

Foodborne and Waterborne Infections

CLS 212: Medical Microbiology

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Types of Foodborne Illness

Infection

- eating food contaminated with pathogens.

Intoxication

- eating food contaminated with the toxins formed by bacteria.
- eating food contaminated with other biological or chemical toxins (poisons).

Toxin-mediated infection

- Eating food contaminated with pathogens that grow in the body and form toxins.

Allergy

Intoxication

- Toxins are produced by harmful microorganisms, the result of a chemical contamination, or are naturally part of a plant or seafood.
- Viruses and parasites do not cause foodborne intoxication.
- Some bacteria can cause intoxication. The foodborne bacteria that cause intoxication are: *Clostridium botulinum*, *Staphylococcus aureus*, *Clostridium perfringens*, and *Bacillus cereus*.
- Chemicals that can cause an intoxication include: cleaning products, sanitizers, pesticides and metals (lead, copper, brass, zinc, antimony, and cadmium).
- Seafood toxins include toxins from tropical fish, shellfish, lobsters, shrimps, and crabs. Plants and mushrooms can also cause an intoxication.

Toxin-mediated Infection

- A toxin-mediated infection is when a person eats food containing harmful bacteria. While in the intestinal tract, the bacteria produce toxins that cause illness.
- Viruses and parasites do not cause a toxin-mediated infection.
- Some bacteria can cause toxin-mediated infection. The foodborne bacteria that cause toxin-mediated infection are: *Shigella spp.*, Shiga toxin-producing *E.coli* and *Salmonella typhi*.

Foodborne and Waterborne Infections

Foodborne infections

Any disease that can be acquired:

- By eating food contaminated with a pathogen.
- By getting the pathogen into the digestive system through dirty hands or surfaces.

Waterborne infections

Any disease that can be acquired:

- By drinking water contaminated with a pathogen.
- By getting water into your mouth during recreational sports such as: fishing, swimming, or boating,...
- By letting contaminated water come into contact with open areas on the skin.

Common Symptoms

- **The most common symptoms GIT infection are:**
diarrhea, abdominal cramps, vomiting, fever, dehydration, and fatigue.
- In rare instances, symptoms may come on as early as 30 minutes after eating contaminated food but they typically do not develop for several days or weeks.
- Symptoms of viral or parasitic illnesses may not appear for several weeks after exposure. Symptoms usually last only one to two days, but in some cases can persist for between seven and ten days.
- For most healthy people, foodborne illnesses are neither long-lasting nor life-threatening. However, they can cause severe consequences in the very young, the very old, and immunocompromised people.

Sources of Microbial Contamination

- **Soil:** contaminating plants and animals with bacteria and parasites.
- **Irrigation and fertilization:** watering plants with sewage or contaminated water.
- **Farms and slaughter houses:** infected animals and products (milk, eggs,..).
- **Food processing:** equipment, packages, staff.
- **Food storage:** temperature, time,..
- **Food handling:** poor hygiene and inadequate cooking in restaurants and at home.

Transmission of infection

- Ingestion of contaminated food or water.
- Contact with infected animals.
- Fecal-oral person to person contact.



Treatment

When foodborne illness symptoms are severe, the victim should see a doctor or get emergency help. This is especially important for those who are at high risk. For mild cases of foodborne illness, the individual should drink plenty of liquids to replace fluids lost through vomiting and diarrhea.

Major Microbial Factors

Three microorganisms cause most foodborne and waterborne infections:

- Bacteria.
- Viruses.
- Parasites.

Common Foodborne Bacteria

Enteric Bacteria

- *Salmonella typhi*
- *Salmonella non-typhi*
- *Shigella*
- *E. coli* (O157:H7)

- *Campylobacter*
- *Brucella*

Toxin Producing Bacteria

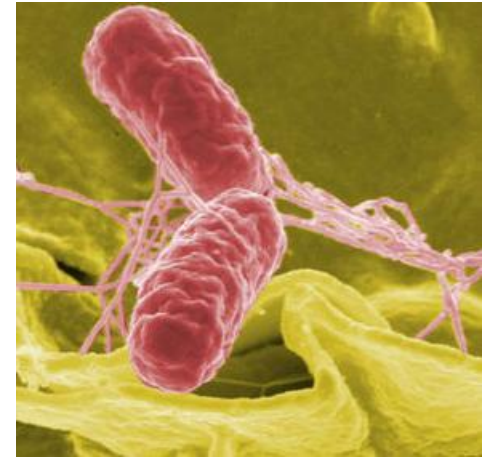
- *Bacillus cereus*
- *Clostridium botulinum*
- *Clostridium perfringens*
- *Staph. aureus*
- *Vibrio*

