

Giardiasis as a predictor of childhood malnutrition in Sohag governorate

Thesis

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توطئة للحصول على درجة الماجستير فى طب الأطفال

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Summary

Giardia lamblia is a widely distributed flagellated protozoan parasite that inhabits the small intestine. It is the most prominent human protozoal enteropathogen with a prevalence rate that varies from 2% to 5% in the industrialized world and 20 % to 30% in the developing world. Giardiasis is more prevalent in infancy and childhood.

Diagnosis of giardiasis is largely dependent on microscopic demonstration of the parasite in the stool, which yields many false negatives due to intermittent excretion of *Giardia lamblia*. Another reliable methods of diagnosis are duodenal aspiration and intestinal biopsy but they are invasive and uncomfortable techniques. So, some other diagnostic techniques were introduced and were studied regarding to their value in diagnosis but these studies were not fulfilled up till now especially regarding to their value as methods in cure assessment.

The aim of this work is to find a relationship between giardiasis and malnutrition. A cross-sectional epidemiological study was conducted during May 2010 to March 2011 on 100 patient aged from 2-15 years collected from the outpatient clinic of Sohag General Hospital, all data of the study were collected after parents verbal consent.

All children were subjected to the following:

- 1- History taking throughout structured questionnaire including: name, age, sex, residence, father occupation mother education, water supply, sanitary disposal, immunization history and dietetic history.
- 2- Clinical examination stressing on: anthropometric measurements including weight height and midarm circumference.
- 3- Laboratory investigations including: complete blood count, serum albumin level and stool analysis for giardiasis.

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List of Abbreviations

WGO	: World Gastroenterology Organisation.
CDC	: Centers for Disease Control and Prevention.
EPA	: Environmental Protection Agency.
IFA	: Immunofluorescence assay.
ELISA	: Enzyme-linked immunosorbant assay.
U.S.	: United States.
IgA	: Immunoglobulin A.
IgG	: Immunoglobulin G.
IgM	: Immunoglobulin M.
PCR	: Polymerase chain reaction.
IBS	: Irritable bowel syndrome.
HIV	: Human immunodeficiency virus.
PI-IBS	: Post-infectious irritable bowel syndrome.
PEM	: Protein-energy malnutrition.
SCU	: Severe childhood undernutrition.
AIDS	: Acquired immunodeficiency syndrom.
KWO	: Kwashiorkor.
MKWO	: Marasmic Kwashiorkor.
SD	: Standard deviation.
ECG	: Electrocardiography.
NCHS	: National Center For Health Statistics.
CBC	: Complete blood count.

Introduction

Giardia lamblia was originally identified by von Leeuwenhoek in the 1600s and was first recognized in human stool by Vilem Dusan Lambl (1824-1895) in 1859 and by Alfred Giard (1846-1908) after whom it is named. Although it was the first protozoan parasite described, its role as a pathogenic organism was not recognized until the 1970s, after community outbreaks and after the appearance of the disease in travelers returning from endemic regions. Prior to that time, the organism was thought to be a harmless commensal organism of the intestine (*Hanivek et al., 2007*).

Parasite infections are a public health issue, especially in developing countries. Among enteroparasites, *Giardia lamblia* is the protozoan most frequently found, with estimated prevalence rates of 20–30% in developing countries and 2–5% in developed countries. Environmental and socio-economic factors, as well as hygiene habits, are important determinants of *G. lamblia* infection prevalence (*Daly et al., 2009*).

G. lamblia is one of the most common causative agents of epidemic and endemic diarrheal illness throughout the world. It continues to be the most frequently identified water-borne intestinal pathogen in the United States. *G. lamblia* has been found in as many as 80% of raw water supplies from lakes,

streams, and ponds and in as many as 15% of filtered water samples (*Teixeira et al., 2007*).

The major complication of giardiasis is nutritional insufficiency, which in adults may produce a variety of macronutrient and micronutrient deficiencies but which rarely produces serious sequelae, provided that infection is treated promptly or a spontaneous remission occurs. In infants and young children, however, nutritional insufficiency can have effects on growth and development. So it is very essential to assess the cure from giardiasis after a suitable course of treatment especially in chronic cases of giardiasis which are more likely to be associated with complications and may need repeated courses of treatment. (**Farthing,1996**).

Aim of the Work

The aim of this study is to determine the association between giardiasis and malnutrition and if giardiasis could be a predictor of malnutrition or not.

Giardiasis

Introduction:

Parasite infections are a public health issue, especially in developing countries. **(Costamagna et al., 2002)** Among enteroparasites, *Giardia lamblia* is the protozoan most frequently found, with estimated prevalence rates of 20–30% in developing countries and 2–5% in developed countries. **(Thompson, 2000)**

Giardiasis is an enteric infection caused by a flagellated, binucleated protozoan parasite called *Giardia lamblia*. **(WGO, 2008)**

Environmental and socio-economic factors, as well as hygiene habits are important determinants of *Giardia lamblia* infection prevalence. **(Teixeira et al., 2007)**

Giardiasis is characterised as a wide-spectrum illness, although the majority (60–80%) of infected individuals is asymptomatic. The main clinical symptom is diarrhea, but abdominal pain and weight loss are also reported. **(Lebwohi et al., 2003)**

In 2001, Katz and Taylor suggested that giardiasis might influence the growth and development of infected children. Concomitantly, protein-energy malnutrition can increase susceptibility to and morbidity from *Giardia lamblia* and other parasite infections.

