic paralysis, impairment of vision, blindness, coma	Organic mercury	Urine, blood, hair
<b>Allergic symptoms (facial flushing, itching)</b>			
Less than 1 hour	Headache, dizziness, nausea, vomiting, peppery taste in mouth, burning of throat, facial swelling / flushing, stomach pain, itching	Histamine (scombroid)	Vomit
	Peri-oral numbness, tingling sensation, flushing, dizziness, headache, nausea	Monosodium glutamate	
	Flushing, itching, abdominal pain, puffing of face and knees	Nicotinic acid (additive / preservative)	
<b>Generalized infection symptoms (fever, chills, malaise, prostration, aches, swollen lymph nodes)</b>			
4-28 (mean 9) days	Gastroenteritis, fever, oedema around eyes, perspiration, muscular pain, chills, prostration, laboured breathing	<i>Trichinella spiralis</i>	Serum, muscle tissue (biopsy)
7-28 (mean 14) days	Malaise, headache, fever, cough, nausea, vomiting, constipation, abdominal pain, chills, rose spots, bloody stools	<i>Salmonella typhi</i>	Rectal swab, stool
Varying periods (depends on specific illness)	Fever, chills, headache, arthralgia, prostration, malaise, swollen lymph nodes, etc	<i>C. jejuni</i> , <i>B. anthracis</i> , <i>Brucella</i> sp., <i>C. burnetii</i> , <i>Fr. tularensis</i> , <i>L. monocytogenes</i> , <i>P. multocida</i>	

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