Less Common

- *Yersinia*
- *Listeria monocytogenes*

Salmonella

- Are Gram negative bacilli.
- The disease is called: **Typhoid (Enteric fever: *S. typhi*)** or **non-typhoidal (Salmonellosis: *S. enteritidis*, *S. typhimurium*)**.
- Reservoir: domestic and wild animals.
- Infection mainly from poultry and eggs (80% cases from eggs).
- Incubation period: 12-36 hours (range 6 hours to 7 days).
- Infectious throughout the course of infection. A temporary carrier state can continue for months, especially in infants.
- Most mild types of salmonella infection clear up in four to seven days without requiring any treatment other than rest and plenty of liquid. In severe cases, treatment with antibiotics may be necessary and a doctor should be consulted.



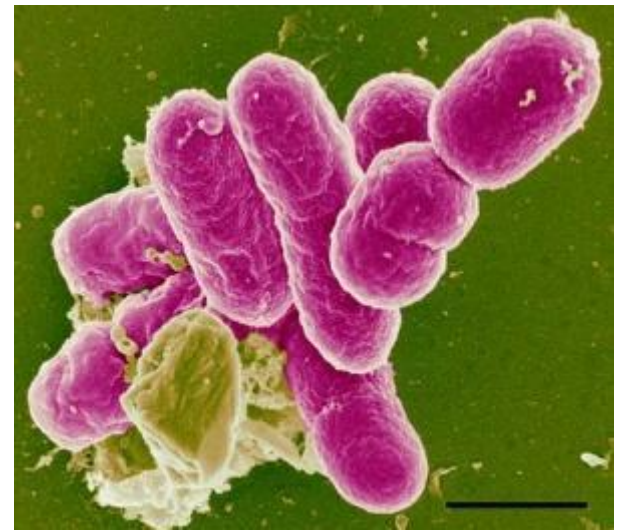
MARY MALLON

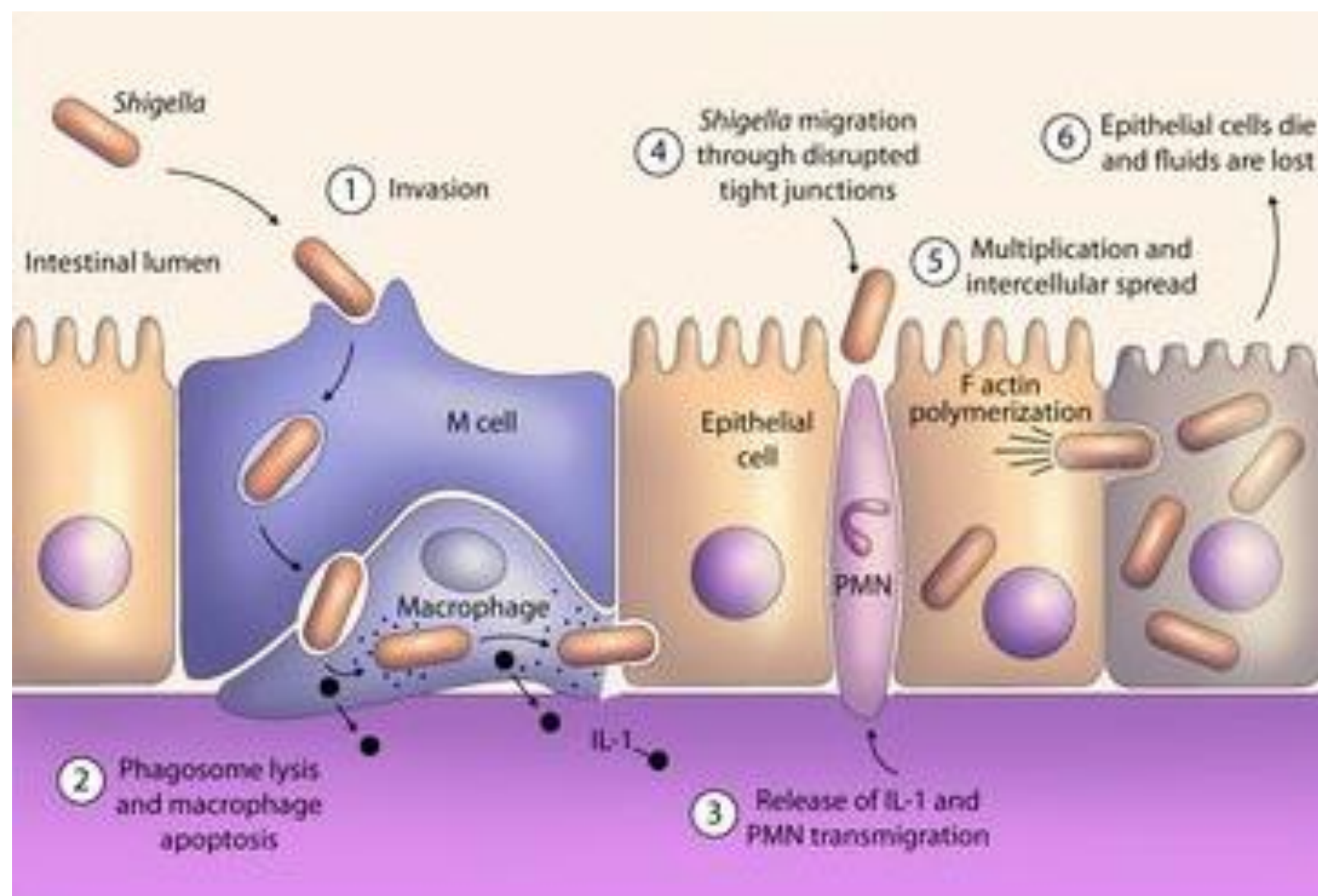
- Mary Mallon caused several typhoid outbreaks, moving from household to household, always disappearing before an epidemic could be traced back to the particular household Mary was working in. All together, she had worked for seven families, with 22 cases of typhoid and one death.
