

Examples of the most common parasites which will be detected in a stool sample

We cannot offer a complete list of parasites because of their vast number. But the laboratory uses a special concentration method and will find any worm eggs, larvae and protozoan cysts and consequently identify the species. If the staff are in any doubt, they consult associated specialists.

Protozoa

Protozoa (in Greek proto = first and zoa = animals) are one-celled eukaryotes (that is, unicellular microbes whose cells have membrane-bound nuclei).

Some protozoa have the ability to form cysts to protect them from harsh conditions, allowing them to survive exposure to extreme temperatures or harmful chemicals or without food, water, or oxygen for a period of time. For parasitic species the cysts will also enable them to survive outside of the host, allowing them to be transferred from one host to another. This ability to form cysts also ensures their survival in a stool sample.

Intestinal entamoeba: Entamoeba is a genus of Amoebozoa found as internal parasites or commensals of animals. Several species are found in humans. Entamoeba histolytica is the pathogen responsible for amoebiasis (which includes amoebic dysentery and amoebic liver abscesses), while others such as Entamoeba coli and E. dispar are harmless. With the exception of Entamoeba gingivalis, which lives in the mouth, and E. moshkovskii, which is frequently isolated from river and lake sediments, all Entamoeba species are found in the intestines of the animals they infect.

Dientamoeba fragilis: Ever since its first description in 1918, Dientamoeba fragilis has struggled to gain recognition as a significant pathogen. There is little justification for this neglect, however, since there exists a growing body of case reports from numerous countries around the world that have linked this protozoal parasite to clinical manifestations such as diarrhea, abdominal pain, flatulence, and anorexia.

Blastocystis hominis: Blastocystis hominis is a single-celled parasite of the intestinal tract. It is difficult to classify this organism as it has characteristics of both, protozoa and yeasts. Blastocystis is not very host specific and seems to be able to cross the species barrier.

According to Blastocystis hominis' life cycle its excretion in stool will only be intermittent. Blastocystis comes in different morphological forms, which can make identification even more difficult. The main forms are a cyst stage and a vacuolar stage, the latter being more visible due to the big vacuole in the cell. Through human feces, the cyst forms enter the external environment and are transmitted to humans and other animals via the fecal-oral route, repeating the entire cycle.

Blastocystis hominis can be found in about 15% of healthy people and it does not necessarily seem to be pathogenic. Cases of high infestation have been reported without any symptoms, but sometimes it can be found as the only possible cause of mushy stools, abdominal pain, feeling sick, bloating and lack of appetite. Only in immune compromised people has strong watery diarrhoea been observed.

In patients with healthy immune systems all other possible causes for their abdominal complaints should be eliminated first and only if symptoms persist this should be attributed to Blastocystis, as it rarely seems to be the cause of the problem.

It can be treated with Metronidazole or Co-trimoxazole (an antibiotic). Both have therapy failures.

Cryptosporidium: Cryptosporidium is a protozoan pathogen of the Phylum Apicomplexa and causes a diarrhoea called illness called cryptosporidiosis.

Cyclospora cayetanensis: Cyclospora cayetanensis is a protozoan that causes disease in humans, and perhaps other primates. It is sometimes referred to as the “yuppie disease” due to outbreaks in the United States from fecally-contaminated imported raspberries and was virtually unknown before about 1990, but has been on the rise since. The health risk associated with the disease is usually confined to adult foreigners visiting endemic regions and acquiring the infection. This is why C. cayetanensis has been labeled as causing “traveler’s diarrhea.” Due to its small size, intracellular habitat, and inability to properly uptake many histological stains, diagnosis of Cyclospora cayetanensis can be very difficult.

Giardia lamblia: Giardia lamblia (synonymous with Lamblia intestinalis and Giardia duodenalis) is a flagellated protozoan parasite that colonises and reproduces in the small intestine, causing giardiasis. The giardia parasite attaches to the epithelium. Giardiasis does not disseminate haematogenously, nor does it spread to other parts of the gastro-intestinal tract, but remains confined to the lumen of the small intestine. Giardia trophozoites absorb their nutrients from the lumen of the small intestine, and are anaerobes. Colonisation of the gut results in inflammation and villous atrophy, reducing the gut's absorptive capability. In humans, infection is symptomatic about 50% of the time

Isospora belli: Isosporiasis is a human intestinal disease caused by a parasite called Isospora belli. Symptoms include diarrhea and weight loss. It is sometimes associated with AIDS.

