

## Cryptosporidiosis

Israa Mohammad Abd AL-Khaliq<sup>1\*</sup>, Amjed Qays Ibrahim Alqaisi<sup>2</sup>

<sup>1</sup>Microbiology Department, Al-Kindy College of Medicine, Baghdad University, Baghdad, Iraq

<sup>2</sup>Biology Department, College of Science, Baghdad University, Baghdad, Iraq

\*Corresponding Author: Israa Mohammad Abd AL-Khaliq  
Microbiology Department, Al-Kindy College of Medicine, Baghdad University, Baghdad, Iraq

Email: [israaalhasan@yahoo.com](mailto:israaalhasan@yahoo.com)

### Article History

Received: 20.05.2023

Accepted: 24.06.2023

Published: 06.07.2023

**Abstract:** Cryptosporidiosis is a parasitic disease result from parasite *Cryptosporidium parvum*, that effect intestinal tract of mammals. It was recorded that this parasite causes 6% of diarrhea in immunocompetent persons and 24% in AIDS persons. The primary symptoms of this disease are non- bloody and watery diarrhea, also may cause abdominal pain, nausea, vomiting, and anorexia, .Infection can affect other organs such as gall bladder, liver, and lungs. The aims of this review article to provide the important update information of *Cryptosporidium* parasite, which is the causative agent of cryptosporidiosis. In conclusion cryptosporidiosis is considered a serious health problem, infect human intestinal tract of different ages, and children are the most cases of this disease which have severe pathologic signs.

**Keywords:** Parasitic disease, *Cryptosporidium parvum*, cryptosporidiosis, immunocompromised patients.

## 1. INTRODUCTION

*Cryptosporidium parvum* is apicomplexan protozoan that cause disease cryptosporidiosis that effect intestinal tract of mammals [1]. The first recorded case of human cryptosporidiosis was in 1976 [2] *This parasite cause diarrhea.*

Regarding the molecular studies are helpfulfor researchers to know the transmission of this disease in humans and animals, by using genotyping tools [3]. The first recorded case of this disease of Iraqi children was in 1994, when a study contained 240 Iraqi children less than5 years old were examined, complained from dehydration and gastroenteritis, there were oocysts of *this parasite* in their stools. Samples were tested with Ziehl-Neelsen stain. Among .Other symptoms were vomiting and fever [4]. The prevalence of this disease in AL-Kut governorate in Iraq in 2012 was (33.83%) from study contained 600 children less than 12 years old [5], and another study done in Basra governorate in Iraq 2015, found that the prevalence of this parasite from 134 children less than 15 years, was (23.8%) [6], while other study done in Pediatric Hospital of Erbil City in 2013, found that the prevalence of this parasite from 100 children less than 5 years, was (14%) [7].

**2. LIFE CYCLE:** As shown in (Figure 1).

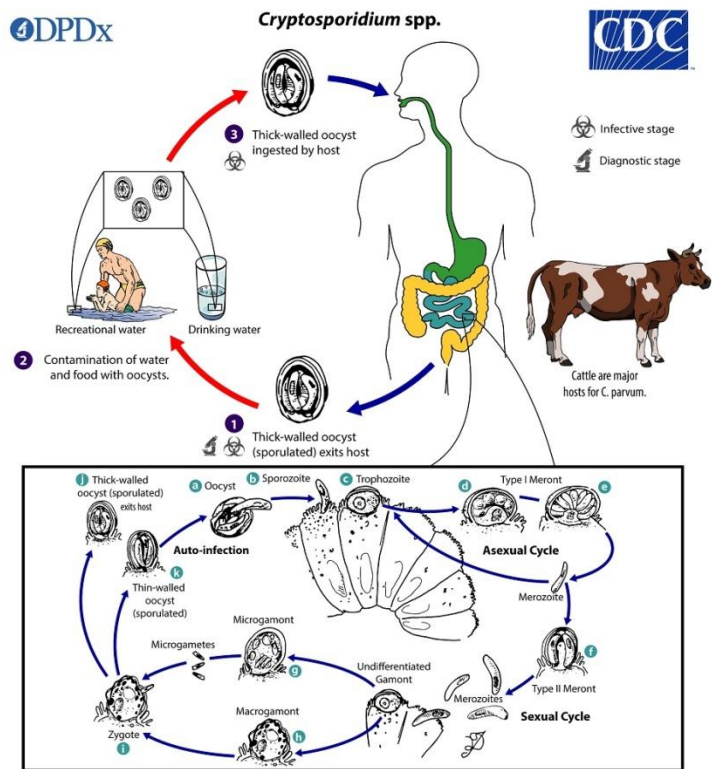


Figure 1: Life Cycle of *Cryptosporidium parvum* [8]

