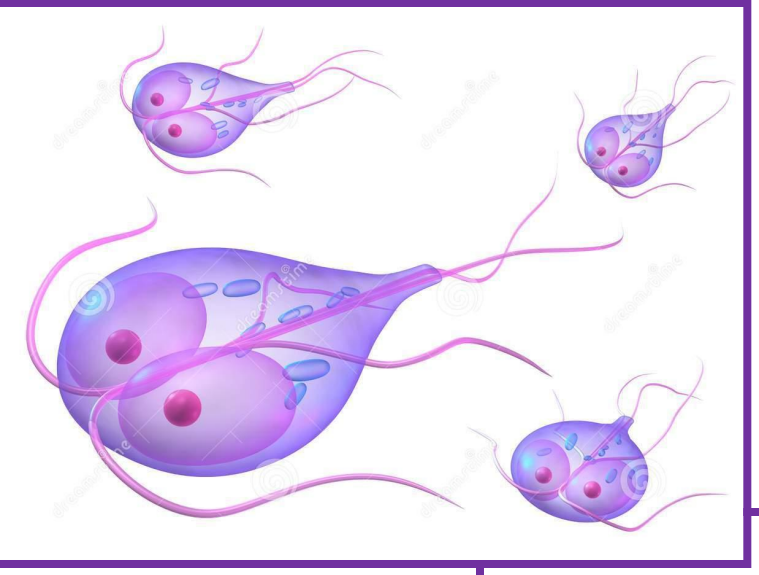


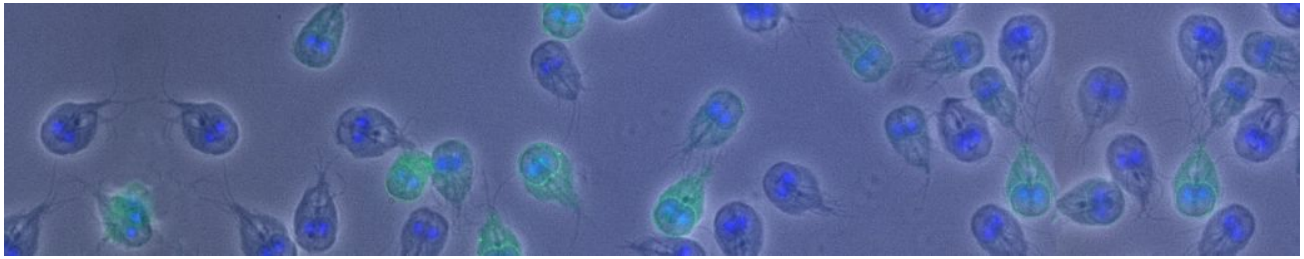
Giardiasis

&

Blastocystis

Dr Upninder Kaur
Assistant Professor
Department of Medical Parasitology
PGIMER, Chandigarh

Giardiasis



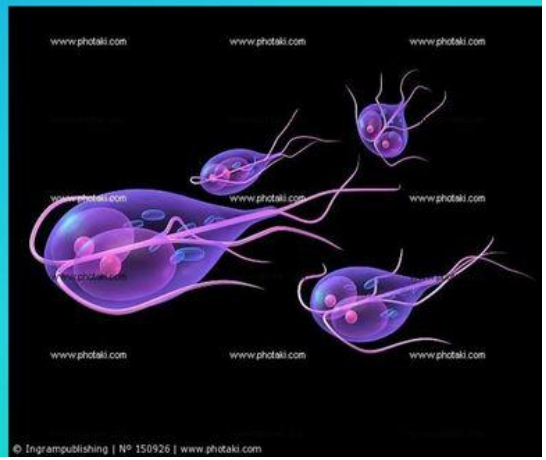
- The flagellate protozoan *Giardia intestinalis* (*G. lamblia* or *duodenalis*), its causative agent

- The most common enteric protozoal infection worldwide

Giardia lamblia

- Taxonomical Classification;

  Kingdom ; Protista
  Subkingdom ; Protozoa
  Phylum ; Sarcomastigophora
  Subphylum ; Mastigophora
  Class ; Zoomastigophora
  Order ; Diplomonadida



What you need to know about giardiasis?

- Giardiasis is also called the disease of "dirty hands" and most often children are ill. Although, according to research scientists, 20% of the world's population suffers from infection with Giardia

Infection is more common in **children** than in adults & quite often leads to epidemics

Giardiasis

- Also known as **beaver fever** in layman terms
- It is most common cause for diarrhea in hikers because mountain streams are loaded with Beaver's feces
- Beavers are reservoir for Giardia

Epidemiology

- More than 280 million cases of giardiasis worldwide each year
- Affecting nearly 2% of adults & 8% of children in developed countries
- 33% of the population in developing countries have been infected
- The largest reported affected children 0 to 4 years of age
- Peak incidence occurs in late summer & early fall due to outdoor water activities

Table 3 Prevalence rates of giardiasis observed in various studies in India

Site of study	*n*	Year	Population	% Prevalence
Northern India				
Amritsar	150	1995	Children <3 y with chronic diarrhea	4
Chandigarh	550	2004	Low socioeconomic status	6
Chandigarh	600	2005	General population	5.5
Chandigarh	970	1991	Low socioeconomic status	69.5
Chandigarh	82,667	2000	Outpatients	4–9
Chandigarh	120	1994	Infants with intractable diarrhea	6
Delhi	175	2008	Children with persistent diarrhea	20
Delhi	127	2002	Children with diarrhea	11
Delhi	100	2008	Adult and children with malabsorption	24
Delhi	939	2002	Urban slum dwellers	8.4
Lucknow	1,071	2007	Urban and rural population	22
Lucknow	1,061	1997	Pre-school slum children	32.9
Punjab	–	1986	Pre-school children	35.1
Srinagar	514	2007	School children	7.2
Southern India				
Bangalore	361	1990	Children with diarrhea	8–10 (<6 m–2.1)
Pune	76	1991	Children <5 y with diarrhea	7.9
Chennai	324	2002	Rural (n=125) and urban (n=199) population	16 (rural), 22.6 (urban)
Karnataka	10,000	1998	Adults	37.1
Karnataka	1,020	1989	Adult and children, healthy	2.5
Vellore	78	1998	Asymptomatic rural population	53.8
Vellore	452	2009	Children in urban slum	22.9
Eastern India				
Varanasi	2,095	1999	Patients with acute diarrhea	1.7
Bihar	326	1996	Rural and semi-urban	28.2
Kolkata	383	1984	Under five children with diarrhea	0.4
Kolkata	1,103	2009	Children and adults with diarrhea	13.3
Kolkata	2,519	2010	Hospitalized patients with diarrhea	11.2
Sikkim	2,559	1970	General population	5.9

Prevalence of intestinal parasites in the patients with suspected gastrointestinal infections

Upninder Kaur, Taruna Kaura, Sofia Rani, Rakesh Sehgal

Abstract:

BACKGROUND: Intestinal parasitic infections (IPIs) are considered a serious public health problem worldwide, particularly in developing countries. It is important to study the trend distribution of IPIs in a particular community. The prevalence rate of intestinal parasites in the present study was undertaken in patients who were reported with suspected gastrointestinal infections at PGIMER, Chandigarh, from May 2013 to April 2017.

MATERIALS AND METHODS: A four-year study was conducted in which all the suspected patients having gastrointestinal infections attending both Nehru Hospital and Outpatient Department attached to Post-Graduate Institute of Medical Education and Research, Chandigarh, were analysed for IPIs at Department of Medical Parasitology, PGIMER, Chandigarh. Direct microscopic examination of stool samples was done using saline and iodine preparations.

RESULTS: 1042/2404 samples were found to be positive for intestinal parasites. The predominant parasite isolated was *Giardia lamblia* with a prevalence rate of 68.9% followed by *Entamoeba histolytica* (14.9%). The present study showed preponderance of males (69.2%) than females (30.7%). The most affected age group varied with the type of IPI and maximum cases were observed in monsoon period.

CONCLUSIONS: The epidemiological studies of these parasites are necessary for effective prevention and control strategies. More surveillance studies, therefore, should be planned to establish the exact proliferation and prevalence of intestinal parasites in a particular region.

Keywords:

Gastrointestinal infections, intestinal parasites, prevalence

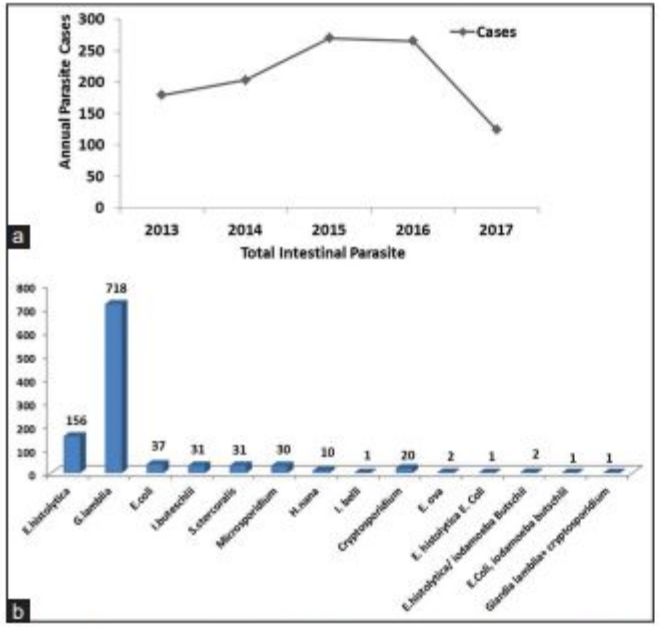


Figure 1: Year-wise prevalence and distribution of intestinal parasitic infections

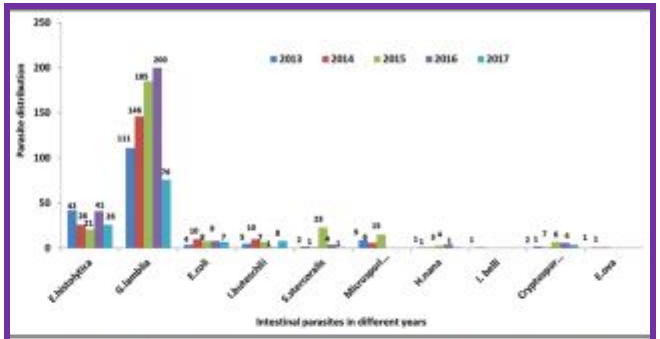
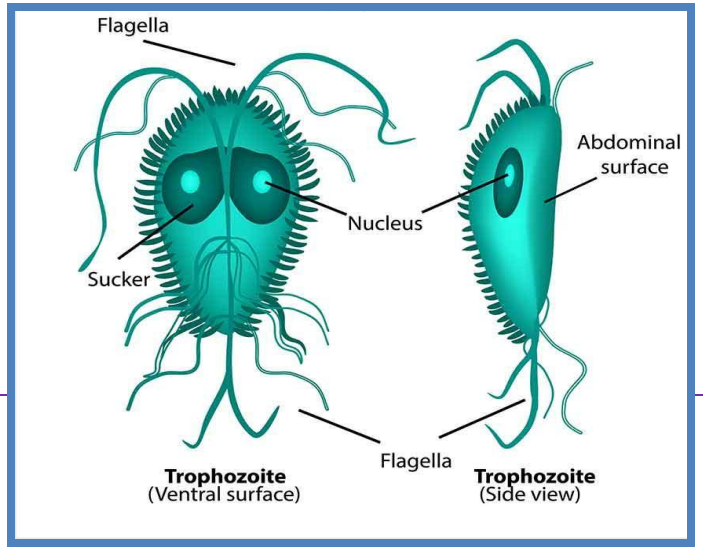


Figure 2: Year-wise distribution of different intestinal parasitic infections

FORMS



- *Dominant & active - trophozoite*
- *Inactive - cyst*

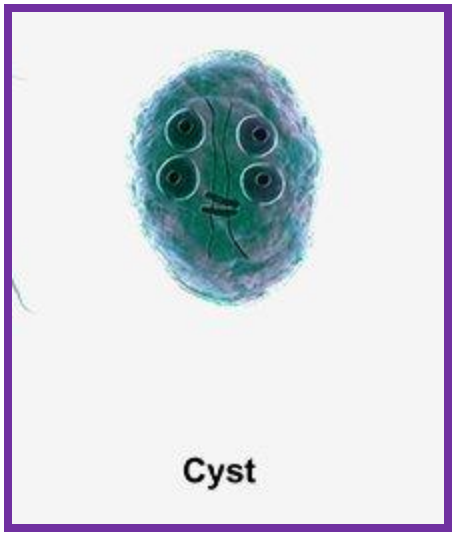
Active Trophozoite is characterized by pear shape, four pairs of flagella for its motility & two nuclei on either side

Sticks to the intestinal lining using a hook-like ‘sucker’

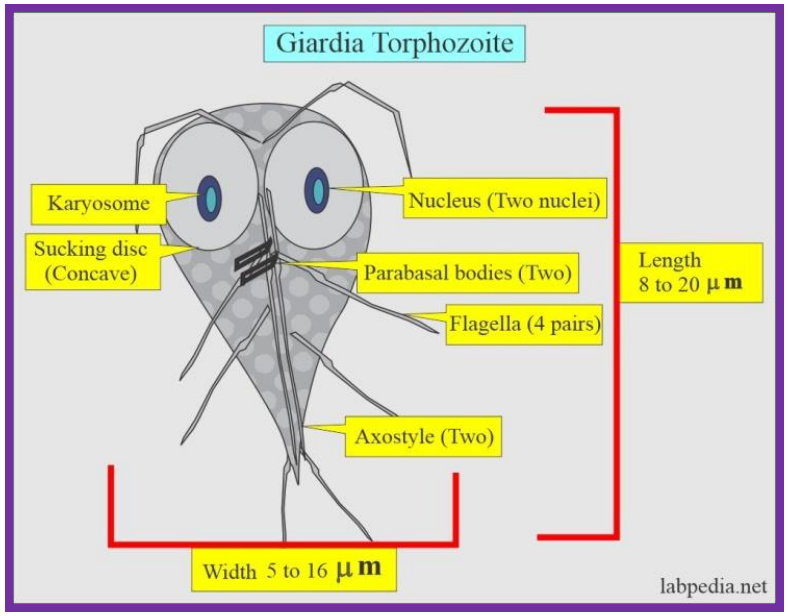
Although active, the trophozoite cannot live outside of the human body for long, therefore, it confines itself in a hard-shelled cyst

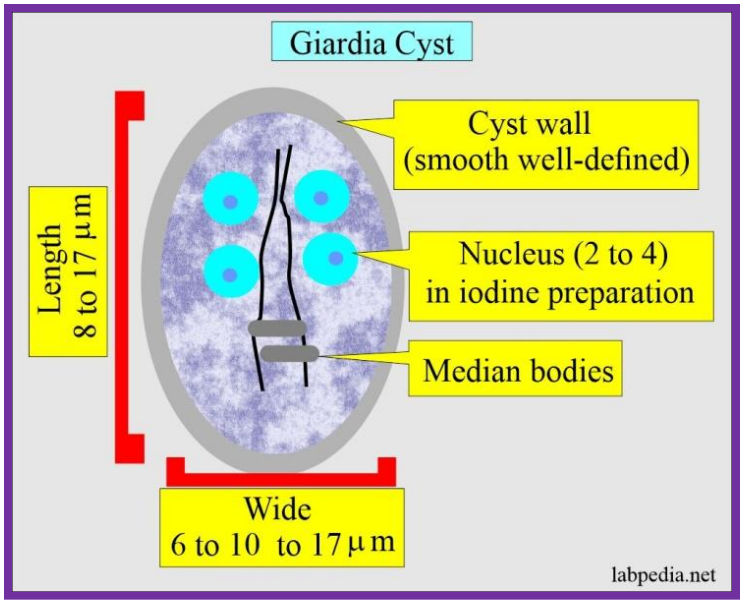
FORMS

Inactive cyst can exist for longer duration outside the body and is responsible for contaminating food & water particles



