Pathogenic flatworms and round worms

Occurrence of flatworms and round worms is common in fish and shellfish and over 50 species of helminth parasites from fish and shellfish are known to cause disease in human beings. These parasitic helminths have complicated life cycles during their development involving a number of intermediate hosts. Generally, sea snails or crustaceans serve as first intermediate host, marine fish as second intermediate host, and mammals as the final host for sexually mature parasites. In between these hosts, one or more free living stages may occur. Infection of human may be part of this life cycle or it may be a side track causing disruption of the life cycle.

The pathogenic flatworms and round worms transmitted by fish and shellfish are

Nemotodes or Round worms	**Fish/shellfish involved**
Anisakis simplex	Herring
Pseudoterranova dicipiens	Cod
Gnathostoma sp.	Fresh water fish, frog
Capillaria sp.	Freshwater fish
Angiostrongylus sp.	Freshwater prawns, snails, fish

Cestodes or tapeworms	
Diphyllobothrium latum	Freshwater fish
D. pacificum	Marine fish

Trematodes or flukes	
Clonorchis sp.	Freshwater fish, snails
Opisthorchis sp.	Freshwater fish *Paragonimus* sp. Snails, Crustaceans, Fishes

Echinostoma sp.	Clams, Freshwater fishes, Snails
Heterophyes sp.	Snails, Freshwater fish, Brackishwater fish
Metagonimus yokagawai	Freshwater fish

A. Nematodes or round worms

- Round worms or nematodes are common and found in marine fish all over the world.
- *Anisakis simplex* is commonly known as "herring worm" and *Pseudoterranova dicipiens* is known as "Cod worm".
- Live worms when ingested by humans penetrate into the wall of the gastrointestinal tract and cause an acute inflammation ("herring worm disease").
- *Gnathostoma sp* is another nematode found in freshwater fish in Asia. The ingested larvae migrate from the stomach to other body regions (subcutaneous sites in the thorax, arms, head and neck) and induce a creeping sensation and edema.
- *Capillaria philippinensis* infection in humans causes severe diarrhea and possible death due to fluid loss.
- *Angiostrongylus cantonensis* is an common nematode in Asia and is associated with freshwater fish, snails and prawns, and known to cause meningitis in humans.

B. Cestodes

- Very few cestodes or tapeworms are transmitted to humans through fish.
- The broad fish tapeworm, *Diphyllobothrium latum* is a common human parasite affecting the intestinal tract of humans.
- The related species (*D. pacificum*) is transmitted by marine fish.
- These parasites are transmitted through the consumption of raw or semi processed fish.

C. Trematodes

- Some of the trematodes or flukes are common in Asia. The liver fluke (*Clonorchis sinensis*) is a common parasite infecting bile-ducts in the liver of humas in Asia.
- Flukes such as *Metagonimus yokogawai* and *Heterophyes heterophies* infect the intestines of the final host (humans) causing inflammation, symptoms of diarrhea and abdominal pain. The adult oriental lung fluke, *Paragonimus sp*. lives in cysts in the lungs of final hosts.

Control of parasitic infection

All infections involving parasites are transmitted by eating raw or uncooked fish products. Control measures to reduce the public health problem related to the presence of parasites include:

- Avoidance of capture and consumption of nematode-infected fish by selecting specific fishing grounds, specific species or specific age groups.
- Sorting and removal of nematode-infected fish or removal of nematodes from fish.
- Application of techniques to kill nematodes in the fish flesh (Ex. Freezing)

Foodborne viruses

The incidence of foodborne outbreaks of viral gastroenteritis is quite common. Viral disease transmission to human beings via consumption of seafood has been known since the 1950s and human enteric viruses are implicated as a major cause of shellfish- associated disease conditions. Presently, more than 100 known enteric viruses are excreted along with faeces by infected individuals and finally find their way in to domestic sewage.

The seafood associated viral infection causing illness are ;

- Hepatitis- typeA (HAV)
- Norwalk virus (small, round structured)
- Snow Mountain agent
- Calcivirus
- Astrovirus
- Non-A and Non-B viruses

Their presence pathogenic viruses in seafood are mainly due to the contamination through infected food handlers and sewage polluted water. Shellfish being filter feeders filter large volume of water (upto 1,500 litres/day/oyster) and concentrate virus from the water. The concentration of virus in the shellfish is much higher than in the surrounding water. The infection with a few number of virl particles can cause food-borne disease.

Infected persons discharge large quantities of virus in the feces and contamination of food occurs by direct or indirect contact with faecal matter. Among the foods the outbreaks of viral diseases is dominated by bivalve molluscs. Infected food handlers are involved in the transmission of the virus and any food that comes into contact with human hands and does not subsequently receive a substantial heat treatment get contaminated by viruses.

Survival of viruses in the environment and in food

- The survival of viruses in the environment and in food is dependent on factors such as temperature, salinity, solar radiation, and presence of organic solids. Enteric viruses survive much longer than coliform bacteria, and for several months in seawater at temperatures <10ºC. Thus, there is little or no correlation between presence of virus and coliforms which are the common indicator bacteria for faecal pollution.All enteric viruses are resistant to acid pH, proteolytic enzymes and bile salts in the gut.

- Hepatitis type A virus is one of the more heat stable viruses and has an inactivation time of 10 min. at 60ºC, thus are able to survive some commonly used culinary preparation methods (steaming, frying).
- Enteric viruses are resistant to some commonly used disinfectants (e.g. phenolics, ethanol, quaternary ammonium compounds), but sensitive to halogens (e.g. chlorine, iodine). Ozone is highly effective in clean water.

Foods involved in viral infection

Seafood-associated viral infections are mainly due to the consumption of raw or improperly cooked molluscan shellfish. HAV transmission has been attributed to unsanitary practices during processing, distribution or food handling. One of the largest outbreaks of food-borne illnesses involving 2, 90,000 cases was reported in China in 1988 due to the consumption of contaminated and inadequately cooked clams.

Prevention of foodborne viral disease

- Prevention of foodborne viral disease mainly relies on measures taken to prevent direct or indirect faecal contamination of food that will not receive a virucidal treatment before consumption.
- Consumption of bivalve shellfish harvested from pollution-free waters or depurated in clean seawater or by cooked.
- Preventing contamination by food handlers by adopting good personal hygiene and health education.
- Preventing food handlers suffering from intestinal infections from handling foods.