### 3. EPIDEMIOLOGY

Cryptosporidiosis is a worldwide disease, and the most important symptom is diarrhea. Parasite spread among people by fecal-oral route, and transmission through environment occurs by contaminated water sources. The oocysts of this parasite could be found in even treated drinking water with chlorine [9]. In Milwaukee 1993, an outbreak occurred, and 403,000 individuals die. Another outbreak in Copenhagen in a hospital, there were 18 AIDS patients infected with cryptosporidiosis from ice machine [10]. The decrease in the pureness of water sources and filtering also cause water contamination [11], household communications and sexual infected partner, workers in the health care, swimming in public water pools, and travelers to endemic areas, all of it increase infection rate [12].

### 4. CLINICAL MANIFESTATIONS

It is range with the individual immune condition.

#### 4.1 Immunocompetent person

Clinical symptoms ranges from asymptomatic patients, to acute diarrhea, and persistent diarrhea that may last several weeks. Incubation period has a few days. In developing countries, cryptosporidiosis may cause malnutrition and growth retardation in children [13].

#### 4.2 Immunocompromised person

Severity of disease in AIDS patients depends on CD4 counts, chronic diarrhea may last more than 2 months, with CD4 less than 50 per cubic millimeter [13]. Signs and symptoms of disease include:

#### 4.3 Atypical gastrointestinal disease

An important complication is the outlet obstruction of abdomen that may cause GIT disorders ending with severe reduction intake of nutrient [14]. Rupture of the cysts may cause pneumomediastinum and pneumoretroperitoneum [15].

#### 4.4 Disease of the biliary tract

Forbes *et al.*, in 1993 [16], showed that sclerosing cholangitis, is the most important complication of biliary tract.

#### 4.5 Pancreatitis

As depicted by [17]

#### 4.6 Disease of the respiratory tract

Cryptosporidiosis may cause sinuses, inflammation of nasal mucosa, nasal flow and change in the voice, if it is located in the upper respiratory tract [18], while in the lower respiratory tract, it may cause dyspnea, hypoxemia, fever, and cough [19]. The direct inhalation of aerosolized drops or by contaminated coughing on utensils, may involve transmission of oocysts [20].

### 5. LABORATORY DIAGNOSIS

#### 5.1 Examination with wet mount method:

By examination of stool samples with using iodine [21].

#### 5.2 Stained smears:

Smears of stool samples could be stained by using modified Ziehl-Neelsen smear [22], or by using safranin stain [23] (Figure 2).

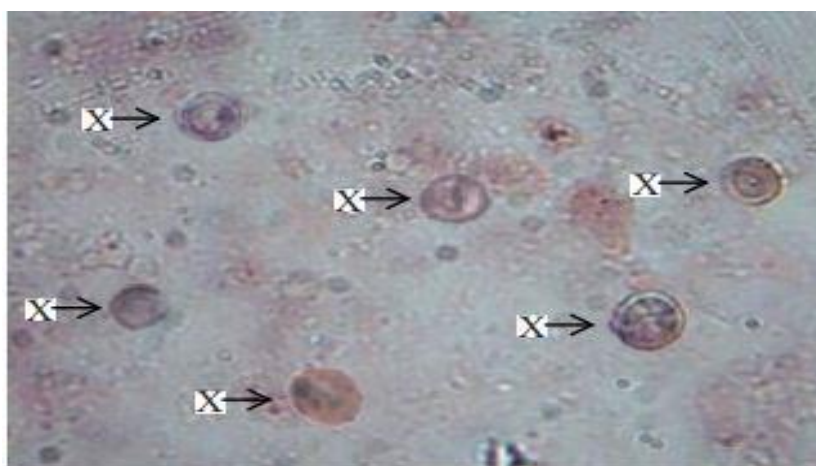


Figure 2: *Cryptosporidium parvum* stained with safranin stain [23]

#### 5.3 Immunological methods

It could be antigen detection method or antibody detection method in serum samples, and both of them give specificity and sensitivity in the range of about 93%-100% [24].

#### 5.4 Histological examination

This examination is based on the histological investigations of the parasite stages in the biopsy of intestinal mucosa. The parasites have a small, rounded shape, measuring 3-5  $\mu\text{m}$ , arranged in clusters or rows in the brush border [25].

#### 5.5 Molecular methods

By using PCR technique, which is a more sensitive method to detect oocysts, a fast method, and can detect species of the parasite [26].