When the contaminated food or water is consumed, the inactive cyst becomes active & transforms itself into the disease-causing trophozoite


Giardia Torphozoite
Karyosome
Nucleus (Two nuclei)
Sucking disc (Concave)
Parabasal bodies (Two)
Flagella (4 pairs)
Axostyle (Two)
Length 8 to 20 µm
Width 5 to 16 µm
labpedia.net


Giardia Cyst
Cyst wall (smooth well-defined)
Nucleus (2 to 4) in iodine preparation
Median bodies
Length 8 to 17 µm
Wide 6 to 10 to 17 µm
labpedia.net

Causes

- The primary reason for the spread - is the consumption of unsafe food & water infected with parasites
- Swimming pools, municipal water supplies & natural water lakes
- Hands are contaminated with fecal matter during a diaper change or improper washing of hands

Pathophysiology

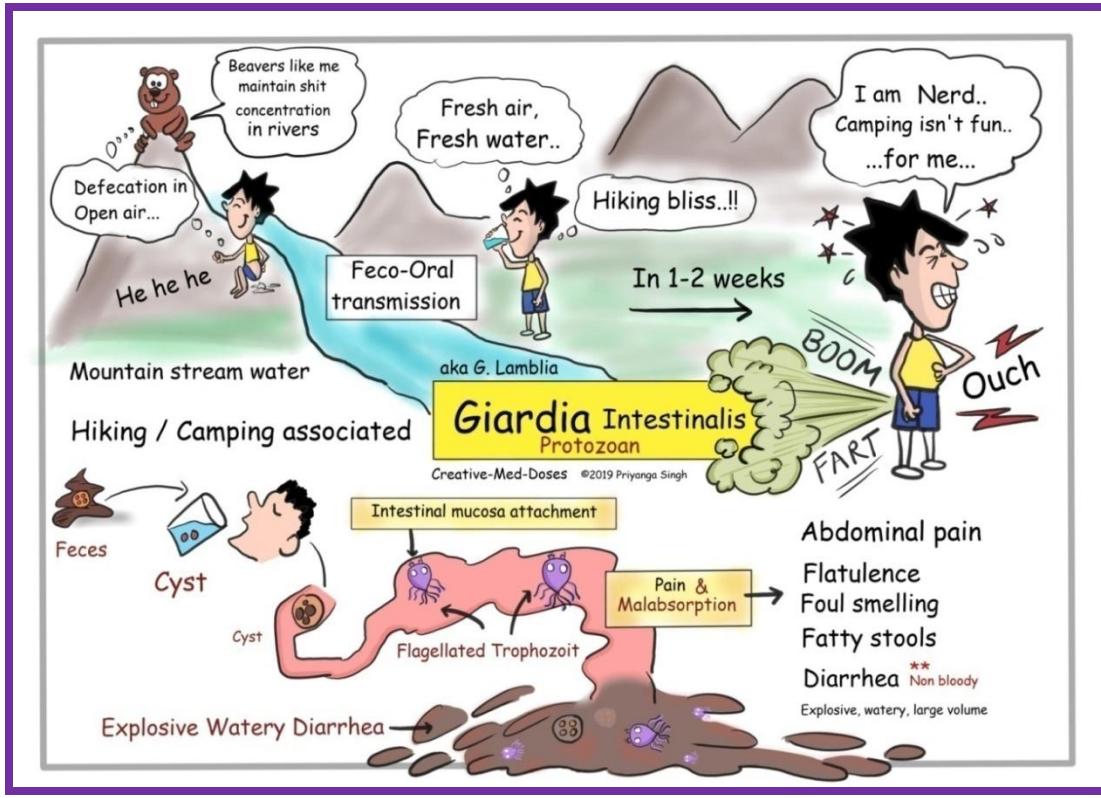
- **Ventral disk** of the trophozoites that they use to adhere to the intestinal epithelium - responsible for causing the various signs & symptoms

- Protozoa disrupt small intestine epithelial cell junctions as well as brush border enzymes

- Affected patients show altered gastrointestinal motility

Symptoms

- Although some people have the parasite in them, they don't show any signs & symptoms but can spread the infection onto others
- For people where the trophozoite is active - symptoms develop 1-2 weeks after getting infected by the parasite & last for 2-6 weeks
- Common symptoms :
  - Foul-smelling watery diarrhea
  - Greasy stools
  - Abdominal cramps and bloating
  - Loss of appetite
  - Headache
  - Gas or flatulence
  - Fatigue or malaise
  - Nausea or vomiting
  - Weight loss
  - Dehydration
  - Dizziness or confusion



Symptoms

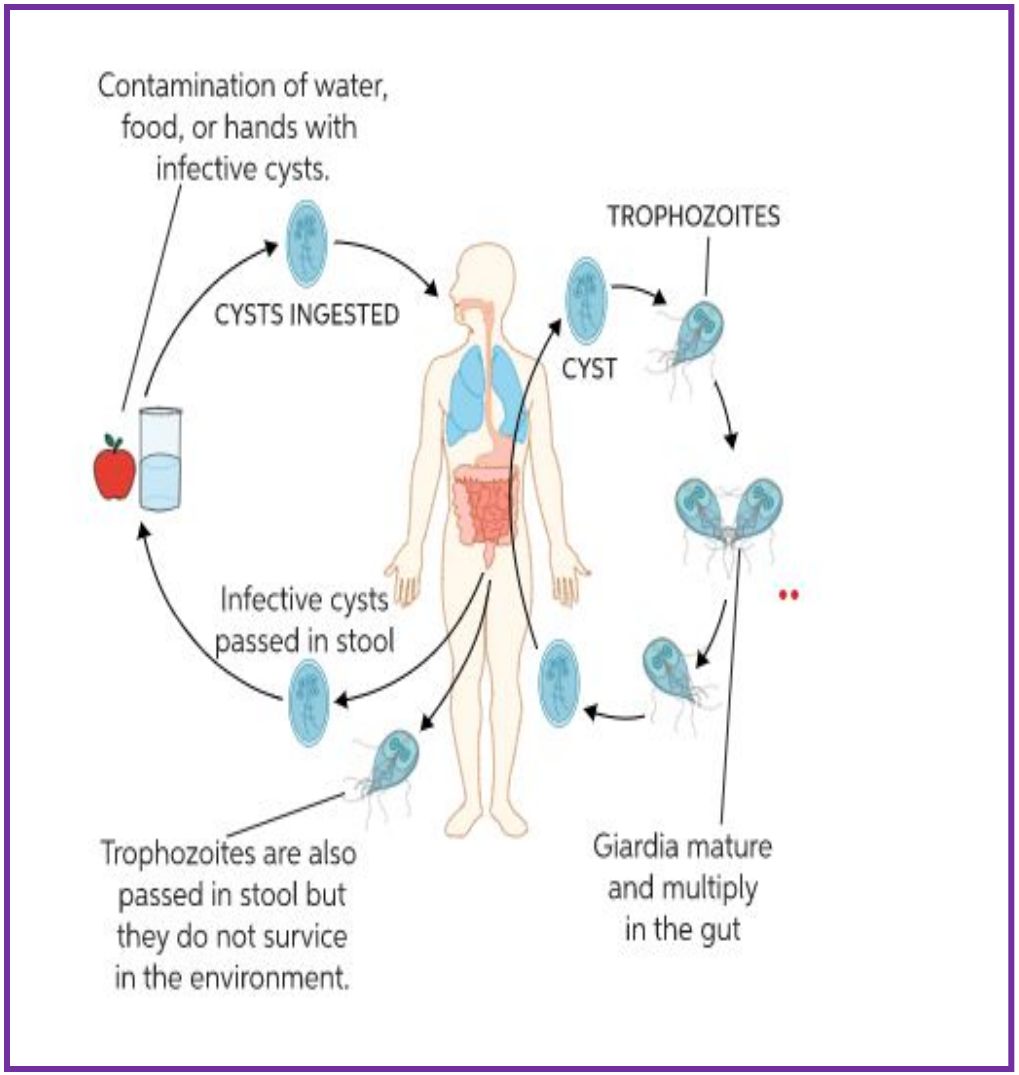
- Asymptomatic infected people - exhibit **weight loss** because Giardia obstructs in fat absorption
- Fever & vomiting are unusual symptoms
- Although it is not fatal, with time, especially in children, if left untreated can lead to complications such as **dehydration, malnutrition & lactose intolerance**
- In children, prolonged giardiasis can impair mental development
- Experience symptoms outside of the gastrointestinal tract, such as itchy skin, hives, and swelling of the eyes and joints, although these are less common

Transmission

- Transmitted via the fecal-oral route with the ingestion of cysts
- Primary routes - personal contact & contaminated water & food

- Cysts can stay infectious - for up to three months in cold water

Life Cycle of Giardia



Risk factors

- People in childcare settings
- Touching contaminated surfaces like bathroom handles
- People who are in close contact with someone who has the disease
- Travelers within areas that have poor sanitation
- Backpackers or campers who drink untreated water from springs, lakes or rivers

- Swimmers who swallow water from swimming pools,
- Untreated recreational water from springs, lakes, or rivers
- People with weakened immune systems
- People who have contact with infected animals or animal environments contaminated with feces

Assemblage Distribution

- *Giardia* is considered to be a species complex of several assemblages
- Seven genetic assemblages (A-F)
- Only Assemblages A & B are predominantly associated with human infections

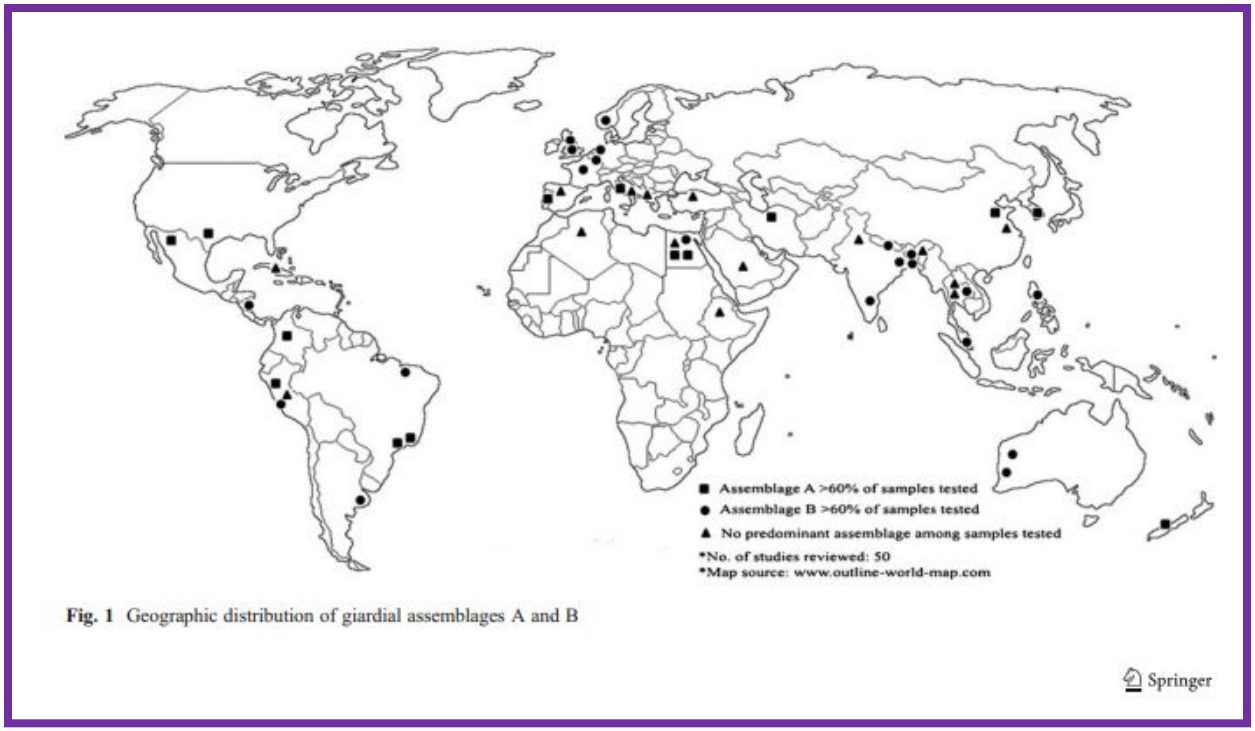


Fig. 1 Geographic distribution of giardial assemblages A and B

Springer

Table 1 Global prevalence rates of giardial assemblages

Country/ Region	Year	*n*	Assemblage %		
			A	B	Mixed
Asia					
South Korea	2000	07	100	0	0
China (Anhui province)	2000	08	50	50	0
China (Henan province)	2010	18	66.6	33.4	0
Bangladesh	2005	283	07	82	06
Philippines	2007	133	14	86	0
Nepal	2009	35	20	74	6
Malaysia	2009	42	02	98	0
Thailand	2010	61	08	51	41
Thailand	2000	12	41.7	58.3	0
India	2009	101	6.9	87	5.9
Middle East and Africa					
Iran	2008	38	87	7.8	5.2
Saudi Arabia	2010	40	57.5	37.5	5
Egypt	2004	105	49	10	15
	2008	89	65	14	21
	2009	41	75	20	05
	2008	18	05	80	15
Ethiopia	2007	59	53	22	25
Algeria	2009	41	36	56	06
Europe					
UK	2002	33	27	64	09
	2010	267	24	73	03
Belgium	2009	72	0	70	30
Turkey	2004	44	43	57	0
France	2005	25	36	64	0
Norway	2007	63	05	95	0
Albania	2006	22	45.5	54.5	0
Netherlands	2006	98	35	65	0
Italy	2002	30	80	20	0
	2005	37	43	27	30
Portugal	2006	25	100	0	0
Spain	2008	108	40	57	04
South America					
Mexico	2008	12	100	0	0
Colombia	2007	24	100	0	0
Nicaragua	2008	119	21	79	0
Argentina	2008	43	07	93	0
Peru (Trujillo)	2008	16	62.5	37.5	0
Peru (Lima)	2010	166	39.7	48.7	12
	2003	25	24	76	0
Brazil (Sao Paulo)	2007	37	78	22	0
Brazil (Rio de Janeiro)	2007	62	100	0	0
Brazil (Ceara)	2008	58	16	74	10
Cuba	2008	20	45	55	0
North America					
Texas	2009	8	75	25	0
Australia and New Zealand					
Australia	2010	124	25	75	0

Thakur *et al. BMC Res Notes* (2021) 14:26
https://doi.org/10.1186/s13104-020-05419-1

BMC Research Notes

RESEARCH NOTE Open Access

Genetic diversity of *Giardia* isolates from patients in Chandigarh region: India

Shabnam Thakur, Upninder Kaur and Rakesh Sehgal*

Abstract

Objective: The aim of study was to characterize *Giardia* isolates genetically among patients in Chandigarh region, India. For this, nested PCR targeting fragment of the glutamate dehydrogenase (*GLUD1* earlier named as GDH) gene was used. Phylogenetic analysis was done by constructing neighbor-joining tree made out of the nucleotide sequences of *G. intestinalis* isolates obtained in this study and with the known sequences published in GenBank.

Results: Out of 40 samples, *GLUD1* gene was amplified in 33 samples (82.5%). The product of *GLUD1* gene was successfully sequenced only in 32 samples. In these samples, assemblage B was found in 27 (84.37%) samples whereas 5 (15.6%) samples had assemblage A. Among assemblage B most of them were of BIII. Therefore, genotyping of *Giardia* would be helpful in conducting epidemiological studies.

