Parasites and Food Pollution

- ## Basic definitions in Parasitology:

1. **Parasites** are organisms that derive nourishment and protection from other living organisms known as hosts. They may be transmitted from animals to humans, from humans to humans, or from humans to animals. Several parasites have emerged as significant causes of foodborne and waterborne illness. These organisms live and reproduce within the tissues and organs of infected human and animal hosts, and are often excreted in feces.

It is may be:

a- **Ectoparasite**: they live adherent on the outer skin, and take the food by sucking human blood such as lice , ticks and mosquitoes. It is transmitted to human a lot of diseases such as malaria, elephantiasis, and others).

b- **Endoparasites**: they live inside the body such as worms, and take the food from human body.

2**. Host** a neighborhood that carries the parasite and it has several types:

(A) final host (Definitive host): It holds adult (sexually) phases of the parasite.

(B) intermediate hosts: It holds sexually immature (asexually) phase of the parasite.

(C) Reservoir host: It is any animal that carries the same parasite that infects the human and lies its importance in that the source of human infection from time to time.

(D) Essential host: It is the final host that the parasite favored it from others.

(E) Accidental host: It is abnormal host or non-natural host for parasite.

(F) Transport host: It is the host that carries eggs or larvae of the parasite without any change but as a mediator helps to spread.

- ✓ Parasites may be present in food or in water and can be identified as causes of foodborne or waterborne illness.
- ✓ Parasites may be transmitted from host to host through consumption of contaminated food and water, or by putting anything into your mouth that has touched the stool (feces) of an infected person or animal.
- ✓ Parasites are of different types and range in size from tiny, single-celled, microscopic organisms (protozoa) to larger, multi-cellular worms (helminths) that may be seen without a microscope. The size ranges from 1 to 2 μm (micrometers) to 2 meters long.

The more common foodborne parasites include the following:

1- **Several protozoa**.

2- **Three types of worms**, tapeworms (cestodes), flukes (trematodes) and roundworms (nematodes).

Protozoa and Foodborne parasitic worms

1- Protozoa

Protozoa are one-celled organisms but are larger and more complex than bacteria. These parasites are generally not susceptible to antibiotics that kill bacteria but there are effective drugs to treat some (not all) parasitic infections. Many parasitic infections are asymptomatic, others cause acute short lived effects, and still others may persist in the body causing chronic effects.

Protozoan parasites may be present in freshwater sources that have been contaminated with human or animal feces or in fruits and vegetables grown or washed with such contaminated water may have parasites on their surface and be sources of infection.

Example of Foodborne protozoa:

Toxoplasma cause of the disease toxoplasmosis, it is a single-celled, microscopic parasite found throughout the world. It is the third leading cause of death from foodborne disease. It is interesting to note that these organisms can only carry out their reproductive cycle within members of the cat family. In this parasite-host relationship, the cat is the definitive host. The infective stage (oocyst) develops in the gut of the cat. The oocysts are then shed into the environment with cat feces.

People get toxoplasmosis the following ways:

• By consuming foods (such as raw or undercooked meats, especially pork, lamb, or wild game) or drinking untreated water (from rivers or ponds) that may contain the parasite.

• Fecal-oral: Touching your hands to your mouth after gardening, handling cats, cleaning a cat's litter box, or anything that has come into contact with cat feces.

• Mother-to-fetus (if mother is pregnant when first infected with T. gondii).

• Through organ transplants or blood transfusions, although these modes are rare.

Foodborne parasitic worms

Cestodes (tape worms):

Taenia saginata (beef tapeworm) and ***Taenia solium*** (pork tapeworm) are parasitic worms. Taeniasis is the name of the intestinal infection caused by adult-stage tapeworms (beef or pork tapeworms). Cysticercosis is the name of the tissue (other than intestinal) infection caused by the larval-stage of the pork tapeworm only. It is interesting to note that humans are the definitive hosts of both organisms. This means that the reproductive cycle, and thus egg production by the organisms, occurs only within humans. Eggs are passed in human feces and they may be shed into the environment for as long as the worms remain in the intestines (for as long as 30 years).