- She was finally overtaken by the authorities in 1907 and committed to an isolation center on North Brother Island, NY. There she stayed until she was released in 1910, on the condition that she never accept employment involving food handling.
- But she was found to work as a cook and to cause typhoid outbreaks again. She was admitted back to North Brother Island, where she lived until her death in 1938.



Shigella

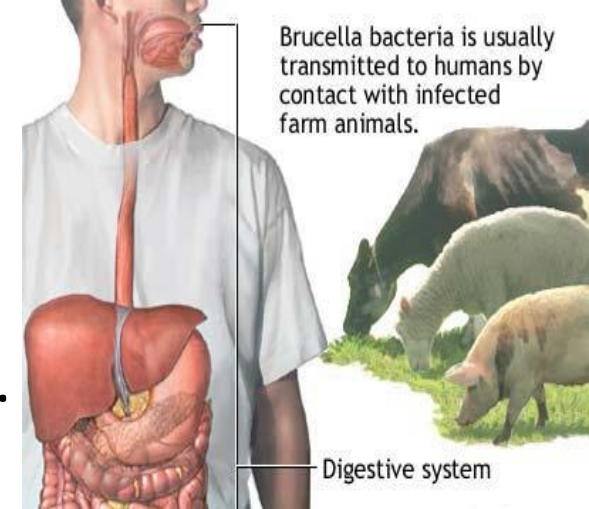
- Gram negative bacilli.
- The disease is called: Bacillary Dysentery or Shigellosis.
- Characterized by bloody diarrhea with pus.
- Some strains produce Shiga toxins.
- The only significant reservoir are human.
- Infection is more common in infants and children.
- Incubation period: 1-3 days (range 12-69 hours).
- Antibiotic treatment is recommended for malnourished children, immunocompromised, food handlers, healthcare workers, and children in daycare centers.