Keywords: *Giardia*, Genotype, *GLUD1* (glutamate dehydrogenase), PCR, Sequencing

Table 1 PCR results of samples with their assemblages

Sample No	PCR	Assemblages
1	+ve	B
2	+ve	B
3	+ve	B
4	+ve	B
5	+ve	B
6	+ve	B
7	+ve	B
8	+ve	B
9	+ve	B
10	+ve	B
11	+ve	B
12	+ve	B
13	+ve	Unable to sequence
14	+ve	B
15	+ve	B
16	+ve	B
17	+ve	B
18	+ve	B
19	+ve	B
20	+ve	B
21	+ve	A
22	+ve	B
23	−ve	–
24	−ve	–
25	−ve	–
26	−ve	–
27	−ve	–
28	+ve	B
29	+ve	B
30	+ve	A
31	+ve	B
32	−ve	–
33	+ve	A
34	+ve	B
35	−ve	–
36	+ve	B
37	+ve	B
38	+ve	A
39	+ve	A
40	+ve	B

Immunity

- In endemic regions, reinfections can be frequent - acquired immunity is limited
- Humoral immunity appears to be important for host defense against giardiasis
- Ig A antibodies are an important humoral response to infection, since trophozoites are localized to the intestinal lumen
- Patients with immunoglobulin deficiencies tend to have more severe disease, perhaps because of deficiencies in secretory IgA & cell-mediated immunity
- Patients with HIV infection have impaired immune response to the parasite
- Asymptomatic infections occur in the presence of HIV, although with progressive immunosuppression the risk of symptomatic infection increases

CLINICAL MANIFESTATIONS

- Severity of clinical manifestations is variable
  - About half of exposed individuals clear the infection in the absence of clinical symptoms
  - approx 15% of individuals shed cysts asymptomatically
  - the remaining 35 to 45% of individuals have symptomatic infection
- The nature of clinical manifestations in an individual depends
  - virulence of the isolate, the parasite load & the host immune response

› Br J Biomed Sci. 2005;62(2):63-5. doi: 10.1080/09674845.2005.11732686.

Altered lipid parameters in patients infected with Entamoeba histolytica, Entamoeba dispar and Giardia lamblia

D Bansal [1], H S Bhatti, R Sehgal

Affiliations – collapse

Affiliation

1 Department of Parasitology, Postgraduate Institute of Medical Education and Research, Chandigarh, India.

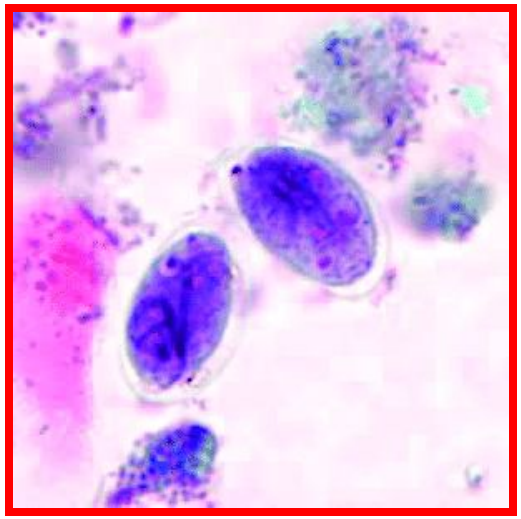
PMID: 15997878 DOI: 10.1080/09674845.2005.11732686

Abstract

Information on the effect of parasitic infections on lipid parameters is scarce. Certain parasites induce significant changes in lipid parameters, as demonstrated by the fact that substitution of lipid/cholesterol for serum in axenic culture medium (in vitro) and in experimental models (in vivo) supports vigorous growth of Entamoeba histolytica. Thus, significant changes in lipid parameters may be induced in an infected host. Blood samples are obtained from intestinal amoebiasis patients passing E. histolytica (n=8), E. dispar (n=15) or Giardia lamblia (n=9) cysts, or diagnosed with amoebic liver abscess (ALA; n=50) and from apparently normal healthy individuals (control group; n=30). Levels of total serum cholesterol, high-density lipoprotein and low-density lipoprotein are assessed using commercial kits. E. histolytica and E. dispar isolates are differentiated by hexokinase isoenzyme electrophoresis and by enzyme-linked immunosorbent assay (ELISA; Techlab) tests. Results show that E. histolytica, E. dispar and G. lamblia cyst passers had significantly lower levels of total serum cholesterol (73.42 +/- 2.24 mg/dL), compared to levels in ALA cases (101 +/- 2.85 mg/dL) and in controls (166.26 +/- 2.02 mg/dL). Further study of a greater number of cases is needed to explore the relevance of this finding.

Diagnosis

- Microscopic examination of the stool is not preferred due to inconsistent shedding of trophozoites & cysts in infected hosts
- Multiple samples over a period of time, typically one week, must be examined
- **A trichrome stain** of preserved stool is another method used to detect *Giardia*



- Antigen Detection in stool specimens is the current test of choice & provides increased sensitivity

- Utilize either an immunofluorescent antibody (IFA) assay or a capture ELISA against cyst or trophozoite antigens

- Sensitivity - 85-98% ;
- Specificity - 90-100%

- Some commercial EIA tests are available in the microplate format for the detection of *Giardia* antigen in fresh or frozen stool samples & also in preserved stool

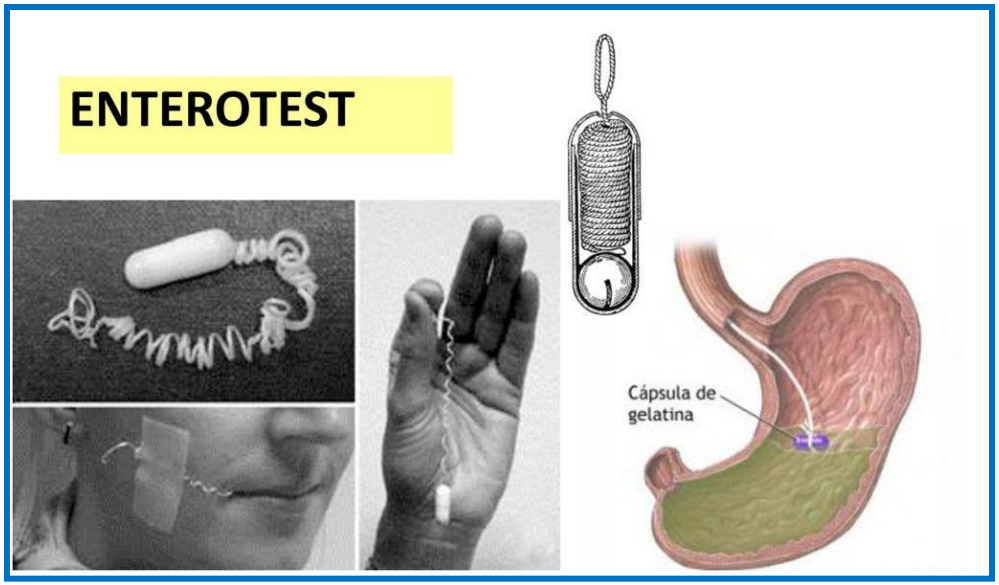
- Sensitivity - 94-100% ; Specificity - 100%

- Rapid immunochromatographic assays are available for the combined antigen detection of either *Cryptosporidium* & *Giardia* or *Cryptosporidium*, *Giardia* & *E. histolytica*

- Advantage - short test time & multiple results in one reaction device

Entero-Test

- String test or duodenal parasites test
- Simple convenient method of sampling duodenal contents/gastrointestinal fluid
- Uses a gelatin capsule with an attached thread
- One end is attached to the inner aspect of the host's cheek, and the capsule is swallowed



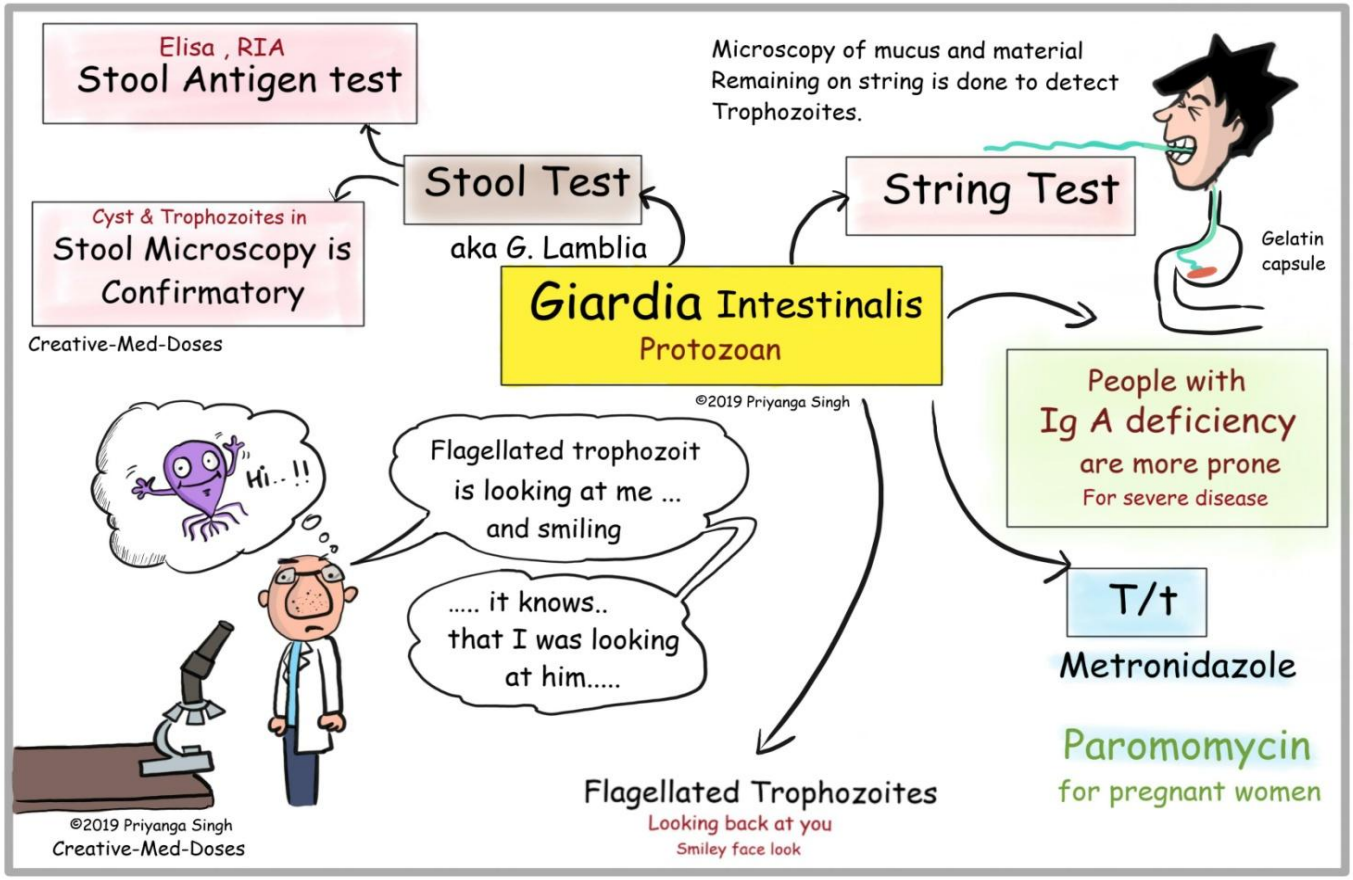
- Following a period of approx 4 hr, the string and any adsorbed gastrointestinal fluid is withdrawn through the mouth
- Shaken in saline to release trophozoites which can be detected with a microscope

Polymerase Chain Reaction

- PCR techniques may detect giardia in stool samples with parasites conc as low as 10 parasites / 100 mcL

- PCR may also be a valuable tool for screening of water supplies

- Excellent specificity & sensitivity


Elisa , RIA
Stool Antigen test
Microscopy of mucus and material Remaining on string is done to detect Trophozoites.
Stool Test
String Test
Cyst & Trophozoites in
Stool Microscopy is Confirmatory
aka G. Lamblia
Gelatin capsule
Creative-Med-Doses
Giardia Intestinalis
Protozoan
©2019 Priyanga Singh
People with
Ig A deficiency
are more prone
For severe disease
Hi..!!
Flagellated trophozoit is looking at me ... and smiling
..... it knows.. that I was looking at him.....
T/t
Metronidazole
Paromomycin
for pregnant women
©2019 Priyanga Singh
Creative-Med-Doses
Flagellated Trophozoites
Looking back at you
Smiley face look

Parasitol Res (1999) 85: 510–512

SHORT COMMUNICATION

Ajaib Singh Paintlia · Ramesh Chander Mahajan
Anuradha Chakraborti · Rakesh Sehgal
Nirmal Kumar Ganguly

Characterization of *Giardia lamblia* groups A and B from North India by isoenzyme and random amplified polymorphic DNA analysis

Abstract *Giardia lamblia* (syn. *G. intestinalis*) infection in young adults leads to acute/chronic diarrhea in some individuals and is asymptomatic in others. Recently, *G. lamblia* strains have been characterized as group A (symptomatic) and group B (asymptomatic or control) by advanced isoenzyme and molecular biology studies. In the present brief pilot study, ten *G. lamblia* isolates obtained from five symptomatic (group A) and five asymptomatic (group B) persons were characterized by isoenzyme and random amplified polymorphic DNA (RAPD) analysis. Isoenzyme analysis demonstrated remarkable homogeneity in seven enzyme patterns, the exception, being that of phosphoglucomutase, for which two zymodemes (I and III) were observed. In contrast, RAPD analysis showed homogeneity for eight primers; exceptions were two primers, A_{02} and B_{05}, which separated group A *G. lamblia* isolates into two rapdemes (A_{R1} and A_{R2}) and group B *G. lamblia* isolates into four rapdemes (B_{R1}, B_{R2}, B_{R3} and B_{R4}). Further phenetic analysis showed average genetic distances of 0.105 within group A and 0.121 within group B *G. lamblia* isolates according to Jaccord's distance scale, which suggests that both lineages appear to consist of a range of variants with no significant ($P < 0.05$) genetic diversity. The two techniques demonstrated a positive association with regard to differentiation between group A and group B *G. lamblia* isolates. These very preliminary results indicate that RAPD analysis could be a potentially useful substitute for isoenzyme analysis.

