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A review article: *Crptospordium spp* in humans from Iraq

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Abstract

Cryptosporidium Spp. is one of the most critical fecal-oral pathogens in the world and a major contributor to mortality from contaminated diarrhea it includes *Cryptosporidium hominis* (*C. hominis*) and/or *Cryptosporidium parvum* (*C. parvum*) are caused by for the most human infections. The life cycle of the parasite includes both asexual and sexual phase. Environmentally resistant spores that commonly contaminate food sources and drinking water are the means by which the infection is generate. In immunocompetent persons, this can result in main diarrhea outbreaks that typically last less than two weeks. Diarrhea can cause severe morbidity and mortality in immunocompromised or immunosuppressed individuals, in particular in AIDS patients. Moreover, in Iraq, it is important to carry out molecular genotyping research in order to identify the species and subtypes of *Cryptosporidium* that infect people and animals. As a result, the parasite *Cryptosporidium* should be considered an important public health problem and be part of Iraq's regular infectious disease surveillance and diagnosis program.

Keywords: *Cryptosporidium parvum*; *Cryptosporidium hominis*; Oocyst; Human; Sporozoite

1. Introduction

Cryptosporidium spp. a pathogenic parasite that present in intestinal of many families (1). Ernst Edward Tyzzer, who first define the parasite in the intestinal epithelium of mice in 1907. Child and adult human infection was first defined in 1976. Due to the reports of disease outbreaks in day care centers as well as in water transmission reports, *Cryptosporidium spp.* conceder as a public health problem especially with patients of immunosuppression (2).

Cryptosporidium spp. is strongly associated with diarrhea in AIDS patients, and is the cause of wide food-borne and water-borne gastroenteritis (3). In Iraq, the high prevalence of infection was explained through several studies due to several environmental factors in various regions, including drinking tap water contaminated with *Cryptosporidium* oocyst, that aid its transmission to man and animals (4).

There are greater than 10 species of *Cryptosporidium*. *C. parvum* and *C. hominis* are the 2 species responsible for the most infection of human Cryptosporidiosis global (5). In spite of the pathogen can be discovered infecting all age groups however it is more common amongst children and aged people as most research have indicated, so age group play an essential role in *Cryptosporidium* infection (6).

Globally, *cryptosporidium ssp.* causes a significant parasitic disease, that cause gastroenteritis and diarrhea in human beings and animals (7). *Cryptosporidium* is a protozoan parasite from intracellular apicomplexan, that infects the epithelium of gastrointestinal tract in the microvillus border of the host which cause disrupting to epithelial cell of the small intestine and loss its function leading to moderate or extreme diarrhea and different abdominal symptoms. In immunocompetent people cryptosporidiosis is considered as a self-limiting disease, while in immunocompromised host

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it can also result in chronic and life-threatening case (8). Many animals, especially cattle, can additionally infected with Cryptosporidiosis, and it also serve as a source of the oocysts for environmental contamination and human infections (9).

1.1. Classification of Cryptosporidium (10)

Phylum: Apicomplexa
Class: Sporozoasida
Sub–class: Coccidiasina
Order: Eucoccidiorida
Sub-order: Eimeriorina
Family: Cryptosporidiidae
Genus *Cryptosporidium*

2. Epidemiology

Although *Cryptosporidium* species are observed all across the world, they are mainly common in developing and rising countries (11). The most regular approach of transmission, recognized as the fecal-oral route, frequently entails ingesting contaminated each food and drinks. If any individual comes into direct contact with animal waste or is exposed to it via cross-contamination, this could occur. When hosts eat contaminated oocysts, *Cryptosporidium* is often transmitted (11, 12).

Mahdi *et al.,*1996 (13) published a study in which they reported the discovery of cryptosporidiosis in Iraq; this was despite the knowledge that the public health importance of *Cryptosporidium* was well known. The authors discovered that the stool samples of 21 (8.8%) out of the 240 children under 5 years old from the Basrah governorate had *Cryptosporidium* oocysts in them. Boys were more inclined to be infected than girls, and children who lived in cities (17/21; 81%) were more likely to be infected than children who lived in rural areas (4/21; 19%).

Since then, studies have been carried out throughout the nation in a range of conditions to determine cryptosporidiosis prevalence in rural areas and city. (14,15).

Studies carried undertaken in a number of parts of Iraq have established that infection rates range. As an illustration, in Al-Najaf City, found a lot decreased infection incidence of 58%. (16) observed a rate of 47.33 percent in the province of Baghdad; (17) found a rate of 23.8 percent in the province of Basra. According to (18), the rate in Kirkuk City was observed to be 22.68%. The fact that the majority of research have focused on babies and younger children, variations in sample sizes, regional and cultural variances, and the use of a different techniques for diagnosis.

The study's finding demonstrated statistically significant relationship between education level and frequency of *Cryptosporidium* infection. For instance, the study showed those with lower educational attainment, especially those who were illiterate that compared to literate people, had a higher prevalence of infection. The results of this investigation align with the studies conducted in southern Egypt by (19). Their findings demonstrated that, in comparison to individuals with lower educational attainment had a far higher prevalence of infection, those with higher educational attainment.

3. Pathogenesis and Clinical signs of Cryptosporidiosis in humans

The *Cryptosporidium* pathogenicity by which causes malabsorption, diarrhea, and wasting is a misleading understanding. Whatever these mechanisms may be, the primary event in pathogenic mechanisms is experiences of attachment and invasion. Which it has detailed ultrastructural characteristics of attachment and invasion, as well as the factors that influence these processes, has been described. However, there is limited knowledge about the specific parasites and host molecules including in these intricate mechanisms (20).