### 6. Treatment

The best drugs for cryptosporidiosis are

#### 6.1 Antimotility agents:

These drugs decrease the movements of the bowel and increase the absorption of fluid to stop diarrhea, such as loperamide [27].

#### 6.2 Fluid replacement

It could be intravenous replacement of fluids or oral. Calcium, potassium, and sodium, can balance fluids of the body [28].

#### 6.3 Nitazoxanide (Alinia)

Which is the only recorded approved drug to treat cryptosporidiosis in immunocompetent patients [28].

#### 6.4 Rifamycins

The infection rate is decreased by 75% when this drug is combined with nitazoxanide [29].

## 7. PREVENTION

### 7.1 Chlorine dioxide:

*Cryptosporidium* parasite is resistant to chlorine, but with the using of high concentrations and contact time, inactivation of this parasite will be appearing for water treatment with chlorine dioxide [30].

### 7.2 Filtered or boiled drinking water

It should be able of removing objects with 1 µm in diameter. Boiled or filtered drinking water should be considered by HIV-infected persons with CD4 counts under 200/mm<sup>3</sup>, and these people should avoid drinking tap water when travel to developing countries. Risk people must avoid contact with the sources of *C. oocysts*, such as diarrheal persons, farm animals, and pets [31].

## 8. CONCLUSIONS

Cryptosporidiosis is considered a serious health problem in Iraq, infect human intestinal tract of different ages, and most infected persons with cryptosporidiosis are children, causing severe pathologic signs.

## REFERENCES

- Centers for Disease Control and Prevention. Cryptosporidiosis. 2017.
- Dozie, I., Nkem, B., & Chukwuocha, U. (2011). Cryptosporidiosis in Imo State, Nigeria. *Journal of Rural and Tropical Public Health*, 10, 106-110.
- Xiao, L., Fayer, R., Ryan, U., & Upton, S. J. (2004). Cryptosporidium taxonomy: recent advances and implications for public health. *Clinical microbiology reviews*, 17(1), 72-97.
- Mahdi, N. K., Al Sadoon, I., & Mohamed, A. T. (1996). First report of cryptosporidiosis among Iraqi children. *EMHJ-Eastern Mediterranean Health Journal*, 2 (1), 115-120, 1996.
- Rahi, A. A., Magda, A., & Al-Charrakh, A. H. (2013). Prevalence of Cryptosporidium parvum among children in Iraq. *American Journal of Life Sciences*, 1(6), 256-260.
- Salim, M. (2018, May). Epidemiological study on Cryptosporidium among children in Basra Province-Iraq. In *Journal of Physics: Conference Series* (Vol. 1032, No. 1, p. 012072). IOP Publishing.
- Koyee, Q. M., & Faraj, A. M. (2015). Prevalence of Cryptosporidium spp. with other intestinal microorganisms among regular visitors of Raparin Pediatric Hospital in Erbil City-Kurdistan region, Iraq. *Zanco Journal of Pure and Applied Sciences*, 27(4), 57-64.
- Centers for Disease Control and Prevention. <https://www.cdc.gov/dpdx/cryptosporidiosis/index.html> (2019).
- Meinhardt, P. L., Casemore, D. P., & Miller, K. B. (1996). Epidemiologic aspects of human cryptosporidiosis and the role of waterborne transmission. *Epidemiologic reviews*, 18(2), 118-136.
- Mac Kenzie, W. R., Hoxie, N. J., Proctor, M. E., Gradus, M. S., Blair, K. A., Peterson, D. E., ... & Davis, J. P. (1994). A massive outbreak in Milwaukee of Cryptosporidium infection transmitted through the public water supply. *New England journal of medicine*, 331(3), 161-167.
- Chen, X. M., Keithly, J. S., Paya, C. V., & LaRusso, N. F. (2002). Cryptosporidiosis. *New England Journal of Medicine*, 346(22), 1723-1731.
- Farthing, M. J. (2000). Clinical aspects of human cryptosporidiosis. In: Petry, F., ed. *Cryptosporidiosis and microsporidiosis. Contributions in microbiology. Karger, Basel*, 6, 50-74.
- Moon, A., Spivak, W., & Brandt, L. J. (1999). Cryptosporidium-induced gastric obstruction in a child with congenital HIV infection: case report and review of the literature. *Journal of pediatric gastroenterology and nutrition*, 28(1), 108-111.
- Samson, V. E., & Brown, W. R. (1996). Pneumatosis cystoides intestinalis in AIDS-associated cryptosporidiosis: More than an incidental finding?. *Journal of clinical gastroenterology*, 22(4), 311-312.
- Forbes, A., Blanshard, C., & Gazzard, B. (1993). Natural history of AIDS related sclerosing cholangitis: a study of 20 cases. *Gut*, 34(1), 116-121.
- Godwin, T. A. (1991). Cryptosporidiosis in the acquired immunodeficiency syndrome: a study of 15 autopsy cases. *Human pathology*, 22(12), 1215-1224.
- Giang, T. T., Pollack, G., & Kotler, D. P. (1994). Cryptosporidiosis of the nasal mucosa in a patient with AIDS. *AIDS*, 8(4), 555-556.
- Palmieri, F., Cicalini, S., Froio, N., Rizzi, E. B., Goletti, D., Festa, A., ... & Petrosillo, N. (2005). Pulmonary cryptosporidiosis in an AIDS patient: successful treatment with paromomycin plus azithromycin. *International journal of STD & AIDS*, 16(7), 515-517.
- Mor, S. M., Tumwine, J. K., Ndeezi, G., Srinivasan, M. G., Kaddu-Mulindwa, D. H., Tzipori, S., & Griffiths, J. K. (2010). Respiratory cryptosporidiosis in HIV-seronegative children in Uganda: potential for respiratory transmission. *Clinical infectious diseases*, 50(10), 1366-1372.
- Smith, H. V., & Nichols, R. A. (2010). Cryptosporidium: detection in water and food. *Experimental parasitology*, 124(1), 61-79.