Brucella

- Are Gram negative intracellular coccobacilli.
- The disease is called: Brucellosis (Malta fever).
- Reservoir: sheep, cows, goats...
- Infection mainly from drinking unpasteurized milk. Also farmers, pet doctors and lab workers are at risk.
- Incubation period: 1-3 weeks (range 3 to 60 days).
- Symptoms: Fever is the most common symptom and sign of brucellosis, occurring in 80-100% of cases. Other symptoms include: Bone & Joint pain, GI symptoms, ..
- Epidemiology: Latin America, Middle East, Mediterranean, eastern Europe, Asia, and parts of Africa.
 - Up to 78 cases/100,000 people/year
 - Arabic Peninsula 20%
- Some countries used it in Biological Warfare.





BRUCELLA REV. 1 VACCINE FOR SHEEP AND GOATS

Reg. No. G 0125 (Act 36/1947)
Namibia: NSR 0565



BRUCELLA S19 VACCINE FOR CATTLE

Reg. No. G 0101 (Act 36/1947)
Namibia: NSR 0593

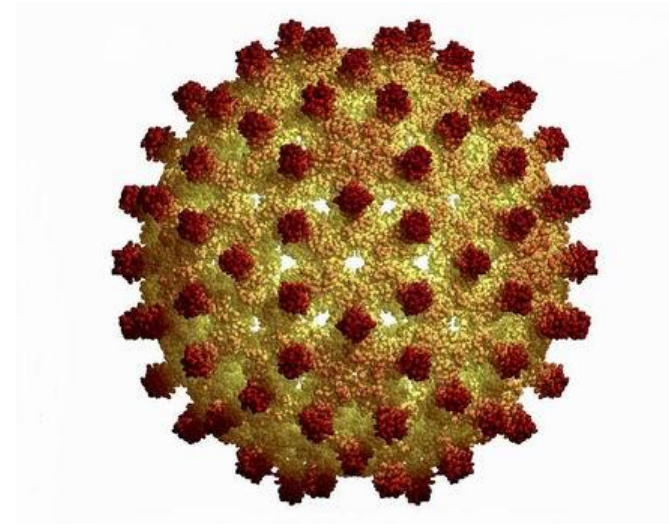


Common Foodborne Viruses

- Hepatitis A.
- Norovirus.
- Rotavirus.