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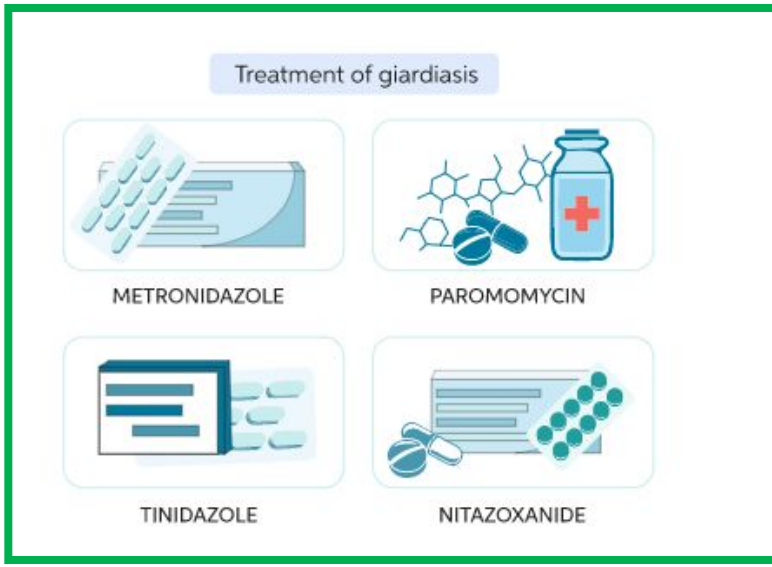
Department of Parasitology,
Postgraduate Institute of Medical Education and Research,
Chandigarh 160012, India

Treatment

- Treatment is not always necessary as the infection usually resolves on its own
- Nitroimidazole medication is used
- WHO - recommend metronidazole as first line therapy
- **Probiotics**, when given in combination with the standard treatment, has been shown to assist with clearance of *Giardia*



Drugs commonly used to treat giardiasis

DRUG	ADULT DOSE	SCHEDULE	COMMENT
Tinidazole	2 g	1 time	Can be given to children 3 years of age and older Pregnancy drug class C
Metronidazole	250, 500, or 750 mg	1 time or 3 times daily for 5 days. (Usually 250 mg, 3 times a day, for 5 days)	Contraindicated in first trimester of pregnancy
Mebendazole	100 mg	Twice daily for 5 days	Contraindicated in first trimester of pregnancy Pregnancy drug class B
Nitazoxanide	500 mg	Twice daily for 3 days	Can be given to children 1 year of age and older Available in liquid form Pregnancy drug class B
Albendazole	200-400 mg	Twice daily for 5 days	Pregnancy drug class C

Differential Diagnosis

Differential diagnosis includes:

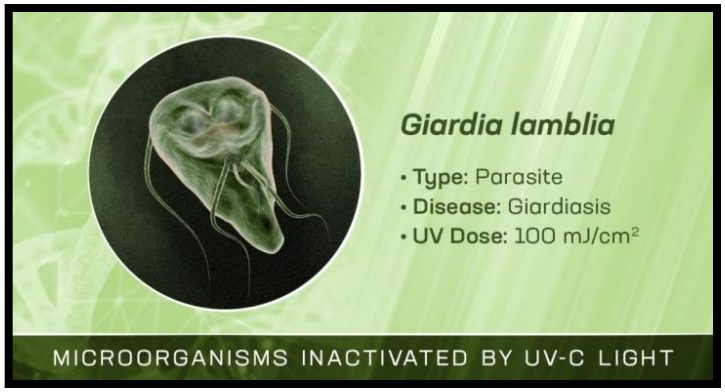
- Travelers' diarrhea
- Lactose intolerance
- Inflammatory bowel disease
- Cryptosporidiosis
- Irritable bowel syndrome
- Strongyloidiasis
- Viral gastroenteritis

  – CDC recommends testing all individuals with diarrhea lasting more than three days for giardiasis

Prevention

- CDC recommends hand-washing

- Avoiding contaminated food & untreated water
- Boiling water - kills infectious cysts



- Chemical disinfectants or filters may be used
- Iodine-based disinfectants are preferred over chlorination as the latter is ineffective at destroying cysts

Prognosis

- In people with a good immune system, infection may resolve without medication
- A small portion, however, develop a chronic infection
- People with an impaired immune system - at higher risk of chronic infection
- Children with chronic giardiasis are at risk for failure to thrive as well as growth stunting
- Up to half of infected people develop a temporary lactose intolerance
- Some people experience post-infectious irritable bowel syndrome
- Development of food allergies due to its effect on intestinal permeability

Applying genome technologies

- Researchers are using advanced genome technologies to study *Giardia*

- Parasite has a compact genome

- Making it possible to investigate genes that regulate fundamental aspects of parasite biology including:

3D structure of multiple proteins important to the life cycle of Giardia.

  - Invasion & development within the host
  - Understanding the genes that control key aspects of parasite biology will underpin approaches to detect, treat & control giardiasis

Vaccine

- There are no vaccines for humans
- There are several vaccine candidates in development
- They are targeting: recombinant proteins, DNA vaccine, variant-specific surface proteins (VSP), cyst wall proteins (CWP)
- At present, one commercially available vaccine exists – ***GiardiaVax***, made from *G. lamblia* whole trophozoite lysate
- Vaccine for veterinary use only in dogs & cats

G. duodenalis in HIV/AIDS patients

- Involved in acute/chronic diarrhea & subsequent weight loss

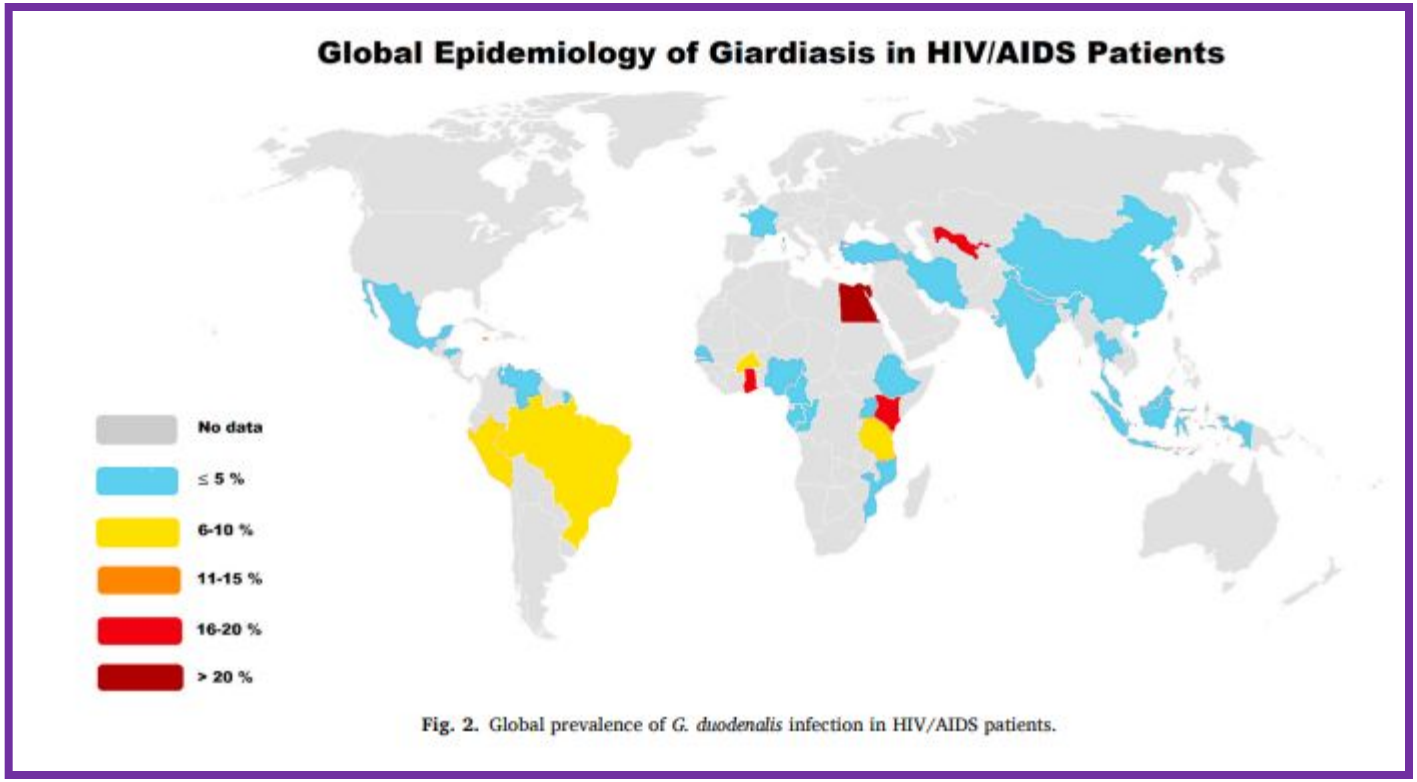


Fig. 2. Global prevalence of *G. duodenalis* infection in HIV/AIDS patients.

Mahdavi et al, 2021

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Case Report

A report on a case of Giardia duodenalis

Pudasaini Sujata[1], Pathak Rakesh[1], Upadhyaya Satyam[2], Sharma Anna[2]

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[2]Department of Pediatrics, Nepal Medical College Teaching hospital, Kathmandu, Nepal

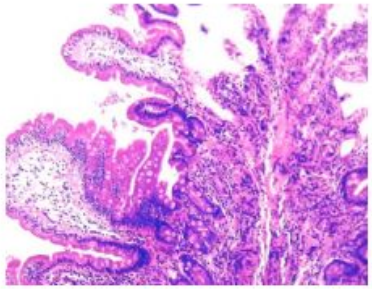

Figure 1: *Duodenal mucosa with numerous Giardia trophozoites (HE stain, x 100)*

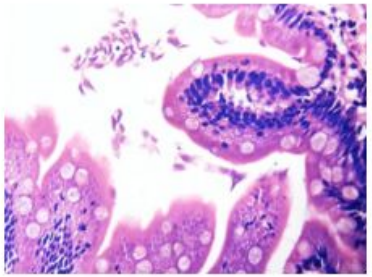

Figure 2: *Photomicrograph showing high power view of Giardia trophozoites (HE stain, x 400)*

A four-year-old boy presented with complaints of chronic diarrhea to an out patient department of Pediatrics. Patient was having diarrhea since 2 years of age. Since then the child was on treatment for chronic diarrhea. Milestone of the child was normal except for the weight which was 15 kgs. Hematological profile was normal. Endoscopy was done. Though the patient showed no abnormality of duodenum on endoscopy ; the diagnosis of Giardiasis was confirmed on histological examination.

Histopathology revealed severe degree of inflammation , the surface epithelium showed trophozoites of *Giardia lamblia*.

CASE REPORTS AAEM
Ann Agric Environ Med 2005, 12, 299–303

CUTANEOUS MANIFESTATION OF GIARDIASIS - CASE REPORT

Aldona Pietrzak[1], Grażyna Chodorowska[1], Janusz Urban[1], Violetta Bogucka[2], Ewa Dybiec[3]

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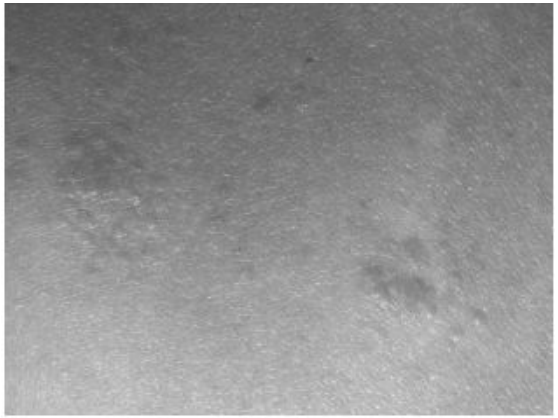
[2]Department of Educational Psychology and Psychoprevention UMCS, Lublin, Poland
[3]Department of Paediatric Radiology, Medical University of Lublin, Lublin, Poland

- A 31-year-old female patient, a physician, was referred to the Outpatient Clinic of the Dermatological Department with a 2.5 month history of skin lesions
- Initially, the patient noted the appearance of 2 painless itching areas
- Examination revealed lesions (1-4 cm in diameter) with tiny, vesicle-like papules and without any signs of inflammation, located on the skin of shoulders, upper parts of the arms and back



- The mycological examination with potassium hydroxide (direct KOH test) was negative

- Antigens of *Giardia intestinalis* were detected in the faeces using immunoenzymatic test (Elisa *Giardia Lamblia* Antigen)

- The histological examination of the skin biopsy specimen showed a normal epidermis

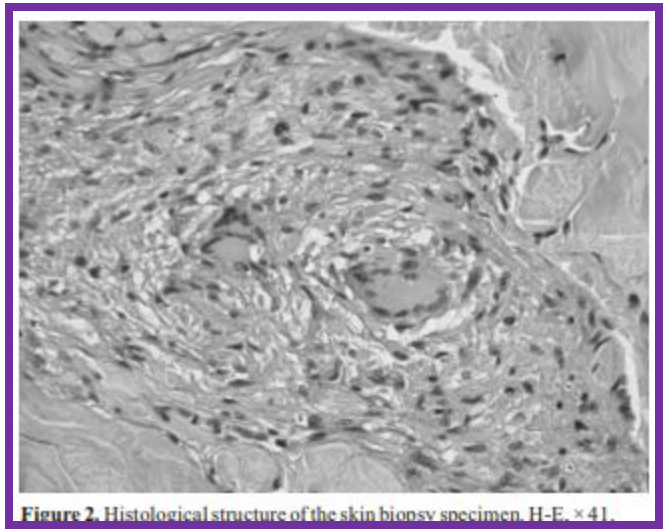


Figure 2. Histological structure of the skin biopsy specimen. H-E. ×41.

- The patient started oral treatment with metronidazole: 250 mg, 3 times a day, for 10 days; after a 1-week break, the patient continued treatment with metronidazole: 250 mg, 3 times a day, for 3 days; and next took 1 dose of tinidazole (2 g)

- Complete clearance of skin lesions

- During 3 years no recurrence of the skin disease was observed

OPEN

Intraepithelial *Giardia Intestinalis*: A Case Report and Literature Review

Mario Noé Martínez-Gordillo, BSc, Angélica González-Maciel, BSc, MSc, Rafael Reynoso-Robles, BSc, Ericka Montijo-Barrios, MD, MSc, and Martha Ponce-Macotela, MD, PhD

From the Laboratorio de Parasitología Experimental (MNM-G, MP-M); Laboratorio de Microscopia Electrónica (AG-M, RR-R); and Servicio de Gastroenterología y Nutrición, Instituto Nacional de Pediatría (EM-B).

Correspondence: Martha Ponce-Macotela, Laboratorio de Parasitología Experimental, Instituto Nacional de Pediatría, Insurgentes Sur No. 3700-C, C.P. 04530, Mexico City, Mexico (e-mail: macotelam@ya-

Abstract: The giardiasis is a neglected parasitic disease. The WHO has estimated more than 280 million of human infections each year; however, intraepithelial giardiasis is a rare entity, there are only 5 reports showing invasive giardiasis.

A pediatric female patient with chronic abdominal pain, diarrhea, or pasty stools, without fever, was seen in the Gastroenterology and Nutrition Service. The stool studies were negative for pathogens and lactose hydrogen breath test was positive. The presumptive clinical diagnosis was giardiasis and the patient was empirically treated with nitazoxanide. But, the patient persisted with abdominal pain and pasty stools.

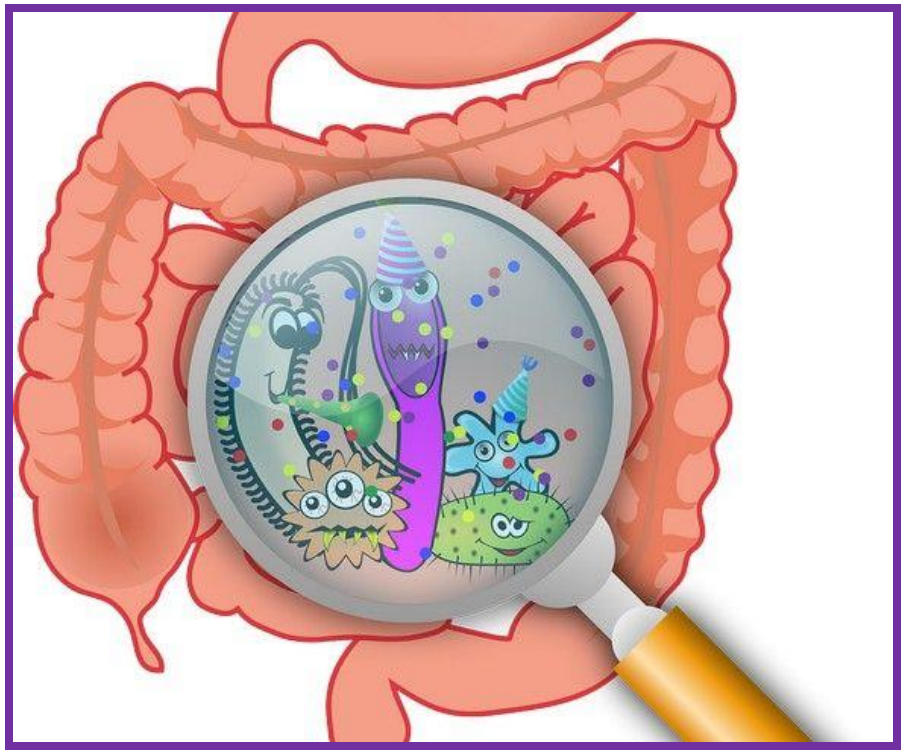
Endoscopy was indicated to search for *Helicobacter* and *Giardia*. Guardian and patient gave written informed consent. Hematological profile was normal. The endoscopy was performed under general anesthesia and the biopsies and duodenal aspirate were obtained. The microscopic analyses of duodenal fluid showed *Giardia* trophozoites. Electron microscopic analysis was negative for *Helicobacter pylori*, but *Giardia* trophozoites with a typical crescent shape within the tissue were found.

The patient was treated with tinidazole, subsequent tests showed that lactose absorption was normal, stool examinations were negative for *Giardia* and abdominal pain had stopped.