Sarcocystis: This parasite’s life cycle is heteroxenous, meaning that it has more than one obligatory host in its life cycle. Sarcocystis relies on the predator-prey relationship of animals. Oocysts are passed through the feces of an infected individual where it undergoes sporogony and becomes infected itself. Intermediate hosts can be cows or pigs. Human infection is rare but can happen when undercooked meat is ingested. Symptoms include diarrhea, which may be mild and transient or severe and life threatening. Human outbreaks have occurred in Europe.

Trematodes: Liver and gut flukes

Fasciolopsis buski: often referred to as the giant intestinal fluke, is a parasite of Southern Asia.

Fasciola hepatica: Known as the common liver fluke or sheep liver fluke, is a parasitic flatworm of the class Trematoda that infects the liver of a various mammals, including man.

Dicrocoelium dendriticum: The Lancet liver fluke (Dicrocoelium dendriticum) is a parasite fluke that tends to live in cattle or other grazing mammals.

Other flukes:

Echinostoma ilocanum: Intestinal fluke which is a common infection in South-East Asia where they have a high prevalence (from 1 to 30%). The infections are acquired by eating raw or undercooked freshwater snails, clams, and fish containing the metacercariae.

Echinostoma lindoense: The Echinostomes are a large group of flukes. The lifecycle has a snail first intermediate host (as with all the Digenean flukes), usually followed by a fish second intermediate host, although in some species this may be an amphibian or another mollusc. A number of these parasites have been reported in man, either as a natural parasite, or more commonly as accidental infections.

Gastrodiscoides hominis: Member of the Digenean fluke family, found in Vietnam, Philippines, Bangladesh and the Assam region of India

Watsonius watsoni: A trematode found in the intestinal wall of some primates. Causes mucohemorrhagic diarrhea, hepatomegaly, ascites and urinary tract disease.

Nanophyetus salmincola: Human nanophyetiasis is a zoonotic disease recently recognized in the coastal US Pacific Northwest and is caused by the trematode *Nanophyetus salmincola*.

Metorchis conjunctus : *Metorchis conjunctus* is North American in distribution and the metacercariae are unusual because they can withstand periods of freezing. In northern communities where dogs are frequently fed rough fish, such as suckers, *Metorchis* can pose a serious health problem to the dogs. Humans also can become infected. Its life cycle and pathology are similar to the Chinese liver fluke, *Clonorchis sinensis*.

Opisthorchis viverrini und felineus : These are trematode parasites that attack the area of the bile duct. *Opisthorchis viverrini* infection predisposes for cholangiocarcinoma, a cancer of the gall bladder and/or its ducts.

Clonorchis (Opisthorchis) sinensis: This is a human liver fluke in the class Trematoda. This parasite lives in the liver of humans, and is found mainly in the common bile duct and gall bladder, feeding on bile. These flukes which are believed to be the third most prevalent worm parasite in the world, are endemic to Japan, China, Taiwan, and Southeast Asia, currently infecting an estimated 30,000,000 humans.

Metagonimus yokogawai: A minute intestinal fluke, the smallest human fluke. The main symptoms are diarrhea and colicky abdominal pain. Migration of the eggs to extraintestinal sites (heart, brain) can occur, with resulting symptoms.

Heterophyes heterophyes: A fluke found in the Nile delta region of Egypt, parts of Turkey, and some foci in the Far East (Japan, Central and Southern China and Philippines)

Intestinal bilharziosis: The bilharziosis parasites (*Schistosoma*) are sanguinary, minute flat worms to be found in great quantities in blood vessels of the abdomen. Five of the species are pathogenic for humans. The initial clinical manifestations of the disease, which they give rise to, Schistosomiasis, are either cystic or intestinal. Other organs are invaded by the eggs of these worms, the liver and the spleen being privileged targets. Known since very ancient times and widespread in the tropics, where it affects some 300 million individuals, Schistosomiasis figures among the most virulent epidemics in sub-Saharan Africa, the West Indies and South East Asia.

Intestinal nematodes: Roundworms

The nematodes or roundworms (Phylum Nematoda) are one of the most common phyla of animals, with over 80,000 different described species (over 15,000 are parasitic).

Parasitic forms often have quite complicated life cycles, moving between several different hosts or locations in the host's body. Infection occurs variously by eating uncooked meat with larvae in it, by entrance into unprotected cuts or directly through the skin, by transfer via blood-sucking insects, and so forth.

However, it can be difficult to find some of these species in a stool sample.