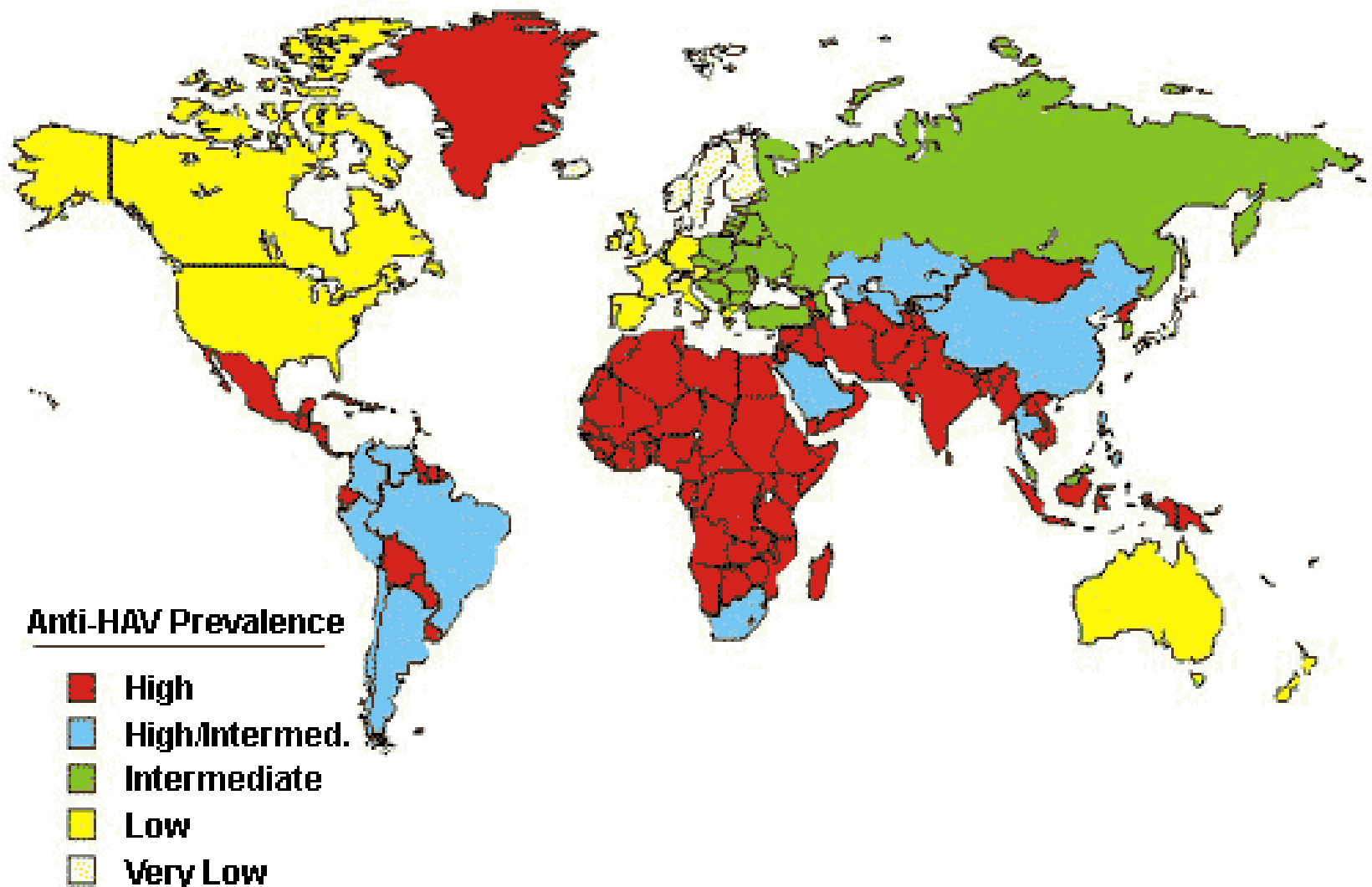


Hepatitis A Virus



- Acute viral infection characterized by dark urine and jaundice.
- Severity of disease varies, asymptomatic infections are possible.
- Reservoir: Humans.
- Incubation period: 30 days (range 15-50 days).
- Highly infectious, requiring only a few virus particles to cause infection.
- Associated with community outbreaks & 40% of cases are sporadic.
- No chronic infection.
- Protective antibodies develop in response to infection -confers lifelong immunity.
- It's a self-limiting disease: 20% require hospitalization while 85% fully recovered within 3 months.

Geographic Distribution of Hepatitis A Infection





Thousands
potentially exposed
to Hepatitis A virus
at
Calgary McDonald's



You can pass the virus on
without showing symptoms for
up to 30 days.
A 2005 food-handler linked
outbreak in Texas resulted in 17
patrons becoming ill.



Diners at the fast-food
outlet from Oct. 1 to Oct.
23 may have been
exposed to virus that can
cause liver disease

Thousands of Calgarians are at
risk of contracting hepatitis A after
a food-handler at a McDonald's
tested positive for the disease. A
sign posted at one door said the
eatery was closed, and would
remain so until the "nuisance has
been removed or corrected."
Dr. Judy MacDonald, the health
region's deputy medical officer of

health was quoted as saying
**"There are potentially
thousands of people that
would have been at that
restaurant over that period of
time."**

A shot to prevent infection is
available to anyone and can be
effective for patrons who ate at
the location less than 14 days
ago. It is expected that thousands
will line-up for the clinic.
Food handlers can also receive
Hepatitis A virus vaccination to
protect themselves from infection.

- Handwashing can
reduce the chance of
passing on Hepatitis A
to patrons.
- Don't work when ill to
reduce the chance of
passing on foodborne
bugs.
- Hepatitis A can be
transferred by dirty
hands to any food.