During the life cycle of *Cryptosporidium*, the main virulence factors is the manufacturing of toxins that harm the absorption of chloride ions, resulting in decreasing the absorption area which caused by villous atrophy. Crypt hyperplasia and lymphocytes infiltration are also found in children with more severe infections. the parasite often disrupts the normal release of prostaglandins, which also activates the contraction of digestive smooth muscle cells substance P, that effects in an extend in the vascular permeability of endothelial cells in the gut and inflammation, and tumor necrosis factor (TNF), which is additionally related with infection processes(21).These complex mechanisms may also lead to profuse diarrhea.

In humans, *Cryptosporidium* infections may be asymptomatic while in other cases some of the clinical features noticed, moderate to severe watery diarrhea is the characteristic of gastrointestinal cryptosporidiosis, that often contain mucous same as in infants and children (11; 12).

In very severe cases, particularly immunocompromised host like those with AIDS/HIV, diarrhea may become profuse and cholera-like, leading absorption and hypervolemia, other common features include abdominal pain, low-grade fever, dehydration, fatigue, and weight loss. (**22**)

4. Life cycle

Cryptosporidium life cycle concluded inside a one- only host that called monoxenic, the infection occurred through the ingestion of sporulated oocysts, a thick wall spherical to ovoid shape that contains 4 sporozoites in it, they are 4-6 µm in size (14).

After taking of oocyst by the host, the initial step is excystation process and rupture of oocyst in intestinal lumen releasing infectious sporozoites during this process, then the wall of oocyst opens along a cleft to allow the sporozoites to release (15; 21,23,24).

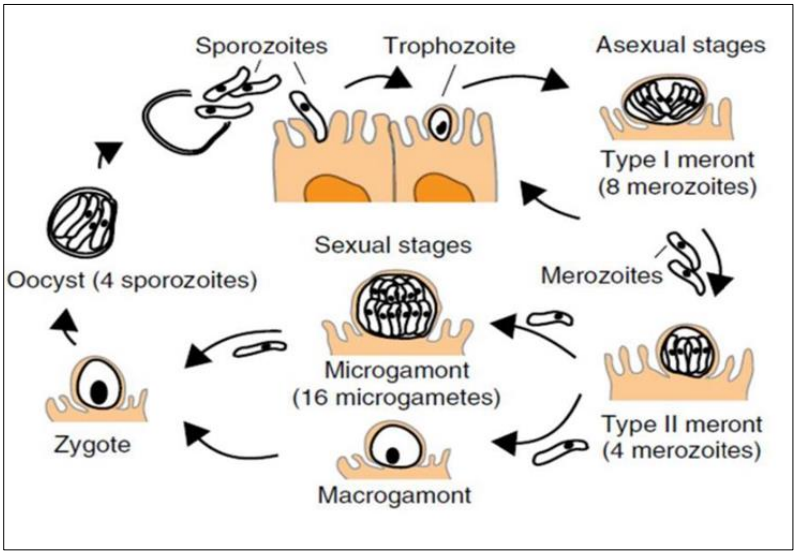

Figure 1 Life cycle of Cryptosporidium spp. (25)

Trophozoite or a fully encapsulated parasite forms through the process of excystation, attachment and internalization, this trophozoite eventually develops into a Type I meront. The trophozoite divides into eight merozoites through cell divisions, within a type I meront. These merozoites have the ability to reinfection the epithelium and produce to either a type I meront, intensifying the infection, or a type II meront, which is destined for sexual reproduction,type II meront, which can initiate the sexual phase thru differentiating into either a microgamont (male) or a macrogamont (female) which then divides and differentiate into microgamete and macrogamete, respectively. Resulting in formation of zygote form from fertilization process of microgametes and macrogametes which will enhance into an oocyst that eventually passes via the fecal to the environment and become prepared to be ingested and begin the cycle in some other host (26). The diploid zygote fertilized macrogametes develop into t two types of oocyst containing thick wall oocyst and thin walled oocysts, this takes place throughout a process known as sporogony, which varieties 4 haploid sporozoites with thin-walled or thick-walled oocysts, thin-wall oocysts initiate a new life cycle (auto-infection) in the intestine lumen to liberate their sporozoites resulting in persistent infection of the patient, thick-walled oocysts, which are shedding in stool to the surroundings and are fairly resistant to disinfectant and different environmental conditions, can immediately transmit to the next host without maturation (27; 28)

4.1. Diagnosis of *Cryptosporidium spp*

Various laboratory methods can be used to diagnose *Cryptosporidium* oocysts, including acid fast stains, fluorescent staining, immune chromatographic, molecular methods and enzyme immunoassays, techniques (29). Chalmers (30) found a study conducted that immunofluorescence microscopy is more sensitive than enzyme immunoassay and

graphical lateral flow of immune chromate. It is also more susceptible to auramine phenol staining and modified Ziehl-Neelsen compared to the standard techniques used in the UK. Immunofluorescence microscopy is generally considered the preferred approach for detecting Cryptosporidium spp. in Europe and the USA (31). In latest years, molecular methods, such as polymerase chain reaction (PCR), have been extensively developed in research laboratories. These techniques for the identification of *Cryptosporidium spp* of high sensitivity and specificity (32,33).

5. Conclusion

This *cryptosporidium* parasite is an important source of morbidity and may play a role in the transmission of other pathogens we recommend more focused studies be conducted on the epidemiology of *cryptosporidium* and to increase awareness to the implementation of measures of hygiene that are thought more effective in fight against this disease.

Compliance with ethical standards

Disclosure of conflict of interest

Authors declares no conflicts of interests.

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