This case suggest that intraepithelial giardiasis could be a common entity but unseen because the giardiasis diagnosis is usually made on fecal samples. Future studies are necessary to determine the role of intraepithelial trophozoites in giardiasis pathogenic mechanisms

Blastocystis

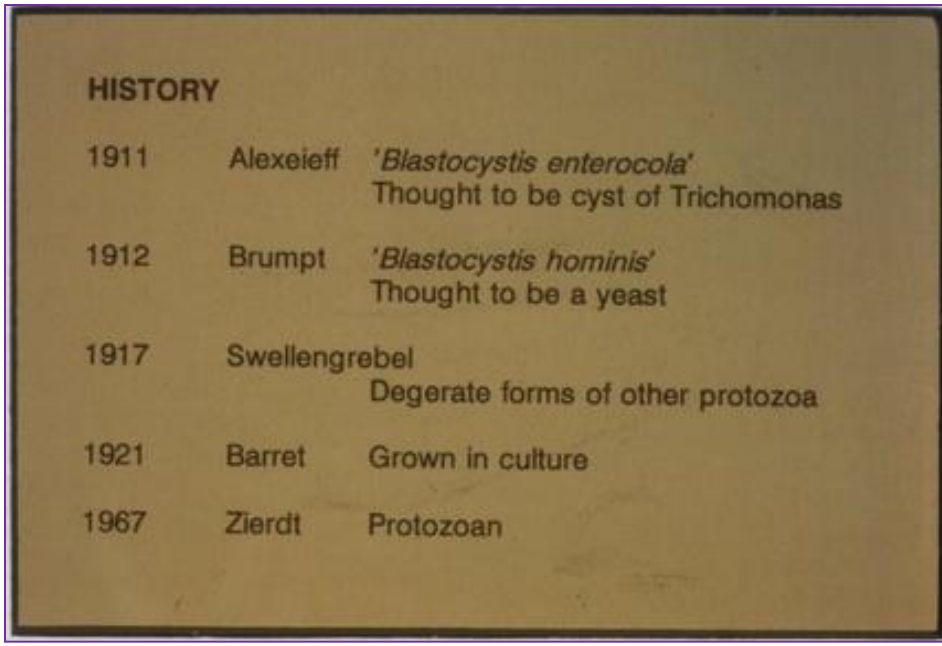
- *Blastocystis* is a protozoal, single-celled parasite that inhabits the gastrointestinal tracts of humans & other animals



- Blastocystis infection is called **Blastocystosis**

Classification

- Appropriate classification of *Blastocystis* has only recently been resolved
- Original description was as a yeast due to its yeast-like glistening appearance in fresh wet mounts & absence of pseudopodia & locomotion
- This was then contradicted by Zierdt, who reclassified it under subphylum Sporozoa (later in Sarcodina)
- Its sensitivity to antiprotozoal drugs & its inability to grow on fungal media further indicated that it was a protozoan



HISTORY

1911	Alexeieff	*'Blastocystis enterocola'* Thought to be cyst of Trichomonas
1912	Brumpt	*'Blastocystis hominis'* Thought to be a yeast
1917	Swellengrebel	Degerate forms of other protozoa
1921	Barret	Grown in culture
1967	Zierdt	Protozoan

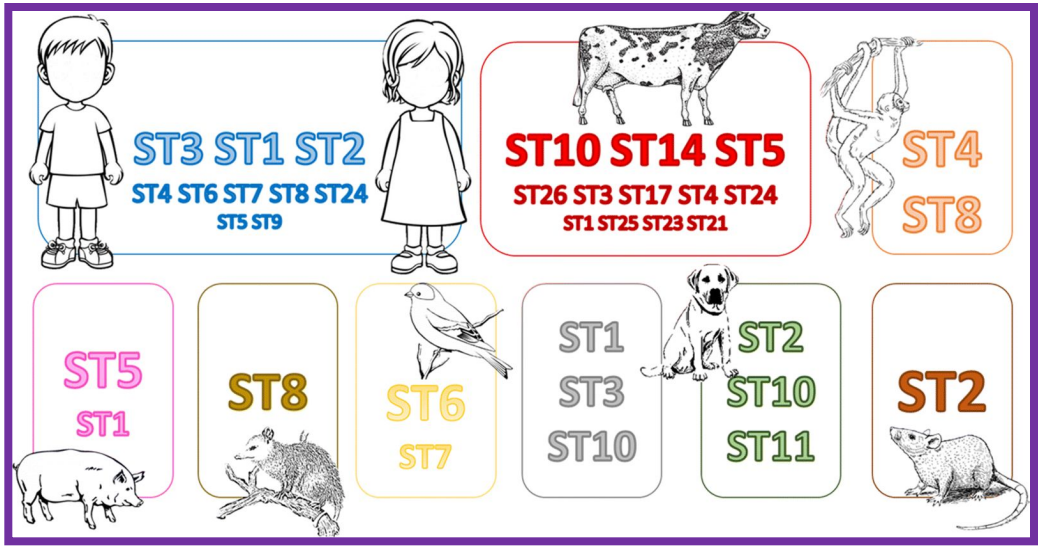
Blastocystis hominis

- Kingdom: Protista
- Subkingdom: Protozoa
- Phylum: Sarcomastigophora
- Subphylum: Sarcodina
- Superclass: Rhizopoda
- Class: Lobosea
- Subclass: Gymnamoeba
- Order: Amoebida
- Suborder: Blastocystina
- Genus: Blastocystis
- Species: Hominis

Epidemiology

- Global distribution
- Most common human parasites in the world
- Prevalence in humans often exceeds 5% in industrialized countries
- In less developed areas, infection rates as high as 100% have been observed
- High rates of infection are found in individuals in developed countries who work with animals

Subtypes & Prevalence



- 24 known subtypes (STs)
- Subtypes identified throughout Asia
- Only 10 have been identified in humans (ST1-ST9 & ST12)
- Subtypes 1, 2, 3 & 4 are the most common
- ST5 in pigs
- ST10 and ST14 in goats, sheep, and cattle
- ST6 and ST7 in birds
- ST1 and ST3 were most common in water samples

Blastocystis spp. in Environmental Sources & Food

Table 16. Prevalence and subtype distribution of *Blastocystis* spp. in food and environmental sourc

Country	Food/Environmental Source	No. of Samples Examined	No. of Positive Samples (%)	Subtypes (STs) Identified	Method(s)
Iran	Treated wastewater	12	5 (41.7)	ST2, ST6, ST8	F, MOL
Malaysia	River water	480	133 (27.7)	NA	MB, IVC
Malaysia	Drinking water treatment plants	85	22 (25.9)	NA	IMS, CM
Malaysia	River water	14	14 (100.0)	ST1, ST2, ST3	MF, MOL
	Various water sources			ST1, ST2, ST3, ST4, ST8, ST10	
Malaysia	River water	7	3 (42.9)	NA	MF, IVC
	Village water sources	16	1 (6.3)		
Nepal	River water	4	4 (100.0)	ST1, ST4	C, MOL
Philippines	Wastewater (influent)	31	7 (23.0)	ST1, ST2	C, IVC, MOL
	Wastewater (effluent)	31	2 (7.0)	ST1, ST2	
Turkey	Tap water	25	3 (12.0)	ST1	MOL
Turkey	Streams and drinking water	228	47 (20.6)	NA	CM
Turkey	River water	195	9 (4.6)	ST1, ST3	C, MOL
	Sea water	48	1 (2.1)	ST1	
Turkey	Surface water	75	4 (5.3)	ST1, ST3	C, MOL
Saudi Arabia	Leafy vegetables	470	13 (2.8)	NA	S, CM
Iran	Fresh vegetables	240	10 (4.2)	NA	S, CM
Syria	Fresh vegetables	128	13 (10.2)	NA	MOL
Korea	Ambient air	71	1 (1.4)	NA	MOL

C—Centrifugation, CM—Conventional microscopy, F—Filtration, IMS—Immunomagnetic separation technique, MB—Membrane filtration, MOL—Molecular technique, S—Sedimentation, NA—Not applicable.

Rauff-Adedotun et al ; 2021

STs 1, 2, 3, 4, 6, 8, 10 have so far been recorded from water samples
Prevalence of ST3 was highest, ST1 was the most widespread subtype

Table 1. Prevalence and subtype distribution of *Blastocystis* spp. in children in Asia (2010–2021).

Country	No. of Samples Examined	No. of Positive Samples (%)	Subtypes (STs) Identified	Method(s)	References
Bangladesh	5679	795 (14.0)	NA	CM, 1VC	Barua et al. [34]
Israel	45,978	5422 (11.8)	NA	CM, IVC	Ben-Shimol et al. [35]
China	170	1 (0.5)	NA	MOL	Zhang et al. [36]
China	609	87 (14.3)	ST1, ST2, ST3	MOL	Qi et al. [37]
China	466	71 (15.2)	ST1, ST3, ST6, ST7	IVC, MOL	Ning et al. [38]
Cambodia	308	15 (4.9)	NA	CM	Liao et al. [39]
India	195	32 (16.4)	NA	CN	Rayan et al. [40]
Indonesia	492	147 (29.9)	ST1, ST2, ST3	IVC, MOL	Yoshikawa et al. [41]
Indonesia	99	33 (33.3)	ST1, ST2, ST3	MOL	Zulfa et al. [42]
Indonesia	141	58 (41.1)	ST1, ST3, ST4	IVC, MOL	Sari et al. [43]
Indonesia	219	15 (6.8)	NA	CM	Subahar et al. [44]
Indonesia	157	44 (28.0)	NA	CM	Sari et al. [45]
Iran	124,366	3986 (3.2)	NA	CM	Ashtiani et al. [46]
Iran	864	36 (4.1)	ST1, ST2, ST3	CM, IVC, MOL	Niaraki et al. [47]
Iran	366	11 (3.1)	NA	CM	Mahmoudvand et al. [48]
Iran	650	37 (5.7)	NA	CM	Abdi et al. [49]

Table 1. *Cont.*

Country	No. of Samples Examined	No. of Positive Samples (%)	Subtypes (STs) Identified	Method(s)	References
Iran	1100	149 (13.5)	NA	CM	Daryani et al. [50]
Iran	350	15 (4.3)	NA	CM	Hazrati Tappeh et al. [51]
Iran	854	26 (3.0)	NA	CM	Norouzi et al. [52]
Iran	200	35 (17.5)	NA	CM	Babakhani et al. [53]
Iran	400	85 (21.3)	NA	CM	Bahmani et al. [54]
Iran	306	9 (2.9)	NA	CM	Saki and Amraee [55]
Iran	1465	31 (2.1)	NA	CM	Turki et al. [56]
Iraq	107	4 (3.7)	NA	CM	Mahdi and Al-Saadoon [57]
Lebanon	249	157 (63.0)	ST1, ST2, ST3	MOL	Osman et al. [58]
Malaysia	71	66 (93.0)	NA	CM	Abd. Ghani and Yusof [59]
Malaysia	300	77 (25.7)	NA	IVC	Abdulsalam et al. [60]
Malaysia	307	65 (21.2)	NA	CM	Al-Harazi et al. [61]
Malaysia	342	4 (1.2)	NA	CM	Sinniah et al. [62]
Malaysia	1760	186 (10.6)	ST1, ST2, ST3, ST4, ST5	IVC, MOL	Nithyamathi et al. [63]
Malaysia	116	2 (1.7)	NA	CM	Tang and Kamel [64]
Malaysia	92	77 (83.7)	NA	CM	Adli et al. [65]
Nepal	342	4 (1.2)	NA	CM	Mukhiya et al. [66]
Saudi Arabia	1289	11 (0.9)	NA	CM	Al-Mohammed et al. [67]
Saudi Arabia	581	10 (1.7)	NA	CM	Bakarman et al. [68]
Thailand	203	9 (4.4)	NA	CM	Suntaravitun and Dokmaikaw [69]
Thailand	1909	626 (32.8)	NA	CM	Sanprasert et al. [70]
Thailand	370	118 (31.9)	ST1, ST2, ST6	MOL	Thathaisong et al. [71]
Thailand	233	29 (12.5)	ST1, ST2, ST3	IVC, MOL	Pipatsatitpong et al. [72]
Thailand	299	10 (3.3)	NA	CM	Punsawad et al. [73]
Thailand	263	46 (17.5)	NA	CM, IVC	Assavapongpaiboon et al. [74]
Thailand	331	44 (13.3)	ST1, ST3	IVC, MOL	Boondit et al. [75]
Thailand	202	3 (1.5)	NA	CM	Kitvatanachai and Rhongbutsri [76]
Thailand	274	37 (13.5)	NA	CM	Popruk et al. [77]
Turkey	195	28 (14.4)	NA	CM	Güdücüoğlu et al. [78]
Turkey	328	77 (23.5)	NA	CM	Hamamci et al. [79]
Turkey	468	35 (7.4)	ST1, ST2, ST3, ST7	CM, IVC, MOL	Sankur et al. [80]
Turkey	1181	7 (0.6)	NA	CM	Calik et al. [81]
Turkey	219	97 (44.3)	ST1, ST2, ST3, ST4	MOL	Dogan et al. [82]

CM—Conventional microscopy, IVC—In vitro cultivation, MOL—Molecular technique, NA—Not applicable.

