



GIARDIA

The term "Giardia" is commonly used to describe both the parasitic organism *Giardia lamblia* as well as the disease Giardiasis. Giardia is a flagellate protozoan which exists in two stages: an active trophozoite stage (inside the host) and the dormant cyst stage (in the environment). Transmission of the cyst, and the disease, occurs strictly by the fecal-oral route.

There are three identified species of Giardia:

Giardia lamblia, ***Giardia muris***, and ***Giardia agilis***. Of the three species, *Giardia lamblia* is the only species of Giardia known to infect humans. *Giardia muris* is commonly found in the animal population, and *Giardia agilis* is found infrequently in aquatic animals such as toads and frogs. Cross-species transmission of *Giardia lamblia* from human-to-animal and animal-to-human has been reported. To date, *Giardia muris*, which routinely occurs in the animal population, has not been isolated from a human.

Giardia was first described over 300 years ago by Anton van Leeuwenhoek after he examined his own stool using a primitive microscope. Since that time Giardia has become the most commonly diagnosed intestinal parasite in the United States.

The Giardia Cyst

The cyst is responsible for the spread of the organism to new "hosts". Giardia cysts are oval in shape and are approximately 7 to 14 microns in size (approximately the size of a red blood cell). During an average fecal discharge of an infected individual, approximately 300 million cysts can be deposited in the environment. In extreme cases, billions of cysts can be excreted.

The cyst is multi-nucleate and produces 2 to 4 trophozoites inside the host by a process called excystation. The Giardia cyst is very resilient and capable of surviving for months in a damp, cool environment. It is more resistant to disinfection than most common bacterial indicators.

The Giardia Trophozoite

The pear-shaped Trophozoite (or "troph") uses its four pairs of flagella for propulsion. The troph is binucleate, and has a large sucking disk which is used to attach the troph to the host's intestine wall. The troph feeds itself by hijacking nutrients before the nutrients can be assimilated by the host.

The troph reproduces by binary fission every 5 to 10 minutes. After millions, or even billions of organisms, are produced, natural processes in the intestine flush some of the trophs "downstream" to the small bowel or colon. Adverse conditions there cause the troph to transform itself into a cyst. This process, called encystation, is the organism's protective mechanism developed in preparation for introduction into the environment.



Giardiasis

The disease Giardiasis is caused by ingestion and subsequent reproduction of Giardia inside the gut. It may result in a lengthy, violent bout of diarrhea in some individuals, or merely intermittent or periodic bouts in others. If the disease remains untreated, the body may adjust to the parasite, and virtually no symptoms will remain. Studies indicate that as many as 10% of Americans may carry the parasite at all times. Giardiasis is not considered a life-threatening illness for otherwise healthy individuals.

Transmission Sources

Water- Lakes, rivers, springs, streams, seemingly "pristine" water.

As a result of Giardia outbreaks in drinking water, the Environmental Protection Agency (EPA), in conjunction with State Agencies, strictly regulates *Giardia lamblia* with the application of the Surface Water Treatment Rule (SWTR). The SWTR mandates that all community water systems serving surface water must remove or inactivate at least 99.9% of giardia from their water supply.

Person or Animal-to-Person Giardiasis is predominately spread through child care centers or in-home child care, by sexual contact or inadequate hygiene of infected individuals, by asymptomatic carriers, or from handling infected pets.

Cases of Giardiasis have occurred in child care settings, (especially where diaper-changing-age children are present); from family contact at home where one individual, including infected pets, passes Giardia to others by incidental contact; and, on rare occasions, from infected cafeteria workers handling raw vegetables.

Diagnosis and Treatment

Diagnosis of Giardiasis has traditionally been through the Ova and Parasite (O&P) examination. This analysis requires a parasitologist to identify Giardia by its morphology, or by visual comparison, to other fecal debris in a smear.

Current trends in diagnosis have migrated towards the immunoassay method. Enzyme-Linked Immunosorbent Assay ("ELISA") format testing and Direct Fluorescence Assay ("DFA") testing are preferable methods as they are more accurate and easier to perform than the traditional method. The DFA technique is the same staining and microscopic technique currently employed in the analysis of drinking water today.

Giardiasis is usually treated with the prescription drugs metronidazole (Flagyl), quinacrine hydrochloride, or furazolidone. Treatment consists of multiple doses which last for 5-10 days. Although some side effects and discomfort may be experienced during treatment, the prescriptions usually eliminate the infection, or are at least 90% effective in eliminating the disease.

No immunity to Giardia has been proven even after treatment. Consequently, an individual may experience multiple episodes of Giardiasis throughout a lifetime.

Environmental Detection

Isolation of Giardia from water sources requires concentration of a large volume of water by passage through a concentrating filter at least 1 micron nominal porosity. Sample volume can range from 10 liters to hundreds of liters depending upon the source water and the method employed. The filter element is washed and the sediment is concentrated in the laboratory. After a series of clean-up steps, the sample concentrate is examined by the fluorescence method.

Fluorescence Assay

The fluorescence method of detecting Giardia employs a monoclonal antibody, tagged with a fluorescent dye, which in turn seeks out the Giardia cyst in a sample concentrate. Once the antibody has located the Giardia cyst, a microscopist can examine the sample through fluorescence microscopy. The cysts are easily identified because they will glow when exposed to the fluorescent light of the microscope.

Further Information

For more information concerning Giardia sampling, detection, immunofluorescent assay and current regulation, please call BioVir Laboratories at 1-800-GIARDIA (442-7342).

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