Instead these roundworms can be collected separately with sticky tape from the anus area.

They tend to migrate out of the anus over night and can be collected from there in the morning.

These are highly infectious and strict hygiene has to be observed.

***Ascaris lumbricoides*: (Roundworm)** Infections with these parasites are more common where sanitation is poor and human feces are used as fertilizer.

***Enterobius vermicularis*:** Human **pinworm**, also known as **threadworm**.

The pinworm lives in the lower part of the small intestine, and the upper part of the colon. It is found worldwide and causes the common infection enterobiasis in humans. It is frequent in children. Unlike many other intestinal parasites, the pinworm does not usually enter the bloodstream or any other organs besides the intestines. Only in rare cases disoriented pinworms can be found in the vagina, and even more rarely in the uterus, fallopian tubes, liver and peritoneum; but the worms cannot survive long in these places.

Except for itching, pinworm infestation does not usually cause any damage to the body. Sleep disturbance may arise from the itching or crawling sensations.

(For this worm a sticky tape sample from the anus is required.)

***Strongyloides stercoralis*:** human parasitic roundworm causing the disease of strongyloidiasis.

***Ternidens deminutus*:** The nematode *Ternidens deminutus* belongs to the Chabertiidae. The parasite is related to *Oesophagostomum* sp. Infection is not infrequent, but only occurs in specific areas. Its distribution includes Asia and Africa, chiefly in Zimbabwe. The normal hosts are various monkeys.

***Trichiuris trichiura*: (Whipworm)** Light infestations are frequently asymptomatic, heavy infestations may have bloody diarrhea and long-standing blood loss may lead to iron-deficiency anemia. Whipworm commonly infects patients also infected with *Giardia*, *Entamoeba histolytica*, *Ascaris lumbricoides*, and hookworms.

***Trichinella spiralis*:** The small adult worms mature in the intestine of an intermediate host such as a pig. Each adult female produces batches of live larvae, which bore through the intestinal wall, enter the blood and lymphatic system, and are carried to striated muscle tissue. Once in the muscle, they encyst, or become enclosed in a capsule.

Larvae encysted in the muscles remain viable for some time. When the muscle tissue is eaten by a human, the cysts are digested in the stomach; the released larvae migrate to the intestine to begin a new life cycle. Female trichina worms live about six weeks and in that time may release larvae. The migration and encystment of larvae can cause fever, pain, and even death. One of the classic signs of *Trichinella spiralis* infection is a combination of splinter hemorrhages (not to be confused with those of bacterial endocarditis) and periorbital edema (eye swelling). *Trichina* are classified in the phylum Nematoda.

Trichostrongylus species:

Black scour worms occur in all sheep production districts of Australia.

It can also be found as a gut nematode in the United Kingdom. On its own it would be unusual to get high enough numbers to cause problems but the worm is sometimes found in mixed infections with other worms.

Parasites which might be missed in a stool sample

Tape worms (cestodes)

When humans are the primary host, the adult cestode is limited to the intestinal tract. When humans are the intermediate hosts, the larvae are within the tissues, migrating through the different organ systems.

Many cestode infestations are asymptomatic at first. However, once symptoms occur, they are usually vague GI complaints such as abdominal pain, anorexia, weight loss, or general malaise.

Unfortunately with intestinal tapeworms, the release of egg containing parts (proglottida) is only intermittent. There might be samples without any traces. But the tapeworm parts can be seen with the naked eye as little white worm like bits in the stool.

The stool has to be observed in case of a suspicion.



Diphyllobothrium latum : Fish tape worm

Taenia solium: Pig tape worm

Taenia saginata: Cattle tape worm

Dipylidium caninum: Cucumber tapeworm or the double-pore tapeworm,

Vampirolepsis nana: *Vampirolepsis nana*, the mouse tapeworm, is the most common cestode in humans especially children. Domestic mice and rats can serve as definitive hosts for *V. nana*.

Hymenolepis diminuta: *Hymenolepis diminuta* is primarily a tapeworm of rodents. Humans are infected following the accidental ingestion of arthropods containing the cysticercoid stage of the parasite.

Rare tape worms:

Mesocestoides: Humans can experience severe diarrhoea with intestinal infections

Raillietina celebensis: (no common name)

Inermicapsifer madagascariensis: Cestode often seen as human infection in Cuba in children 1 –3 years old; causes vague intestinal symptoms; suspected arthropod vector; proglottids, eggs, and egg capsules resemble those of *Raillietina* spp.