

## ***Giardia Lamblia* and Giardiasis**

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### **Abstract**

*Giardia lamblia* is widespread enteric protozoan parasite of human and other mammals . Prevalence data suggest that 200 million people are infected with *Giardia lamblia*. The parasite has been discovered by van Leeuwenhoek in 1961. Life cycle of *G.lamblia* has two stages trophozoite and cyst of which trophozoite is the pathogenic stage and cyst is infective stage and both of them found in fecal material of patient with giardiasis. The parasite transmitted mainly by oral –fecal route .*Giardia* infection which is characterized by malabsorption of small intestine and fatty diarrhea . Pathogenicity of *Giardia* trophozoite occurs due to direct damage of intestinal lining or mechanical blockage of intestinal villi and absorption. Identification of parasite is based on recognized of trophozoite and cyst microscopically and also by detection of antigen from fecal sample .ELISA test ,Direct fluorescent antibody test and PCR test are also helpful ,*Giardia* infection can be effectively treated by metronidazole as primary staples of treatment.

**Keywords:** *Giardia lamblia*, Giardiasis ,trophozoite ,cyst.

### **Introduction**

*G. lamblia* is a unicellular, flagellated protozoan parasite resides in small intestine of host. It is responsible for gastrointestinal illness known as giardiasis are frequently causes of mortality and morbidity throughout the world.[1] It is very common and may infect more than third of the individuals in developing countries . The parasite causes acute or chronic diarrhea in humans especially in children and can infect other mammals,[2] *G. lamblia* live attached and colonize in small intestine on mucosal lining of duodenum and jejunum of host, its life cycle alternative between two stages resistance,dormant cyst stage and multiplying, motile trophozoite stage.[3]

## History

*Giardia lamblia* (synonyms: *Giardia duodenali*, *Giardia intestinalis*) is a pathogenic intestinal flagellated parasite that responsible for very common gastrointestinal disease called giardiasis .[4]It was discovered in 1681by Antonie van Leeuwenhoek who found the parasite in his own fecal sample when examined it microscopically . *Giardia lamblia* was initially named as *Cercomonas intestinalis* in 1859 by lambel .And in 1915 renamed as *Giardia lamblia* by Stiles in honor of professor A. Giard of Paris and Dr. F. Lambl of Prague[5].

## Epidemiology:

unicellular *G. lamblia* is worldwide cosmopolitan ,epidemiological survey reveals that most cases from parasitic infections in children caused by *Giardia lamblia* infection especially in areas with low economic and poor sanitation .[6] The studied reported that two hundred million people in Asia, Latin American, Africa are infected each year with *G. lamblia* .[7] The prevalence rate of *G. lamblia* in industrialized areas is about two to five percent[8] .Study in Basra ,Iraq found that the prevalence rate of infection with *G. lamblia* in preschool children about fifteen to twenty percent and in day care center the prevalence reach twenty one to twenty six percent[8]. Contaminated drinking water responsible for large community outbreaks while smaller outbreak though out the world due to contact with contaminated recreational water[9].

## Classification:

According to protozoan morphology and host species in which they parasitize *Giardia* include more than fifty species [10]. Now 5 species of giardia are recognized *Giardia agilis* ,*Giardia duodenalis* ,*Giardia ardeae* ,*Giardia psittaci* and *Giardia muris*. The only *Giardia lamblia* is considered to be species encountered in humans and as well as in domestic and wild mammals. According to the molecular studies there are eight genetic groups identified for groups found in man also isolated from animals like beavers and mouse [11].

**kingdom** :Protista

**Subkingdom**:Protozoa

**Phylum**:Sarcoastigophora

**Subphylum** Masigophora

**Class** : Zoomastigophora

**Order**:Diplomonadida

**Family**:Hexamitidae

**Genus** :*Giardia*

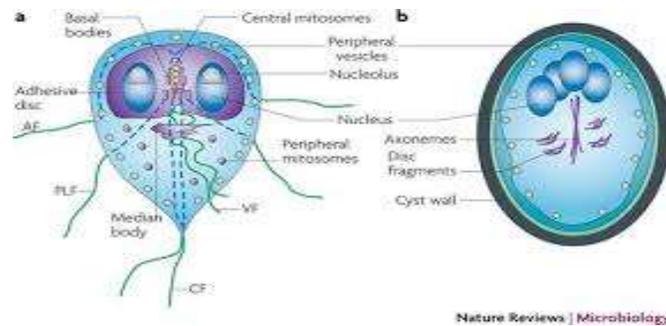
**Species** :*Giardia lamblia*

## Morphology

Life cycle of *Giardia lamblia* consist of two alternative trophozoite and cyst tage:

**Trophozoite** : It is pear in shape , rounded anterior end and pointed posterior end ,it measures about 12-15 micron in length and 5-9 micron in maximum width[12]. The ventral surface has two sucking disk by which the organism adheres to mucosal surface of small intestine. The organism has two nuclei with central rounded karyosome found at anterior end , two axostyle in the mid part of the body , rod like structure across the axostyle known as median body as in fig. 2[13] . The organism has bilaterally symmetrical appearance. Trophozoite has eight flagella (pair of flagella situated anteriorly ,two pairs in the middle and pair of flagella in the posterior end) by which the trophozoite move from place to another [14].