Common Foodborne Parasites

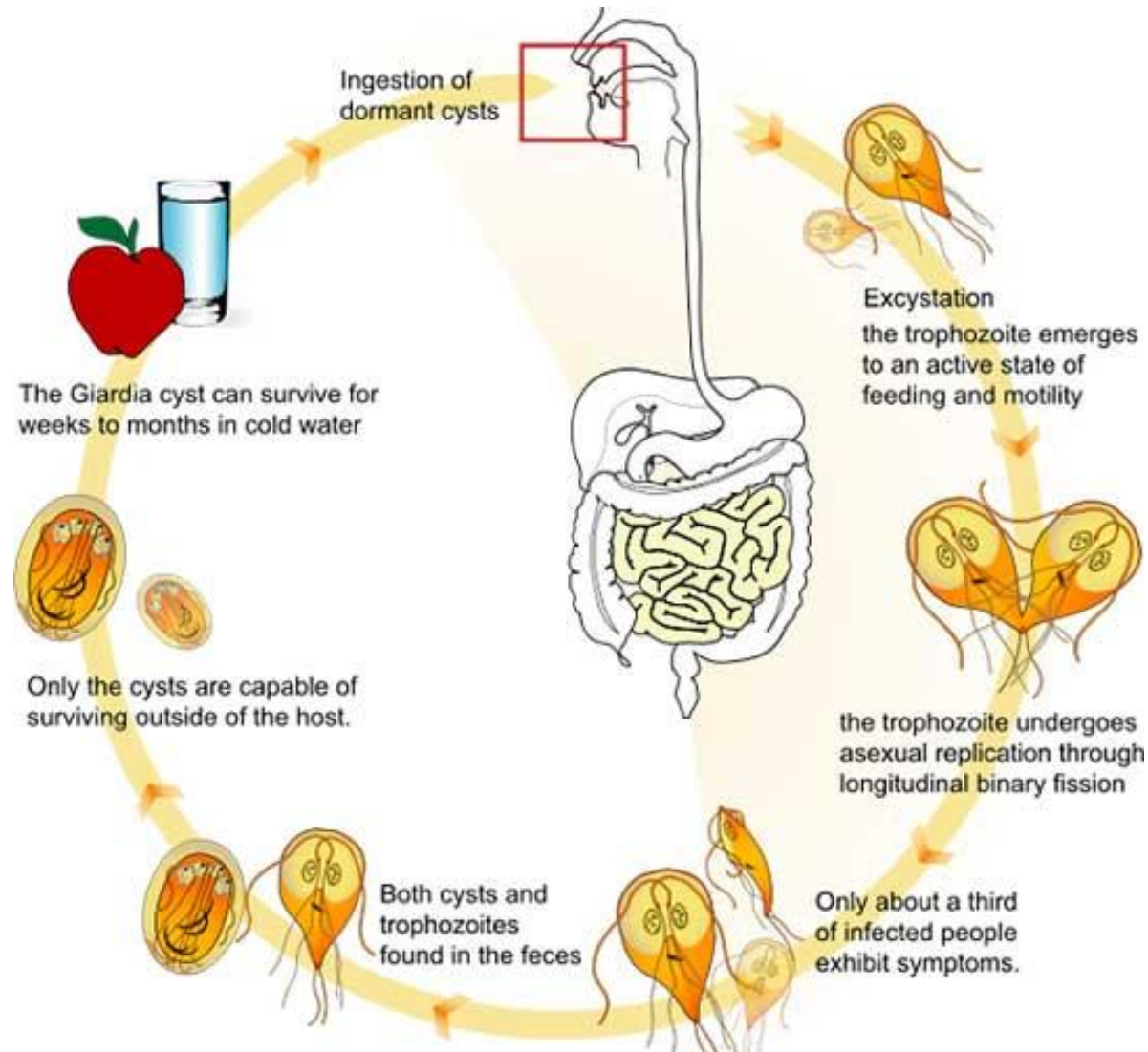
- *Giardia*
- *Cryptosporidium*
- *Cyclospora*
- *Tinea*
- *Toxoplasma*
- *Trichinella*