Subtypes identified - ST1, ST2, ST3, ST4, ST5, ST6 & ST7

Distribution of Blastocystis spp Subtypes

- Till now - 31 Asian countries

- Subtype identification was available for 22 countries

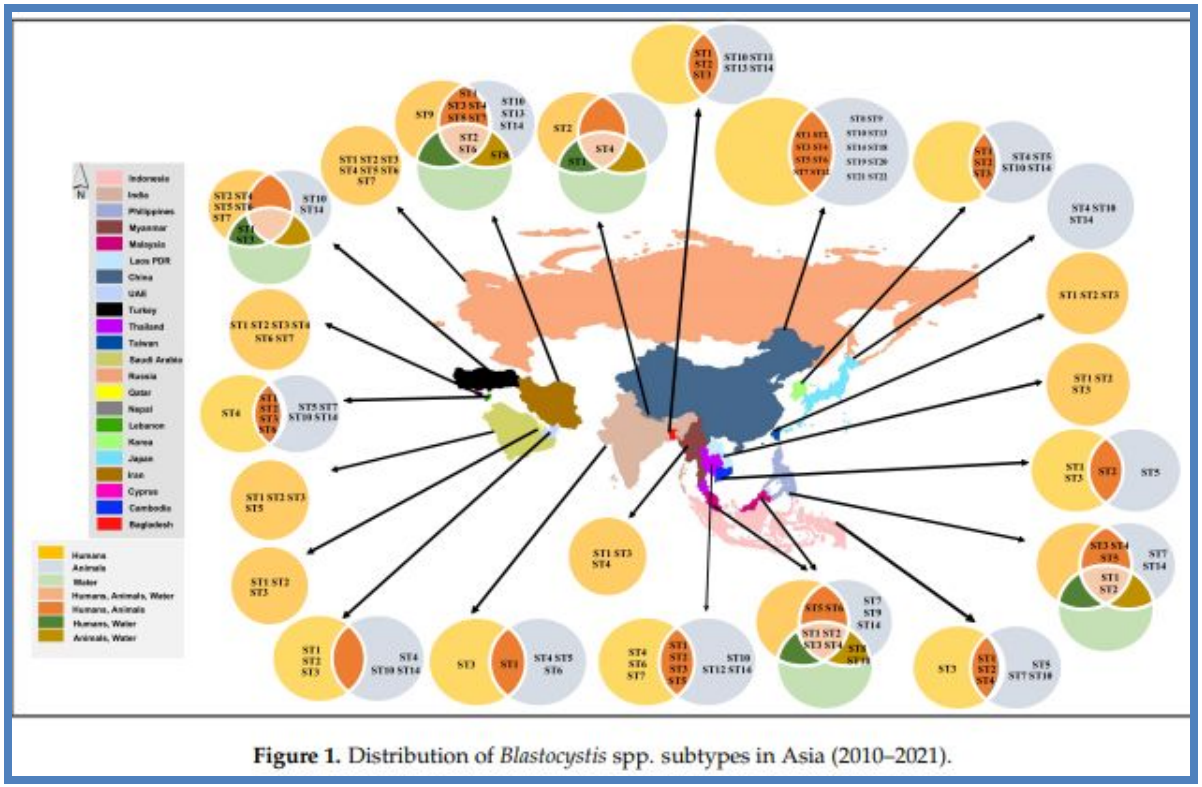
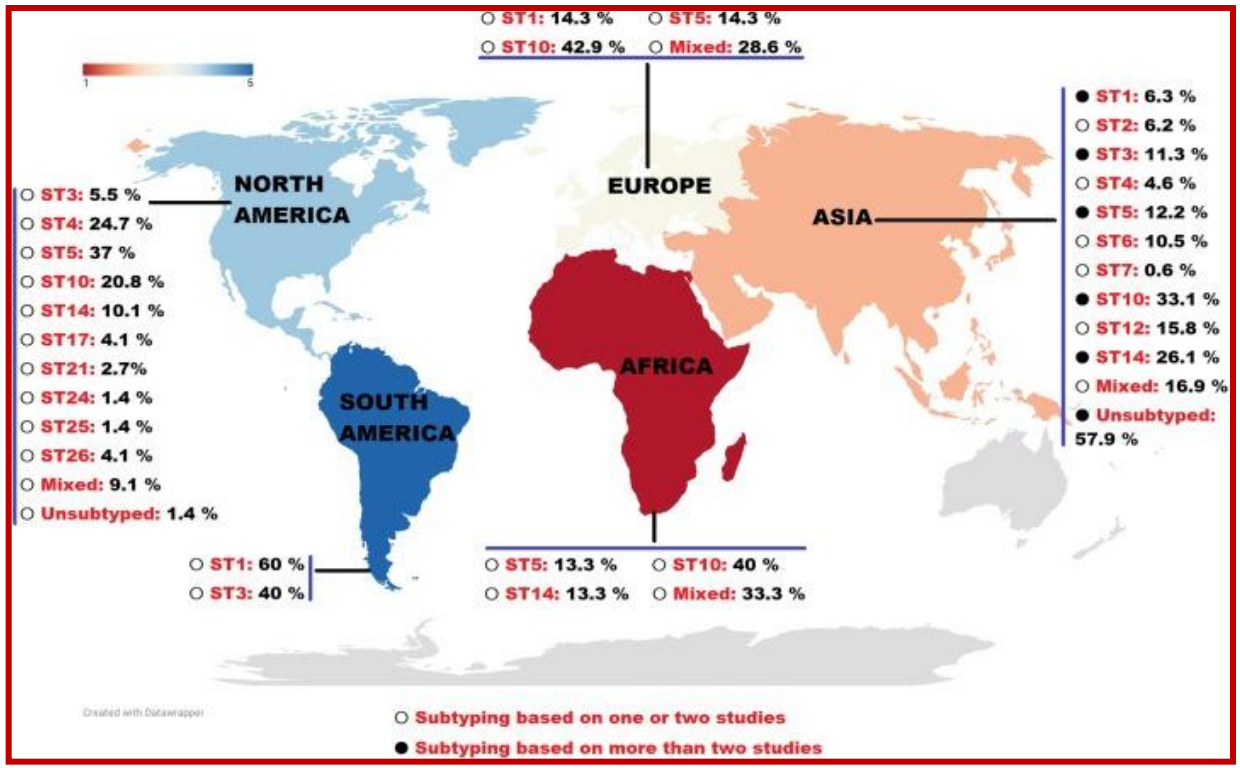


Figure 1. Distribution of *Blastocystis* spp. subtypes in Asia (2010–2021).

✔ The most widespread subtype - ST1


○ ST1: 14.3 %
○ ST5: 14.3 %
○ ST10: 42.9 %
○ Mixed: 28.6 %
1
5
NORTH AMERICA
○ ST3: 5.5 %
○ ST4: 24.7 %
○ ST5: 37 %
○ ST10: 20.8 %
○ ST14: 10.1 %
○ ST17: 4.1 %
○ ST21: 2.7%
○ ST24: 1.4 %
○ ST25: 1.4 %
○ ST26: 4.1 %
○ Mixed: 9.1 %
○ Unsubtyped: 1.4 %
EUROPE
ASIA
● ST1: 6.3 %
○ ST2: 6.2 %
● ST3: 11.3 %
○ ST4: 4.6 %
● ST5: 12.2 %
○ ST6: 10.5 %
○ ST7: 0.6 %
● ST10: 33.1 %
○ ST12: 15.8 %
● ST14: 26.1 %
○ Mixed: 16.9 %
● Unsubtyped: 57.9 %
AFRICA
SOUTH AMERICA
○ ST1: 60 %
○ ST3: 40 %
○ ST5: 13.3 %
○ ST10: 40 %
○ ST14: 13.3 %
○ Mixed: 33.3 %
Created with Datawrapper
○ Subtyping based on one or two studies
● Subtyping based on more than two studies

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journal homepage: www.elsevier.com/locate/meegid

Prevalence and subtype analysis of *Blastocystis* in healthy Indian individuals

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ABSTRACT

There is a growing interest in subtype (ST) analysis of the intestinal parasite *Blastocystis* due to its extensive genetic diversity that might reflect differences in pathogenicity. Although essential for reference, few studies are available on *Blastocystis* in healthy individuals. Moreover, molecular epidemiology data on *Blastocystis* in India still remain to emerge. In the present study we identified the prevalence and ST distribution of *Blastocystis* in healthy Indian individuals. A total of 220 stool samples were obtained; four of 100 samples from 100 adults were chosen randomly for construction of small subunit (SSU) rRNA gene clone libraries in order to elucidate micro-eukaryotic diversity in the human gut. From the SSU rDNA library, 64 sequences annotated to *Blastocystis* were used for ST analysis along with sequences obtained by direct sequencing of SSU rDNA PCR products amplified from the remaining samples and generated using primers targeting *Blastocystis*. Of 220 stool samples collected, 120 samples from 30 infants (aged 1 week to 1 year) were PCR-negative. Of the remaining 100 samples from 100 adults, 27 resulted in specific amplification. Out of these 27, four samples were suspected of mixed ST infection and so these samples were further analyzed by construction of clone libraries. Analysis of cloned sequences revealed that indeed 2 samples had mixed ST infection (ST1 and ST3) while the remaining two showed infection with two separate ST3 strains. ST3 was the most common ST present in our study group (100%) followed by ST1 (7.4%); ST1 was seen only in mixed infections. SSU rDNA clone library sequences generated by processing of pooled samples were identified as ST3. The majority of ST3 sequences exhibited allele 34 commonly found in the European population.

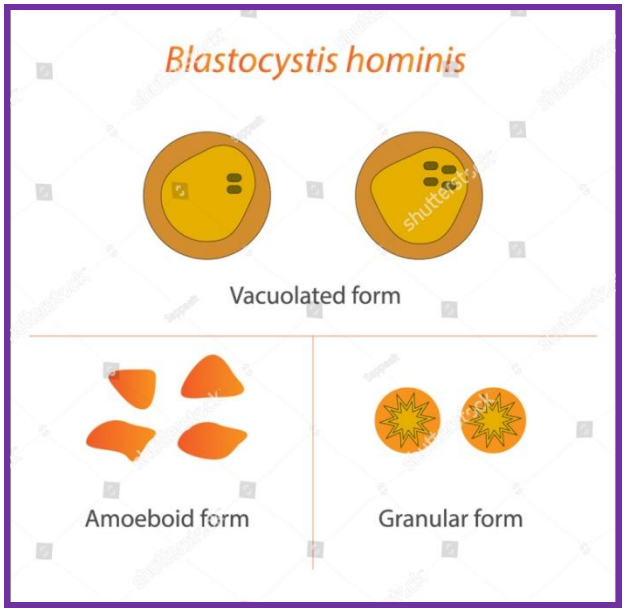
- Although the role of *Blastocystis hominis* in human disease is often referred to as controversial because of the presence of virulent and non-virulent strains since there exists an enormous genetic variation between different strains

- However, *Blastocystis* has never fulfilled Koch's postulate that infection of a healthy individual with *Blastocystis* leads to disease

- The fact that *Blastocystis*' infection route is oral-anal indicates that carriers have been in contact with faecal contaminated matter

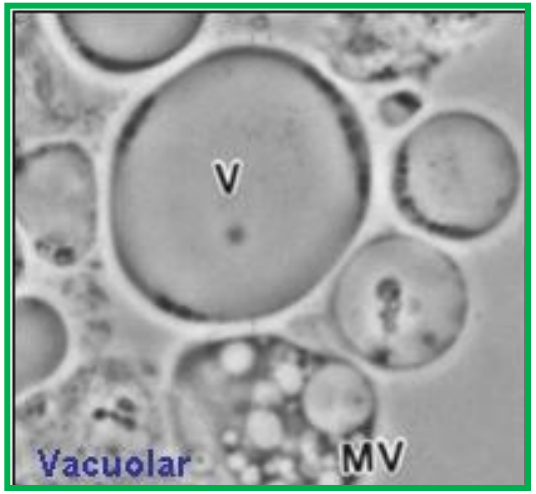
Morphology

- *Blastocystis* has **four** morphological forms
  - **vacuolar**
  - **granular**
  - **amoeboid**
  - **cyst**



Vacuolar form

- Used for the identification of the organism
- Vary greatly in size, with diameters ranging 2 - 200 µm
- Known as central body form because it has a large central vacuole surrounded by a thin band of peripheral cytoplasm
- The function of the vacuole is still unclear, however, it has been suggested that, it is for storage purposes.

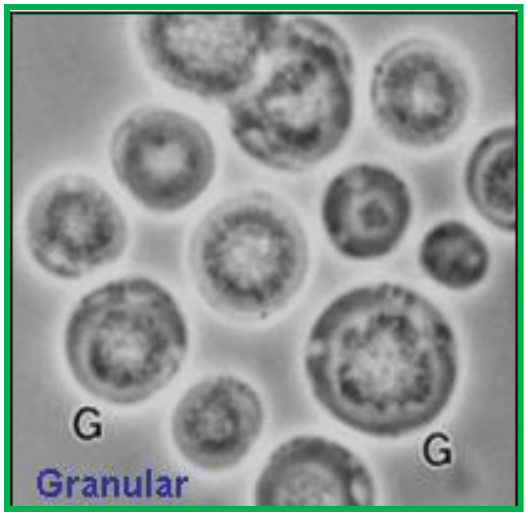


Granular form

- Morphologically similar to the vacuolar forms except that distinct granules are observed in the central vacuole and / or cytoplasm

- Within the central vacuole, these granules appear in different forms too. Three types were suggested – metabolic, lipid & reproductive granules

- It has been suggested that the granules may be an indication that the cell is dying

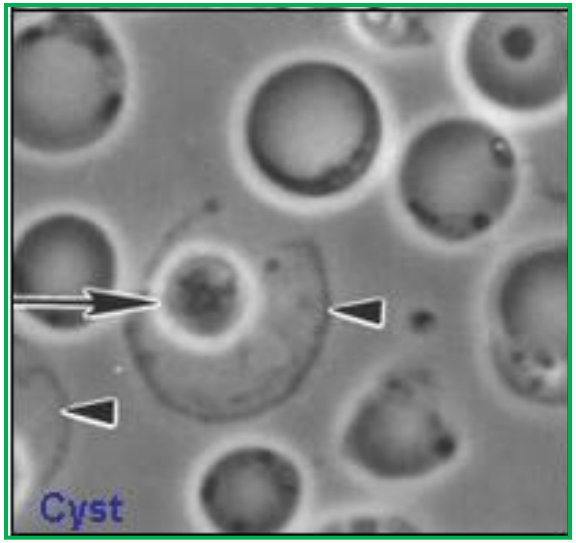


Amoeboid form

- Non-motile & strongly adhesive
- Produced only in cultures taken from symptomatic individuals
- Symptoms could be due to the accumulation of the strongly adhesive amoeboid forms on the host's intestinal wall

Cyst form

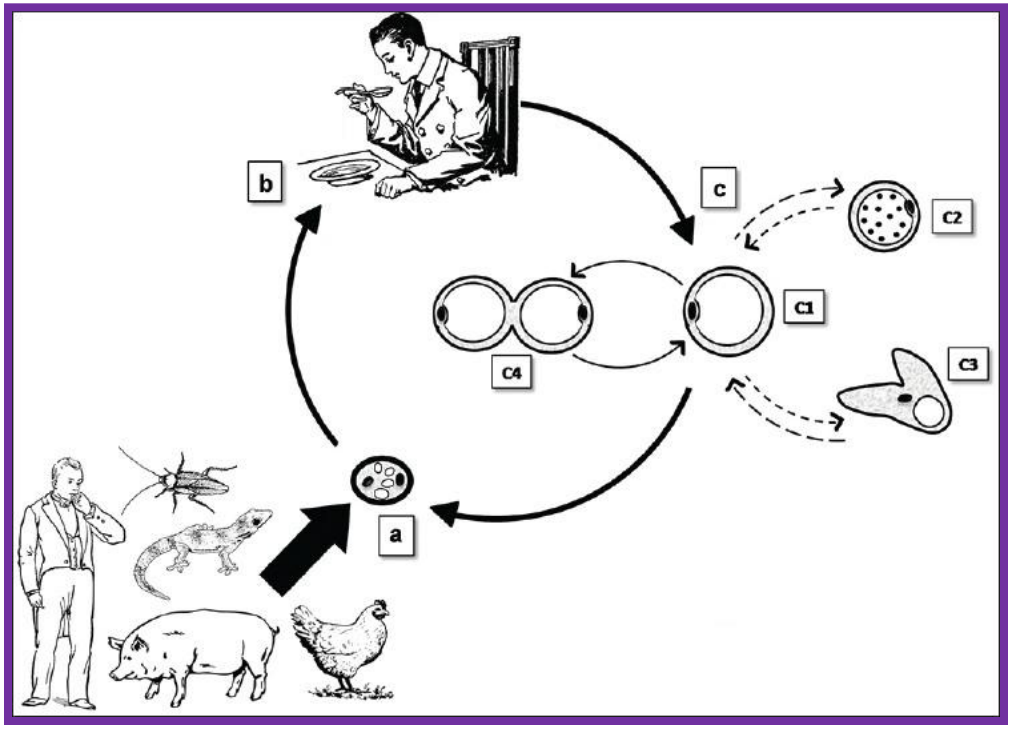
- Resistant form & is able to survive in harsh conditions
- Smaller in size & has a thick multilayered cyst wall
- Lacks a central vacuole & few nuclei, multiple vacuoles & food storage deposits were observed



Stage or form	Size (μm)	Presence of central vacuole	No. of nuclei	Area(s) of occurrence	Description
Vacuolar	2–200 (usually 5–15)	Present	1–4 (usually 1–2)	Culture, feces	Central vacuole occupies 70–90% of cell vol; occasionally, giant cells with multiple nuclei are seen
Granular	6.5–8	Present	1–4	Feces, culture	Granules within central vacuole
Multivacuolar	5–8	Present or absent	1–2	Feces, culture	Rarely seen
Avacuolar	~5	Absent	1–2	Intestine, feces	Rarely seen in feces
Amoeboid	2.6–7.8	Present or absent	1–2	Feces, culture	Rarely reported; conflicting information on morphology
Cyst	3–10	Absent	1–4	Feces, culture	Rarely seen in culture; cyst wall present; may be surrounded by a fibrillar layer