**Cyst**: It is ovoid in shape, measures about 12×6 micron in size.it has remains of flagella inside the granular cytoplasm, the organism possess two pair of nuclei either found in cluster at one end or occurs in pairs at opposite end[15] . The cyst has clear space between the cytoplasm and the protective cell wall as in ( fig. 1). The cyst has ability to adaptation with external environment to become survive for weeks or months [16].



**Figure 1.trophozoite and cyst stage of *G.lamblia*( Nature Reviews Microbiology)**

### Transmission:

The parasite spread by ingestion of mature cyst via fecally contaminated soil, surface, water and food . Direct transmission from person to person through oral- fecal route occurs for example in day care center between children as a result of poor hygiene practices , workers with children are also at risk of infection[17] . *G. lamblia* can be transmitted during different ways such as recreational water and drinking water and these considered main sores of transmission .*Giardia* may also transmitted by anogenital or orogenital sexual contact during oral- anal route[18] .

**Life cycle**: The parasite passes its life cycle in one host. Man acquires the infection by oral ingestion of mature cyst .Excystation of cyst occurs in the duodenum within thirty minutes ,the cytoplasm divides, thus liberate two trophozoites is illustrated (fig. 2) . Vegetative trophozoite is attach to the epithelial lining of small intestine and replicate to produce enormous numbers of parasite colonize in the duodenum and jejunum [19]. Encystation of trophozoite occure in colon to transform to cyst stage ,which is immediately infective upon pass with stool and remain survive for weeks or months in

the external environment. Swallowing about ten mature cysts may initiate infection in new host ,although infected host might shed one to ten billion cysts per day in their fecal material[20].

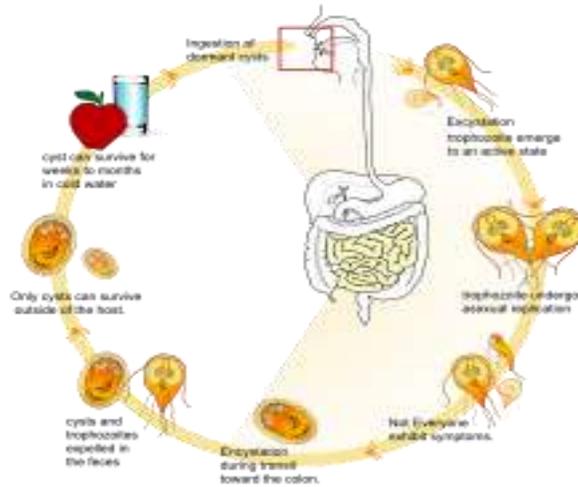


Figure 2. Life cycle of *Giardia lamblia* (From Wikipedia)

### Symptom and Pathology:

Giardiasis infections are commonly a symptomatic, many people can serve as carriers of the organism. Symptoms of giardiasis varies in intensity, the infection commonly a symptomatic .any ages may acquire giardiasis, adults are less frequently affected than children[21]. Clinical symptoms appear after two to three weeks from ingestion and exposure to parasite, foul smell watery diarrhea, flatulence, anorexia, nausea and abdominal cramps. Fat soluble vitamins deficiency. Mechanical interfere with absorption by the parasite coats the intestinal mucosa resulting in malabsorption of fat known as steatorrhea is very common in chronic cases. Inflammation and irritation in mucosal surface of small intestine. Direct damage of mucosa or brush border concedes the main causes of increase secretion of fluid that lead to loss of fluids and then acute or chronic diarrhea [22] .

### Immune response

#### Innate immunity

The innate immune response of host considered the first line of defense against *G. lamblia* infection and play an important role in recognition of the organism[23] . Direct contact of trophozoite with epithelial cells lining of small intestine evoke production of some chemokine and cytokines , these chemical products possess overlapping function in regulating innate immunity and eradication of giardia as well as dendritic cells has ability to recognize and respond to trophozoite of *G. lamblia*[24] . The presence of beneficial microbes in the lumen of small intestine increases the resistance to

parasite[25]. Many studies reveal that the normal human milk destroys and kills the trophozoite of giardia due to the presence of lipase enzyme in human milk. Many studies explained the important role of nitric oxide in the inhibition of trophozoite differentiation into cyst and stopped the process of replication [26].

### Acquired immunity

Giardiasis evokes an antibody response against the organism. The presence of complement and particular antibodies results in the incubation of trophozoite with specific antibody and then inhibits the replication of parasite[27]. Immunoglobulin A (IgA) is very important in parasite clearance and control, which is present in mother's milk and in intestinal secretions. Mast cells play an important role in detaching parasite from mucosal surface by increasing smooth muscle contraction that leads to increased intestinal motility[28]. CD4 (+) T cells are fundamental to the process of parasite eradication. It has been suggested that CD4 (+) T cells play a role during the immune response against *G.lamblia*. They activate and stimulate the differentiation of B cells to produce anti giardia-specific antibodies [29].