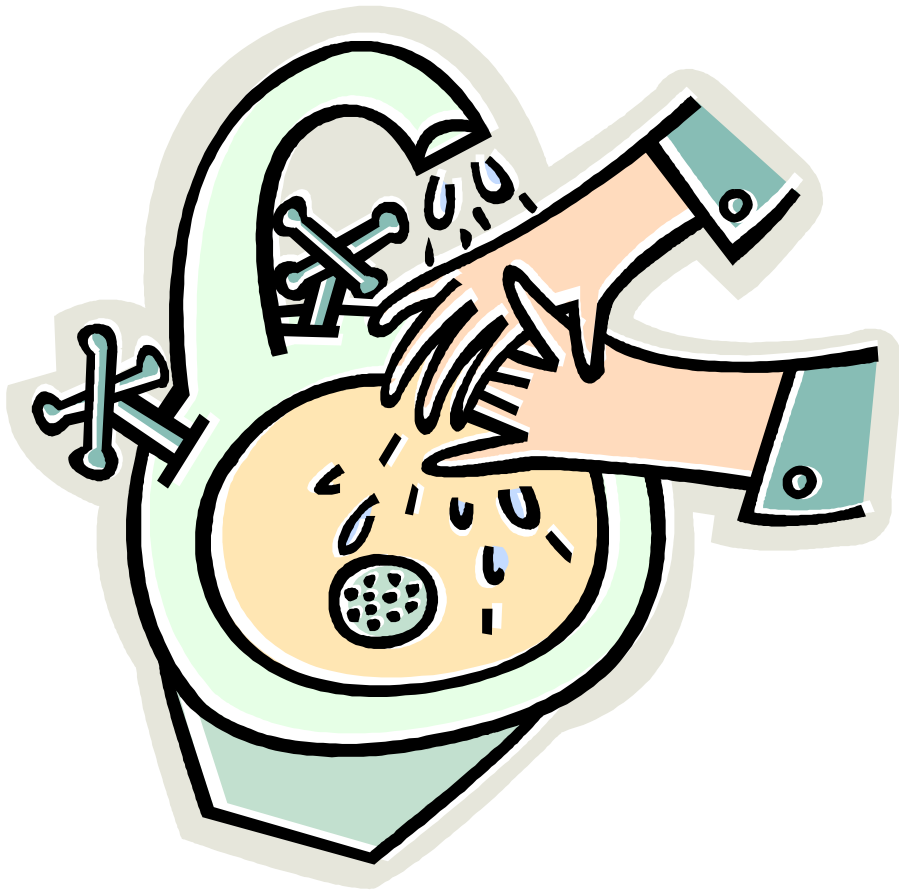
Giardia lamblia

- Also known as: *Giardia intestinalis* is a protozoan flagellate causing giardiasis in the small intestine.
- Characterized by presence of excess fat in the stool.
- It attaches to the mucosa and absorbs nutrients that it gets from the intestinal wall.
- Reservoir: humans, also infects birds, cows, sheep, deer, dogs and cats.
- Incubation period: 7-10 days (range 3-25 days).
- Giardiasis is found worldwide mostly in warm climates and usually in children.
- Treatment is by drinking a lot of fluids and antiparasitic agents (metronidazole).

Life Cycle of Giardia

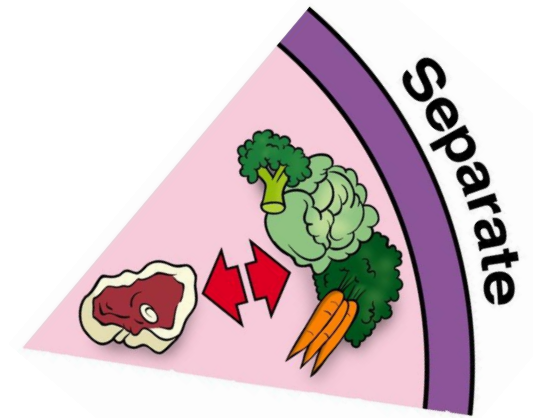


Prevention of Foodborne and Waterborne Infections



Prevention measures include improved sanitation, adequate personal hygiene, proper sewage treatment, exclusion of infected individuals as food-handlers and health care providers. Foods of animal origin should be thoroughly cooked.

WHO Ten Golden Rules



1. Food processed for safety
2. Thoroughly cook
3. Eat immediately
4. Store carefully
5. Reheat thoroughly
6. No contact between raw & cooked
7. Wash hands
8. Keep food preparation surfaces clean
9. Protect from pests
10. Use potable water

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WOULD YOU LIKE IT WITH EXTRA BOTTULISM AND A
TOUCH OF SALMONELLA