In addition, the eggs may remain viable in the environment for many months. These diseases are more prevalent in underdeveloped countries where sanitation practices may be substandard and in areas where pork and beef are consumed raw or undercooked

Nematodes (round worms): include the following human parasites: *Trichinella*, *Ascaris*, and *Anisakis*, *Angiostrongylus* and *Gnathostoma*. Trichinella spiralis, cause of trichinellosis (also known as trichinosis), it is an intestinal roundworm whose larvae may migrate from the digestive tract and form cysts in various muscles of the body. People get trichinellosis (trichinosis) by consuming raw or undercooked meats such as pork, wild boar, bear, bobcat, cougar, fox, wolf, dog, horse, seal, or walrus infected with Trichinella larvae.

Trematodes (flatworms or flukes): usually have two or more intermediate hosts. Some may be present on aquatic vegetables or foods washed in contaminated water (Fasciola and Fasciolopsis) while others encyst in fish (Clonorchis) or crabs and wild boar (Paragonimus).

Fascioliasis is caused by two species of parasitic flatworms or trematodes that mainly affect the liver. It belongs to the group of foodborne trematode infections and is a zoonosis, meaning an animal infection that may be transmitted to humans. The process starts when infected animals (cattle, sheep, buffaloes, donkeys and pigs but also horses, goats, dromedaries, camels, llamas and other herbivores) defecate in fresh-water sources. Since the worm lives in the bile ducts of such animals, its eggs are evacuated in faeces and hatch into larvae that lodge in a particular type of water snail (the intermediate host).

Once in the snail, the larvae reproduce and eventually release more larvae into the water. These larvae swim to nearby aquatic or semi-aquatic plants, where they attach to the leaves and stems and form small cysts (metacercariae). When the plants with the small cysts attached are

ingested, they act as carriers of the infection. Watercress and water-mint are good plants for transmitting fascioliasis, but encysted larvae may also be found on many other salad vegetables. Ingestion of free metacercariae floating on water (possibly detached from carrier plants) may also be a possible mode of transmission.

- ## The control of parasites infection transmission:

1- Proper disposal of human and animal wastes to prevent contamination of foods and drinking water sources is an excellent and basic strategy for preventing many parasitic infections that are transmitted by the fecal–oral route.

2- Well washing of raw vegetables and fruits may remove cysts, oocysts, and eggs of parasites.

3- Adequate cooking of foods and boiling of water able to destroye all infective stages of parasites.

4- Chlorination eliminates bacteria and some parasites from water, but cysts and oocysts are resistant to chlorine.

5- Freezing for several days can inactivate or kill some parasites For food to be eaten raw.

6- Soaking of vegetables in a 1.5% bleach solution, vinegar, potassium permanganate solution (24 mg/L), or saturated cooking salt destroyed infective larvae of some nematode and trematode parasites.

7- Frequent handwashing to prevent cross-contamination during food processing.

8- Control of flies, cockroaches, and other insects may prevent dispersal of infective stages of parasites to foods.

- **Summary of parasites found in different foods**

Foods	Protozoa	Nematodes	Tapeworms	Flukes
Beef				*Taenia saginata*
Pork	*Toxoplasma*	*Trichinella*	*Taenia solium, Taenia asiatica*	
Other meat	*Toxoplasma, Cryptosporidium (lamb, mutton)*	*Trichinella (cougar, walrus, bear, horse, wild boar) Gnathostoma (frogs, snakes)*		*Paragonimus (wild boar, guinea pig)*
Milk	*Cryptosporidium*			
Fish		*Anisakis Gnathostoma*	*Diphyllobothrium*	*Clonorchis*
Fruits, vegetables (raw)	*Cyclospora Cryptosporidium Giardia*	*Angiostrongylus Ascaris*	*Taenia solium Echinococcus*	*Fasciola, Fasciolopsis*
Water	*Cyclospora Cryptosporidium Giardia Toxoplasma*	*Ascaris, Gnathostoma*	*Echinococcus*	*Fasciola, Fasciolopsis*

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