### Laboratory diagnosis

The diagnosis is based on clinical symptoms and confirmed by the identification of trophozoite and cyst stage in fecal sample. Formed stool sample to look for cyst stage while diarrheic stool sample to find trophozoite stage[30]. Repeated sampling is recommended to increase test sensitivity. The direct wet mounts preparation for detection of characteristic falling leaf motility of trophozoite. Diagnosis of Giardia lamblia microscopically after the application of fecal concentration procedures, especially zinc sulphate flotation and centrifugation remains a relatively reliable indicator of infection. Obtaining duodenal fluid sample by string test is more comfortable test than some of the other tests to detect Giardia lamblia organism[31]. From duodenal content, histological test used to determine the mucosal invasion and villous atrophy. Antigen detection test by Enzyme immunoassay (ELISA) test as immunodiagnostic test to detect Giardia cyst wall (Ag) in stool sample. Polymerase chain reaction (PCR) procedure has high sensitivity to identify the nucleic acid of Giardia lamblia[32].

### Treatment

The giardiasis infection usually resolves spontaneously, but, if the case is acute, medications are necessary to treat it, good medication used for treatment is metronidazole, secnidazole and tinidazole [33]. The infectious disease of America and World Health Organization recommend metronidazole as primary treatment of giardiasis[34]. A meta-analysis study done by the Cochrane Collaboration indicates that compared to the standard of metronidazole, albendazole had equivalent efficacy with very low side effect, like neurological and gastrointestinal symptoms [35]. Both medications need a five to ten day long course; albendazole and tinidazole administered with a single dose are effective, whereas metronidazole requires taken three times daily [36]. Also, there are three drugs that give good results in treatment such as quinacrine, nitazoxanide, bacitracin, zinc, and furazolidone. The preferred treatment through

pregnancy is paromomycin because of its poor absorption by intestinal villi, and subsequently minimal insinuation to the foetus [37].

### Prevention and control

Swallowed of fecal contaminated food and water is the common mode of transmission. Therefore, the best method of prevention is reducing this contamination[38]. Purifying or filtering drinking water using the boiling or iodine in endemic areas is important as is the washing of vegetables and fruits that may have been polluted[39]. Children are usually infected with *G. lamblia* and easily spread cysts if poor sanitation is used. Proper washing of hand can help to reduce the transmission[40]. Hand washing carefully before eating before preparing food, , and after using of toilet can prevent many cases of Giardia occurs in day-care centers .Children infected with diarrhea should be avoid swimming pools .Avoid drinking from un treated water such as rivers , lakes and streams. Boiling the water first will destroy and kill the Giardia. Chlorination and filtration good method to remove the parasites[ 41,42 ].

### Conclusions

As the most spread protozoal infection, *G. lamblia* is important for both human and animals health .Although the wide range of effectiveness on the validity of human host, *G. lamblia* remains a careless as parasitic infection infect high numbers of humans . The prevalence and insistence related to control planning for eradication the parasite especially clean the source of drinking water still restricted, therefore , further future research on the mechanism of resistance to infection and strategy for good control measure should be taken to eradicate the giardiasis infection are required.

### Conflict of Interests.

There are non-conflicts of interest .

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### الخلاصة

طفيلي الجيارديا اللامبليا من الاوالي المعوية الواسعة الانتشار للإنسان واللبائن الاخرى وقد سجلت الدراسات نسب معدل انتشار الاصابة 200مليون شخص سنويا مصاب بطفيلي الجيارديا لامبليا. اكتشف الطفيلي من قبل العالم فان ليفنهوك سنة 1961. دورة حياة الطفيلي تتضمن طورين هما الطور المتغذي المسؤول عن الامراضية والطور المتكيس المسؤول عن الاصابة وكلاهما موجود في براز الشخص المصاب .ينتقل الطفيلي بصورة رئيسية عن طريق وصول البراز من اليد الملوثة الى الفم . تتميز الاصابة بداء الجيارديا بسوء الامتصاص للامعاء الدقيقة والاسهال الدهني .امراضية الطفيلي تنتج عن الضرر المباشر للطبقة الطلائية للامعاء او الانسداد الميكانيكي لزغابات الامعاء والامتصاص . الكشف عن الطفيلي يعتمد على تمييز الطور المتغذي والطور المتكيس للطفيلي من خلال الفحص المجهرى المباشر وكذلك عن طريق الكشف عن مستضدات الطفيلي باستخدام عينة البراز . هناك اختبارات اخرى مثل اختبار الاليزا واختبار الاجسام المضادة المشعة واختبار تفاعل سلسلة البلمرة. الاصابة بطفيلي الجيارديا ممكن ان يعالج بشكل فعال بالميترانيدازول كخطوة اولى للعلاج.

الكلمات الدالة: الجيارديا اللامبليا، الجيارديا، الكيس