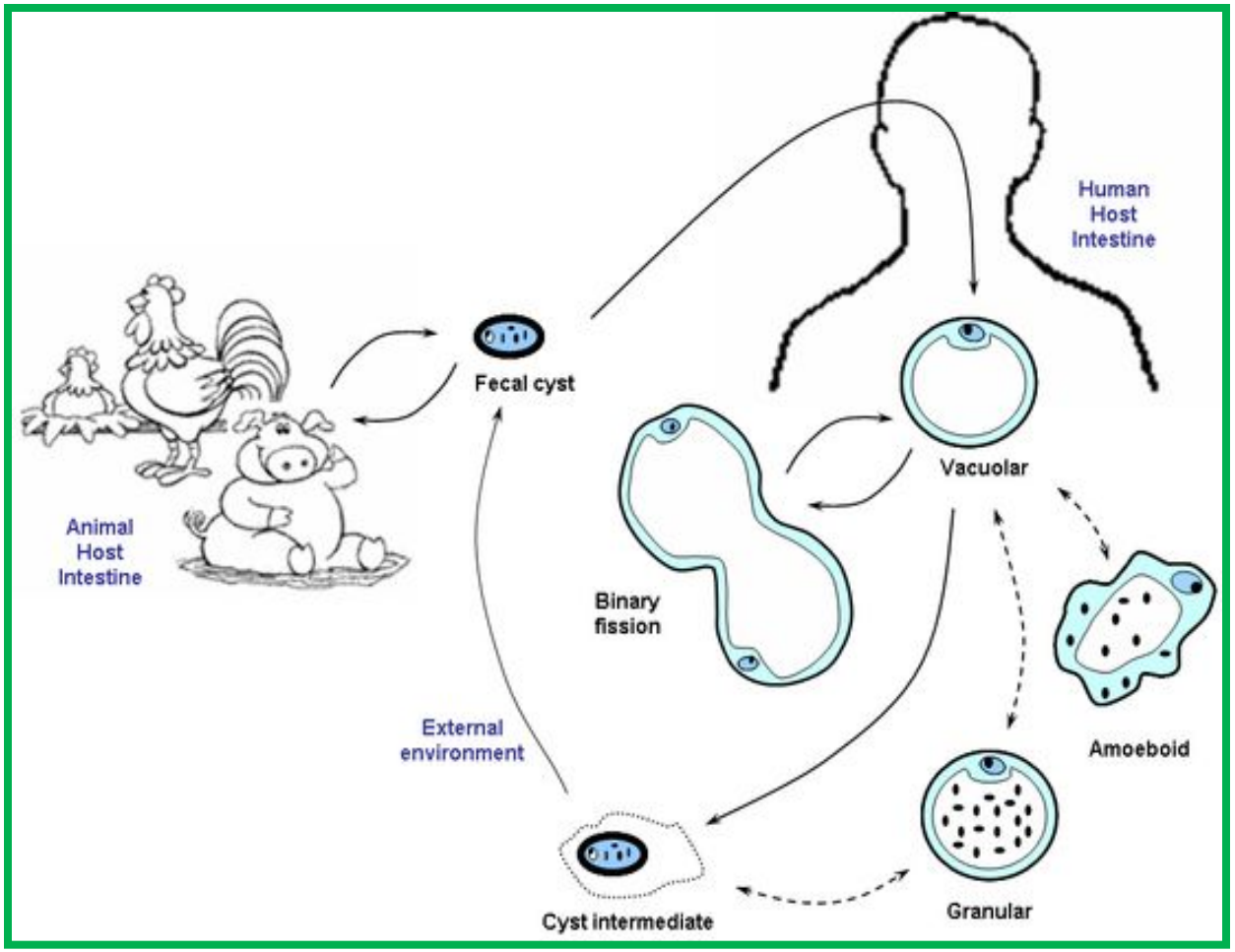
Transmission

- Humans contract infection - drinking water or eating food contaminated with feces from an infected human or animal



- Infection can be spread from animals to humans, from humans to other humans, from humans to animals & from animals to animals

Life cycle

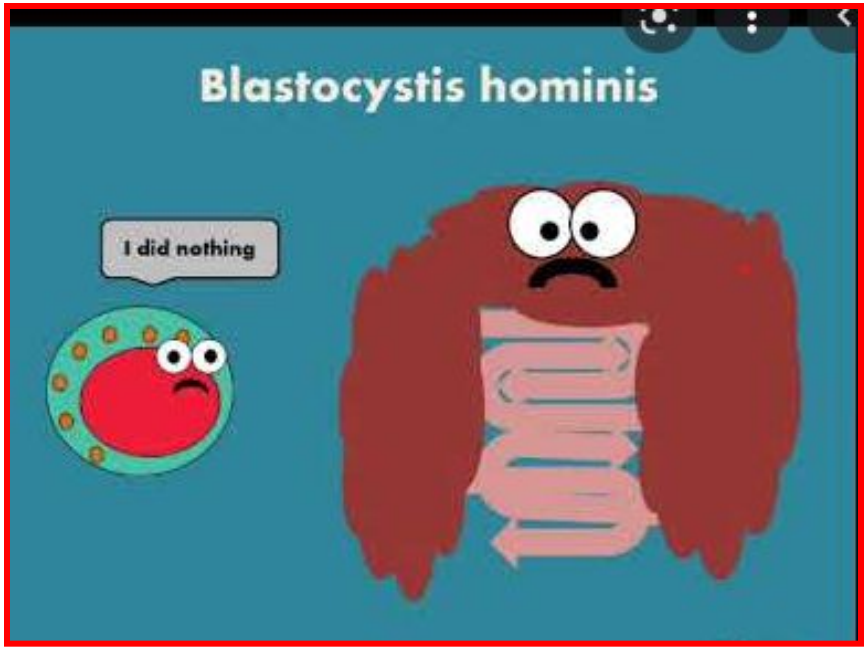

Human
Host
Intestine
Fecal cyst
Animal
Host
Intestine
Vacuolar
Binary
fission
Amoeboid
External
environment
Cyst intermediate
Granular

Risk factors for infection

- International travel
- Military service
- Consumption of Untreated Water (well water)
- Contaminated Food
- Daycare facilities
- Geography
- Prevalence over Time

Signs and Symptoms

- abdominal pain
- itching, usually anal itching
- constipation
- diarrhea
- watery or loose stools
- weight loss
- fatigue
- flatulence



- Less commonly reported symptoms
  - Skin rash
  - Joint pain
  - Intestinal inflammation

Taxonomy

- For many years, one species of *Blastocystis* infected humans, while different species of *Blastocystis* infected other animals
- So they called *Blastocystis* from humans - ***B. hominis***
- gave different species names to *Blastocystis* from other animals
  - for example *B. ratti* from rats
- In recent years, there is no *single* species of *Blastocystis* that infects humans

- In fact, a number of distinct genetic types of *Blastocystis* can infect humans, including those previously called *B. ratti*

- Because of this, in 2007 scientists proposed discontinuing the use of the term *B. hominis*

- Their proposal was to refer to *Blastocystis* from humans & animals as ***Blastocystis* sp. subtype nn**
  - where nn is a number assigned to each group according to the degree of genetic identity of the *Blastocystis* organisms, based on gene sequences, rather than the host that was infected

Variation in severity

- Some species of *Blastocystis* are more virulent than others
- Protein profiles of isolates associated with chronic & acute infection
- Isolates from symptomatic patients produced large amoeboid forms that were not present in isolates from asymptomatic patients

Associations

- Blastocystis colonisation is positively associated with IBS & is a possible risk factor for developing IBS

- Significantly increased immune reaction in IBS patients to *Blastocystis*, even when the organism could not be identified in stool samples

- The following reports have linked *Blastocystis* infection to inflammatory bowel disease:

  - A study using riboprinting identified specific types of *Blastocystis* as associated with inflammation
  - A case report described IBD in conjunction with *Blastocystis* infection
  - Three research groups have reported experimental infection of mice with *Blastocystis* produces intestinal inflammation

CLINICAL MANIFESTATIONS

- An association between *Blastocystis* spp & urticaria (acute and chronic) has also been described

- Symptoms , greater prevalence and pathogenicity have been described in both immunocompromised & immunocompetent hosts, including patients with HIV and transplant recipients

- Disseminated infection is rare; two case reports have described identification of the organism in synovial fluid and peritoneal fluid

- In another report, a child with appendicitis was found to have *Blastocystis* organisms in the stool, appendix, peritoneal fluid

- Patients with *Blastocystis* do not have peripheral leukocytosis or eosinophilia

- White cells in stool specimens are usually absent

- If endoscopy is performed, findings usually demonstrate a macroscopically normal-appearing mucosa, and histopathology generally does not demonstrate intestinal inflammation or mucosal invasion

- Not all studies exclude patients who have other pathogens found, so results can be difficult to interpret

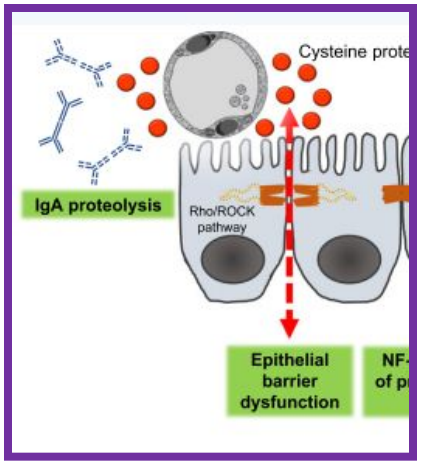
Pathogenesis

- **Barrier disruption**: Actin filaments are important in stabilizing tight junctions they in turn stabilize the barrier, which is a layer of cells, between the intestinal epithelial cells & the intestinal content. *Blastocystis* has the ability to alter the arrangement of actin in intestinal epithelial cells, lead to the diarrheal symptoms

- **Protease secretion**: *Blastocystis* secretes a protease that breaks up antibodies produced and secreted into the gastrointestinal tract lumen

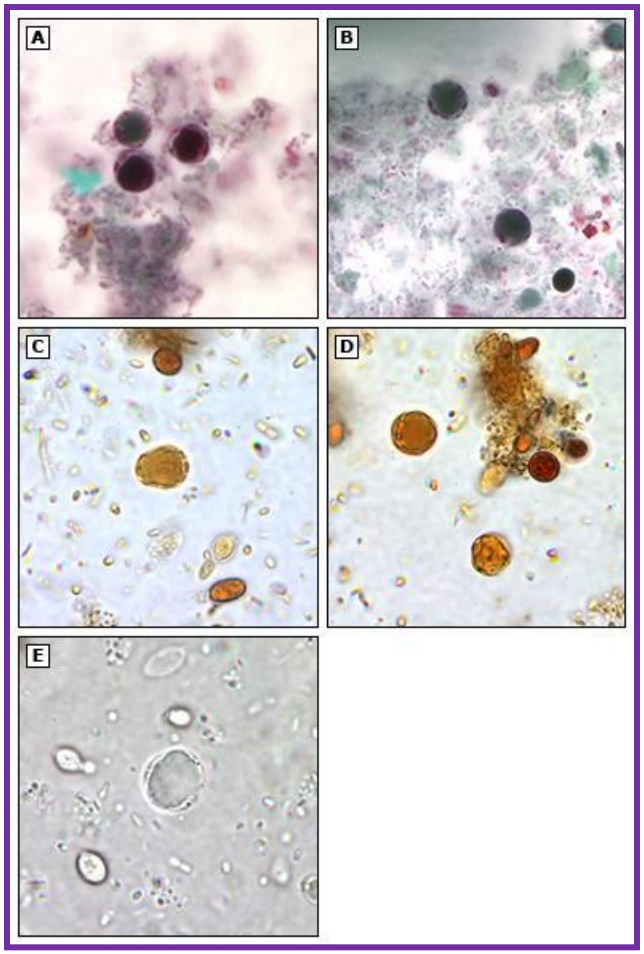
- Immunoglobulin A (IgA), make up the immune defense system of human by preventing the growth of harmful microorganisms in the body and by neutralizing toxins secreted by these microorganisms

- By breaking up the antibodies, it allows the persistence of *Blastocystis* in the human gut



DIAGNOSIS

- Examination of stool specimens - light microscopy of stained smears or wet mounts
- Commonly used microscopic methods include - permanent stained smears (usually trichrome stained)



(A, B) *Blastocystis* spp cyst-like forms stained in trichrome. Nuclei in the peripheral cytoplasmic rim are , staining purple.
(C, D) *Blastocystis* spp cyst-like forms in a wet mount stained in iodine
(E) *Blastocystis* spp cyst-like form in a wet mount, unstained

- ELISA for detecting serum antibodies - not routinely used
- PCR techniques with excellent sensitivity have also been developed
- However, since *Blastocystis* spp can often be found in asymptomatic individuals & its pathogenicity is unclear, the clinical relevance finding a positive PCR result is debatable
- Molecular tests to **differentiate between strains** are limited

TABLE 5. Treatment options and regimens for *Blastocystis* infections

Drug	Dosage[a]	Side effects	Reference(s)
Metronidazole	750 mg tid for 10 days	Metallic taste, transient nausea	90, 115, 161
Adult	500 mg tid for 10 days		140, 267
	1.5-g single dose/day for 10 days		39, 165
Pediatric	15 mg/kg/day for 7 days		307
	20–30 mg/kg/day for 10 days		175
TMP-SMX			
Adult	320 mg TMP and 1,600 mg SMX daily in 2 equal doses for 7 days	Hives, lack or loss of appetite, nausea, skin rash, vomiting	177
Pediatric	6 mg/kg TMP and 30 mg/kg SMX daily in 2 equal doses for 7 days		177
Nitazoxanide			205
Adult	500 mg bid for 3 days	Yellowish urine, abdominal pain, headache, nausea	
Pediatric			
1–3 yr	100 mg bid for 3 days		
4–11 yr	200 mg bid for 3 days		
Paromomycin	25 mg/kg tid for 10 days	Nausea, abdominal cramps, diarrhea	278
Paromomycin-metronidazole combination	1,000 mg paromomycin bid for 10 days and 750 mg metronidazole tid for 10 days		184

[a] tid, three times a day; bid, twice a day.

Genome sequence of *Blastocystis*

❖ Whole genome of a human *Blastocystis* **ST7 isolate** (Denoeud et al., 2011) & the draft genome sequence of *Blastocystis* **ST4** (Ivan et al., 2015)

Genome statistics and intron features of *Blastocystis* ST4 and ST7.

	***Blastocystis* ST4**	***Blastocystis* ST7**
Genome assembly size	12.91 Mbp	18.8 Mbp
G + C content	39.6%	45.2%
Number of genes	5713	6021
Average gene size	1386 bp	1299 bp
Genes with introns	92.7%	84.6%
Average exon number per gene	5.06	4.58
Average length of introns (nt number)	33	50
Average length of proteins (aa number)	416	359
MLO genome size	27,815 bp	29,270 bp
MLO G + C content	21.94%	20.03%
Number of MLO genes	45	45

Direct link to data

- This Whole Genome Shotgun project has been deposited at DDBJ/EMBL/GenBank under the accession JPUL02000000 (http://www.ncbi.nlm.nih.gov/nuccore/JPUL00000000.2).