History of Giardia

In 1681, Antoine van Leeuwenhoek, the inventor of the microscope, first discovered Giardia lamblia in his own stool. Initially, Giardia lamblia was considered to be of doubtful pathogenicity. Lambl rediscovered the parasite in the stool of pediatric patients in Prague in 1859 wherein Lambl published a full description of the trophozoite along with line drawings. **(Mank, 2001)**

The pathogenicity of Giardia was clearly described by Fantham and Porter in 1915 when returning war veterans contracted the disease and the human stool isolates produced diarrhea in kittens. **(Fantham and Parter, 1916)**

In 1954, Rendtorff established that cysts could be transmitted by water source by feeding prisoners Giardia cysts from asymptomatic human donors. **(Rendtorff, 1954)**

Increased awareness and appreciation of the parasite's clinical significance gave rise in the early 1970s when a high percentage of visitors from the Soviet Union returned with symptomatic giardiasis. **(Brodsky et al., 1974)** Giardiasis is now recognized as a disease of travelers worldwide, with the highest prevalence in the developing world. **(Wolfe, 1978)**

The Giardia lamblia Organism

The life cycle of Giardia lamblia (also known as Giardia intestinalis) is comprised of two stages: cyst and trophozoite. The cysts are approximately 7-10 μm in length and are oval in shape. The mature cyst contains four nuclei. They are environmentally resistant and responsible for disease transmission. **(Wolfe ,1992)**

Cysts are able to survive exposure to gastric acid; gastric acid may actually trigger excystation. Cysts may remain viable for several months in cool, moist conditions, and have been detected in natural surface waters. **(Farthing ,1996)**

They are also able to survive standard concentrations of chlorine used in water purification systems. Infection occurs after cysts are ingested. This marks the beginning of the life cycle. After ingestion, mature cysts in the small intestine release trophozoites through a process called excystation. **(Jones ,1988)**

The trophozoite stage is responsible for producing clinical disease in humans. Trophozoites have two distinct nuclei and four pairs of flagellae. They resemble teardrops when viewed from the top and they are spoon shaped from the side. They are 12-15 μm in length. Trophozoites colonize the small intestine, attaching to the mucosa of the bowel using a ventral sucking disks. The trophozoites then multiply by longitudinal binary fission. **(Hill ,1993)**

As the Giardia trophozoites move toward the colon, they retreat into the cyst stage (known as encystation) and the new cysts are excreted in the feces. Bile salts and intestinal mucus boost trophozoite multiplication and encystations. **(Adrabbo and Peura, 2002)**

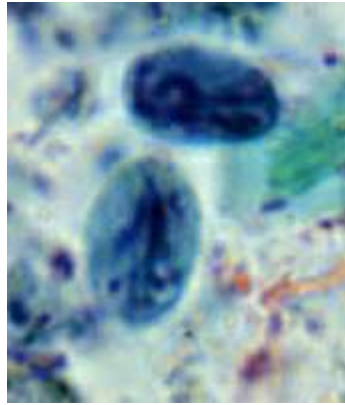


Figure (1) Giardia lamblia cysts Giardia lamblia trophozoites

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Pathophysiology of Giardiasis

The pathogenesis of Giardiasis is not completely understood due to the extensive variation seen in disease expression. Clinical presentation ranges from asymptomatic cyst passage to chronic diarrhea, malabsorption, severe weight loss, and malnutrition. **(Adrabbo and Peura, 2002)**

In asymptomatic patients, histologic exam of the duodenum often shows minimal changes or no abnormal representations. However, the major structural and functional changes associated with giardiasis when symptoms are present are usually found in the small intestine. Factors that influence the clinical presentation of the disease range from the host's immune response to the parasite, the parasite load in the small intestine, and the virulence of the infecting strain of Giardia. There are

several proposed mechanisms of disease that involve both mucosal and luminal factors in patients who exhibit abdominal pain, diarrhea, and malabsorption symptoms. Actual invasion of the mucosa by organisms is a rare finding. The intestinal mucosa may be damaged by the trophozoite itself disrupting the epithelial brush border during attachment, or less likely by direct invasion. **(Farthing, 1996)**

In addition, release of toxic substances from the organism itself may damage intestinal epithelium. Absorptive activities may also be blocked due to the trophozoites "blanketing" the intestinal mucosa and causing functional mucosal obstruction. **(Wolfe, 1992)**

A study by **Dagic et al., (2002)** suggested that intestinal permeability increases during the course of protozoan *Giardia lamblia* infection which causes also damage to the intestinal wall while non pathogenic protozoan infections have no effect on intestinal permeability . This was confirmed by a study by **Chin et al., (2002)** which demonstrated that *Giardia lamblia* induces apoptosis in small intestinal epithelial cells in a strain-dependent manner and increase epithelial permeability across epithelia monolayers.

Kaur et al., (2001) showed that a glycoprotein located on the surface of *Giardia lamblia* trophozoites has been demonstrated to induce fluid accumulation in ligated ileal loops in rabbits . **Eckmann and Gillin , (2001)** reported that *Giardia lamblia* infection in gerbils accelerates intestinal transit time and increases smooth muscle contractility , both of which may play a role in giardial diarrhea .

Some studies have shown that immunologic mechanisms may also play a role since individuals with decreased gamma globulin levels have a higher prevalence of infection and