21. Fallahi, S., Aghamolaei, S., Rostami, A., biderouni, F. T., Haghghi, A., & Salehi, N. (2014). Evaluation of modified Ziehl-Neelsen, direct fluorescent-antibody and PCR assay for detection of *Cryptosporidium* spp. in children faecal specimens. *Journal of parasitic diseases*, 14, 5.
22. AL-Khaliq, I. M., Nasser, A. J., & Ghadban, M. M. (2021). Role of *Lactobacillus plantarum* and *Lactobacillus acidophilus* as a Treatment of Cryptosporidiosis in Mice. *International Journal of Drug Delivery Technology*, 11, 812-816.
23. Chan, R., Chen, J., York, M. K., Setijono, N., Kaplan, R. L., Graham, F., & Tanowitz, H. B. (2000). Evaluation of a combination rapid immunoassay for detection of *Giardia* and *Cryptosporidium* antigens. *Journal of clinical microbiology*, 38(1), 393-394.
24. Scallan, E., Hoekstra, R. M., Angulo, F. J., Tauxe, R. V., Widdowson, M. A., Roy, S. L., ... & Griffin, P. M. (2011). Foodborne illness acquired in the United States—major pathogens. *Emerg Infect Dis*, 17(1), 7-15.
25. Bennett, J. E., Dolin, R., & Blaser, M. K. (2015). Principles and practice of infectious diseases. 8<sup>th</sup>.ed. Philadelphia, Elsevier Churchill Livingstone.
26. Checkley, W., White, A. C., Jaganath, D., Arrowood, M. J., Chalmers, R. M., Chen, X. M., ... & Houpt, E. R. (2015). A review of the global burden, novel diagnostics, therapeutics, and vaccine targets for cryptosporidium. *The Lancet Infectious Diseases*, 15(1), 85-94.
27. Cabada, M. M., White, A. C., Venugopalan, P., Sureshbabu., & Bronze, M. S. (2015). Cryptosporidiosis Treatment & Management. Medscape. WebMD, 2, 181-187.
28. Giacometti, A., Cirioni, O., Barchiesi, F., Ancarani, F., & Scalise, G. (2000). Activity of nitazoxanide alone and in combination with azithromycin and rifabutin against *Cryptosporidium parvum* in cell culture. *Journal of Antimicrobial Chemotherapy*, 45(4), 453-456.
29. Chauret, C. P., Radziminski, C. Z., Lepuil, M., Creason, R., & Andrews, R. C. (2001). Chlorine dioxide inactivation of *Cryptosporidium parvum* oocysts and bacterial spore indicators. *Applied and environmental microbiology*, 67(7), 2993-3001.
30. Kaplan, J. E., Masur, H., & Holmes, K. K. (2002). Guidelines for preventing opportunistic infections among HIV-infected persons--2002. Recommendations of the US Public Health Service and the Infectious Diseases Society of America. *MMWR. Recommendations and reports: Morbidity and mortality weekly report. Recommendations and reports*, 51(RR-8), 1-52.