Patient	Clinical history	Diagnosis	Treatment	Outcome	Study
One 11 y.o male and one 12 y.o male	Both presented with right lower quadrant tenderness, anorexia, abdominal pain, nausea, vomiting	Initially diagnosed with appendicitis. Stool examination showed *Blastocystis* and patients were then diagnosed with *Blastocystis* infection	Metronidazole and co-trimoxazole	Complete recovery	[15]
24 y.o female	Nine week history of urticaria, hives, chronic diarrhoea, IBS	Initially diagnosed with cellulitis. Treated with non-steroidal cream with no recovery of symptoms. Presented with hives and diagnosed as urticaria. Extensive investigation showed 4 + *Blastocystis* in her stool.	Metronidazole	All urticarial and IBS symptoms cleared	[24]
45 y.o female	Four month history of erythematous and pruriginous lesions on trunk and limbs, mild gastoenteric complaints	Diagnosed with urticaria. Extensive investigation showed the stool postive for *Blastoycstis*.	Paromomycin and metronidazole	All urticarial and gastrointestinal symproms cleared	[25]
32 y.o female	Four year history of allegic rhinitis and chronic urticaria, swelling in pressure sites	Diagnosed with delayed pressure urticaria. Treated with systemic corticosteroids with only partial clearance of symptoms. Stool examination positive for *Blastocystis*	Metronidazole	All urticarial symptoms cleared	[26]
60 y.o female	Four year history of anaphylactoid reactions, severe asthma and generalised urticaria	Diagnosed with chronic urticaria. Extensive investigation identified *Blastocystis* in the stool	Paromomycin	All urticaria symptoms cleared	[27]
74 y.o male	Diarrhoea, abdominal pain, nausea, fatigue and fever	Hospitalised. Stool were positive for *Blastocystis*	Metronidazole	Clearence of symptoms after 10days	[18]
29 y.o female	Six month history of morning stiffness, pain and swelling of joints, elbows, ankles, knees, diarrhoea, abdominal pain and vomiting	Treated for presumed infectious arthritis of the knee. No improvement. Microscopy of the synovial fluid and stools both showed the presence of *Blastocystis*.	Metronidazole	After two weeks knee inflammation subsided and all abdominal pain and diarrhoea were cleared	[28]
24 y.o male	Six week history of diffuse abdominal pain and diarrhoea	Stool examination was positive for *Blastocystis* and *Endolimax nana*.	Metronidazole	Complete resolution of symptoms 10days later	[29]
19 y.o male	Three week history of hives, abdominal pain for 2.5months	Diagnosed with acute urticaria. Routine testing showed the presence of *Blastocystis* in the stool ST3	Metronidazole	10days after treatment both urticaria and abdominal discomfort were cleared	[21]
20 y.o male	Urticaria and flatulence	Treated with antihistamines with no success. Further investigation showed *Blastocystis* ST2 in the stool. Initially treated with metronidazole but treatment failure appears to have occured. Then treated with co-trimoxazole with no success and finally treated with combination metronidazole and paramomycin	Metronidazole then co-trimoxazole followed by paromomycin	All symptoms cleared 10 days later	[22]
40 y.o female	Hospitalised due to severe diarrhoea and fever	*Blastocystis* ST8 infection diagnosed from stool cultures. Treated with metronidazole. Symptoms persisted and the patient also noted bloating, flatulence and abdominal pain. Further treated with co-trimoxazole	Metronidazole then co-trimoxazole	All symptoms cleared	[30]

Case Reports > Trop Biomed. 2019 Dec 1;36(4):987-992.

A case report of Blastocystis infection and Steven Johnson's syndrome

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Affiliations – collapse

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PMID: 33597468

Free article

Abstract

Blastocystis species (spp.) is an emerging pathogen. There are several unsolved issues linked to this parasite ranging from its nomenclature, commensal status, standardization of laboratory diagnostic methods, genotypes and treatment. Recently, there has been an increase in reports of Blastocystis spp. from symptomatic cases which provide enough evidence of its pathogenic potential. A range of signs and symptoms, from gastro-intestinal to cutaneous manifestations have been attributed to Blastocystis infection. Few reports have established an association between intestinal infection with Blastocystis spp. and skin manifestations in form of urticaria, palmoplantar pruritus and allergy with complete resolution of cutaneous lesions with eradication of the parasite. In this report, we describe a case of Steven Johnson's syndrome (SJS) in a 6 years old girl along with infection with Blastocystis spp. marked by diarrhea and abdominal pain. Stool examination revealed the presence of all forms of the parasite with subsequent decrease in parasite burden and diarrhea over a period of time. Interestingly, the clearance of Blastocystis spp. from stool was followed by recovery from skin lesions and other symptoms. In this case, the course of SJS was clearly associated with Blastocystis infection. Though skin manifestation with Blastocystis infection has been previously reported, this is the first report of its association with SJS. This report indicates newer insights of the parasite that are less well

Blastocystis hominis — An Emerging Cause of Diarrhoea in Renal Transplant Recipients

K Rao, Uma Sekar*, KT Iraivan+, G Abraham***, P Soundararajan++

Abstract

Blastocystis hominis is an intestinal protozoan that is emerging as an important cause of diarrhea in the immunosuppressed population. We report two cases of diarrhea caused by this organism in renal transplant recipients. The infection was diagnosed promptly by careful stool examination and treated successfully with metronidazole. These case report highlights the fact that unusual parasites like *Blastocystis hominis* should be looked for and treated in cases of diarrhea occurring in renal transplant recipients. This reduces the rate of post-transplant morbidity and mortality.

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Case Report

Case 1

A 44 year old male who had undergone live renal transplant in 1994 presented with the complaints of abdominal pain, passing watery loose stools more than ten times a day and associated vomiting 4-5 times a day for the preceding three days. He also had colicky abdominal pain. Patient was on double immunosuppression - Tab. Prednisolone 10 mg od and Sandimum Neoral 100 mg BD. On admission he was empirically treated with Inj. Ciprofloxacin 200 mg IV BD and was given IV fluids.

On examination the patient had signs of dehydration but no evidence of acute abdomen. The pulse rate was 92/min, and the blood pressure was 100/70 mm of Hg. Investigations showed Hb of 12.8 gm%, PCV 37.3%, RBC 4.41 million/cu mm, TC 18000, DC Poly 90.8%, Lymphocytes 4%, Eosinophils 1.5%, Monocytes 2.1%. The liver function tests were within normal limits. BUN was 34 mg/dl and creatinine was 2.3 mg/dl. A fresh sample of stool sent for routine examination showed cysts of *Blastocystis hominis* with a few WBCs and no RBCs. Culture of the stool was negative for bacterial pathogens. The patient was treated with Inj. Metronidazole IV 500 mg TDS and his diarrhea subsided in 24 hours. Ciprofloxacin was stopped and metronidazole was continued for seven days. The dose of Neoral was reduced to 175 mg/day.

Case 2

A 64 year old male who had undergone live related renal transplant in 1995 was previously treated for pulmonary tuberculosis in 1996. He was on double immunosuppression with Tab. Prednisolone 5 mg OD and Azathioprine 100 mg OD. He had excellent graft functions with post-transplant diabetes mellitus. The patient presented with the complaints of passing loose stools > 7 times a day with associated low grade fever for the preceding three days.

On examination the patient had evidence of mild dehydration and the abdomen was soft without tenderness. He was afebrile on admission. Investigations showed Hb of 8.5 gms%, PCV 27.6%, RBC 2.57 millions/cu mm, TC 2000, DC Poly 60%, Lymphocytes 35%, Eosinophils 5%. The random blood sugar, renal and liver functions were within normal limits the serum potassium level was 2.4 mmol/litre. Examination of fresh stool sample showed cysts of *Blastocystis hominis*. The stool culture was negative for bacterial pathogens. The patient was treated with Tab. Metronidazole 400 mg TDS, Tab. Domperidone and syrup KCl. The dose of prednisolone was reduced to 25 mg OD. His symptoms improved within two days and metronidazole was discontinued after seven days.

J Parasit Dis (Oct-Dec 2014) 38(4):440–443
DOI 10.1007/s12639-013-0236-2

SHORT COMMUNICATION

JPD

Blastocystis sp. from food animals in India

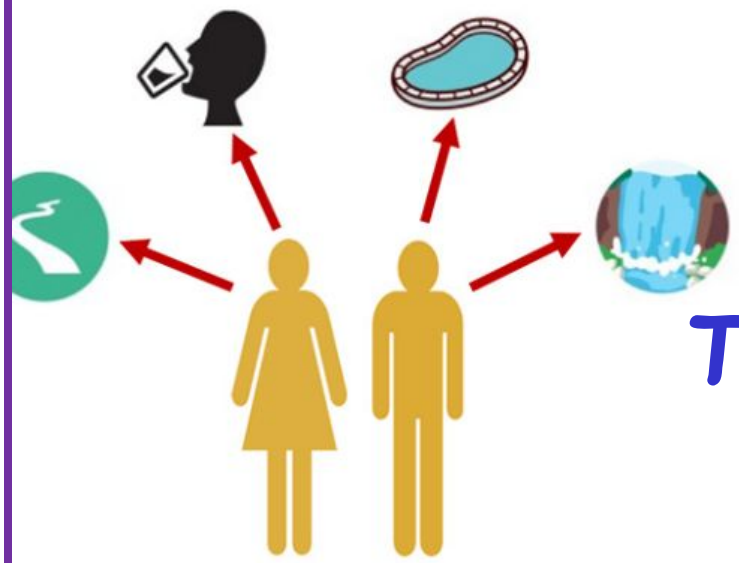
C. Sreekumar · J. Selvaraj · S. Gomathinayagam · M. Thangapandiyan · G. Ravikumar · Parimal Roy · C. Balachandran

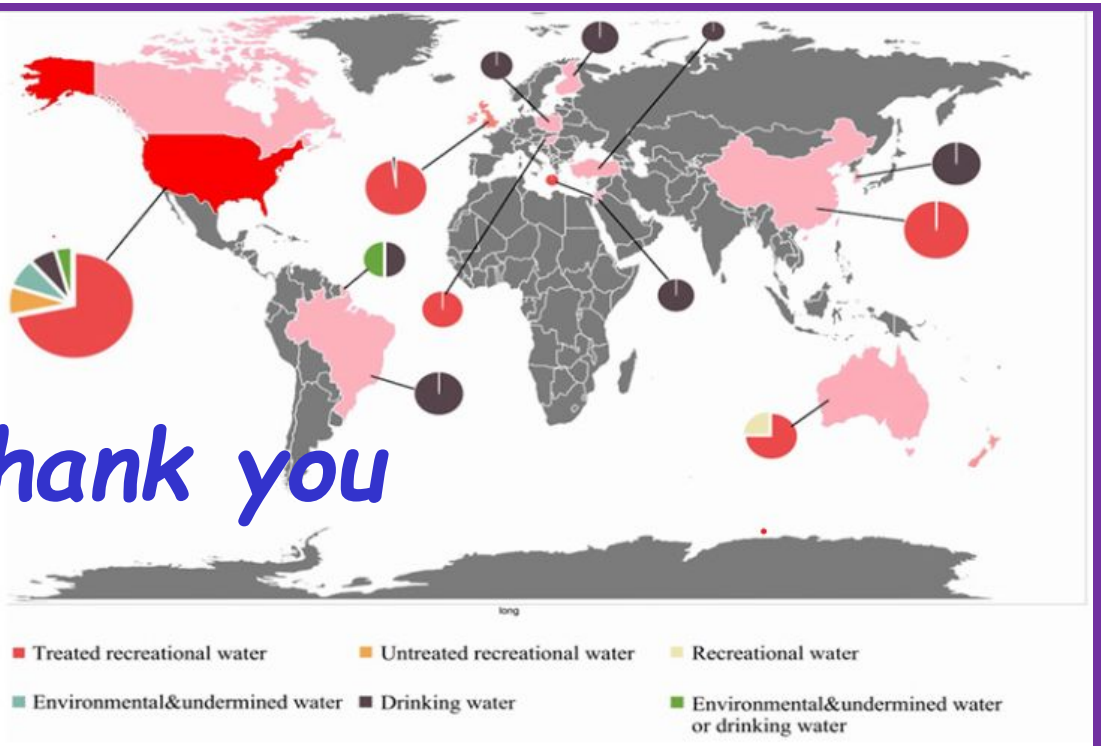
Among the 24 dead bodies of animals positive for Blastocystis, caecal scrapings were positive in all, while only six duodenal scrapings revealed the organism. Fecal smears, stained using trichrome, have been considered ideal clinical specimen for the diagnosis of Blastocystis .The present study suggests that, in morbid specimens, in addition to faecal smears, caecal scrapings can be included as potential specimen for the diagnosis of the parasite. The field of genotype analyses and phylogeny of Blastocystis is fluid and fast evolving, with data and information being frequently updated. It is believed that there are many genotypes (subtypes) that can be shared between humans and other animals. Noel et al. (2005) grouped the organism into 7 clades comprising of 12 subtypes

According to this classification, the **poultry isolates** belonged to **subtypes 1, 6 or 7.** Organisms of the subtype **1, 2 or 5** were isolated from **pigs.** Of these, the subtype 1, which is cross-infective between animals and birds, has been frequently isolated from patients exhibiting symptoms of irritable bowel syndrome. Subtype 2, which is also the most commonly isolated subtype from monkeys, has also been associated with human infection. The presence of Blastocystis in birds and piglets, which are basically meant for human consumption, indicates the possibility of feco-oral transmission to humans associated with the husbandry and/or consumption of these animals and birds. With 75% of the emerging human infections believed to have animal origins, further studies need to be undertaken to ascertain the prevalence of Blastocystis in domestic livestock and elucidate the molecular epidemiology of the organism in food animals in India

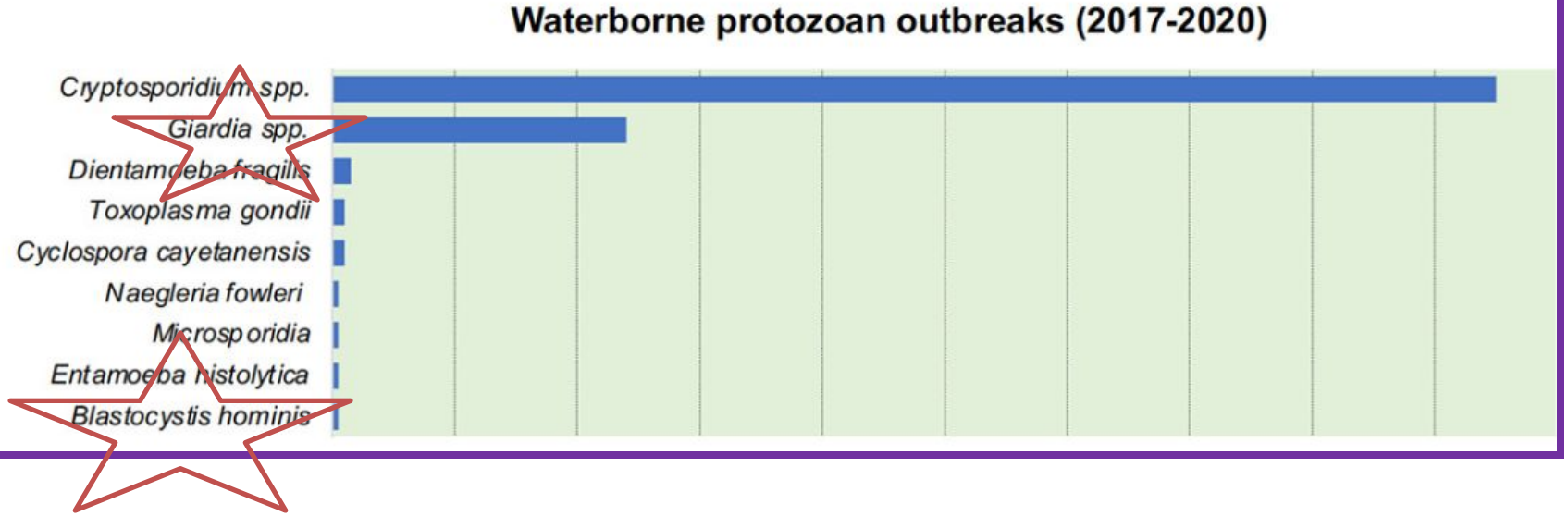
Conclusion

- Blastocystis sp. was included in the Water Sanitation & Health programmes of the WHO, 2008
- Increasing interest of the scientific & medical community in Blastocystis sp. was coupled with new data about epidemiology, pathogeny & whole genome sequencing
- Sequencing of genomes from different STs & comparative genomic projects are in progress and will be useful to identify specific virulence factors
- As more information from the genome is gathered there will be more opportunity to identify possible genes that transcribe for pathogenicity & treatment resistance




long
Treated recreational water
Untreated recreational water
Recreational water
Environmental&undermined water
Drinking water
Environmental&undermined water or drinking water

Thank you


Waterborne protozoan outbreaks (2017-2020)
Cryptosporidium spp.
Giardia spp.
Dientamoeba fragilis
Toxoplasma gondii
Cyclospora cayetanensis
Naegleria fowleri
Microsporidia
Entamoeba histolytica
Blastocystis hominis