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Prevalence of Human Intestinal Cryptosporidiosis in Iraq during 2000-2020.

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Abstract*: The prevalence of cryptosporidiosis among Iraqi people is reviewed from 2000-2020. Since the disease is opportunistic, the distribution is mentioned among immunocompetent and immunocompromised individuals in different Iraqi provinces. The prevalence rates are also illustrated in relation to age and residency. It is zoonotic disease infecting humans and animals.Transmission can occur through fecal-oral route, including direct as well as indirect routes. The direct mode of infection takes place by person-to-person contact or animals-handlers. The indirect route involves drinking contaminated water or eating contaminated food. Cryptosporidiosis in immunocompromised patients is characterized by debilitating, chronic, often cholera-like diarrhea associated with severeabdominal colic, loss of body weight and dehydration.The main symptom of human cryptosporidiosis in immunocompetent is diarrhea, weight loss, dehydration and abdominal pain which might be life-limiting disease. Thus, it is a public health concern in many parts in the world.Since, Cryptosporidium is acid-fast parasite, Zeihl-Neelsen stain method should be applied as a routine diagnostic tool in the laboratories in order to reduce the suffering often faced by those patients.*

Keywords: Intestinal cryptosporidiosis, Iraq, Prevalence.

Introduction

Cryptosporidiosis is an emerging, zoonotic and opportunistic diseasewhich leads to intestinal and pulmonary diseases in both humans and animals (1).It is caused by protozoan parasite belong to genus *Cryptosporidium.*There are 41 species of *Cryptosporidium*, buthuman infection involves mainly 2 species: *C. hominis* and C.*parvum* (2).

The major factor controlling the susceptibility and severityof cryptosporidiosis appears to be the immunestatus of the host(1). Those with great risk of infection including the immunocompromisedpatients(3,4). They are including AIDS patients, malignancy, cytotoxic drugs receivers, prolonged corticosteroid therapy, the drugs used to prevent organ transplant rejection, those with chronic diseases and persons who have congenital immunodeficiency (5,6). Cryptosporidiosis in those patients is characterized by debilitating, chronic, often cholera-like diarrhea associated with severeabdominal colic, loss of body weight and dehydration (7).The main symptom of human cryptosporidiosis in immunocompetent is diarrhea, weight loss, dehydration and abdominal painwhich might subside after 2 weeks.

Transmission can occur through fecal-oral route, including direct as well as indirect pathways. The direct mode of infection takes place by person-to-person contact or animals-handlers. The indirect route involves drinking contaminated water or eating contaminated food. Water is the major medium for contamination by*Cryptosporidium*(8,9) which leads to diarrheal disease in both humans and animals (10–12).

Cryptosporidium spp. are worldwide in its distribution. They are responsible for millions of cases and thousands of deaths in 2016 (13).*Cryptosporidium* is the causative agent for moderate to severe diarrhea in children in Asia and Africa (14). Thus, it is a public health problem in many parts of the world.In addition, cryptosporidiosis can be undetectable and unrecorded in most countries(15,16).In Iraq, the first case has been reported in 1996 (17). Then many surveys were carried out in different provinces among general population, patients, children of both sexes with or without diarrhea in the urban and rural areas. The prevalence rate is varying from one region to another.

Since *Cryptosporidium* is an opportunistic parasite, this review is todetermine the rate of infection in order to identifying measures to reduce the burden ofcryptosporidiosis in different communities in Iraq.

Results and Discussion

The prevalence rates of cryptosporidiosis are reviewed according to the types of communities including general and selected populations in different Iraqi provinces (Chapter 1, Figure 1).

Many predisposing factors have implanted in the distribution of cryptosporidiosis and other diarrheal infections, such as inadequate water supplies, unclean water, poverty, crowdness, malnutrition, displaced or refugee, poor hygiene and sanitation, improper washing of green vegetables, poor animal husbandry and animal handlers (18–20).

A significant association was found between cryptosporidiosis and water contamination. In Wasit province, about 31.6% of the inhabitants use storage water, while only 1.3% use sterile water bottles (21). In addition, the use of waste water to irrigate vegetables or organic manure as a fertilizer that are eaten without proper washing leads to food-borne parasitic infections (22,23). In marsh region of South Basrah, 36.4% of water samples were contaminated with intestinal parasites (24).

Immunosuppression could be caused by malignant disease itself or chemotherapy or both of them (25-27).Also in 1991 and after use of depleted uranium (U238) by U.S. troops during their aggression in Iraq might have contribution to such situation. This has been proved by determination of radioactive using gamona spectrometric analysis of plants, water and soil specimens taken from southern Iraq(28,29).

Since *Cryptosporidium* is acid-fast parasite, the routine diagnostic technic used in the mentioned surveys is the modified Zeihl-Neelsen stain. Nevertheless, ELISA and PCR were used as well in 2 works (26,30). The different methods might have an influence on the prevalence rate in the area or the examined population. Therefore, if this is true, there will be a close relationship between the rate of infection and the method followed for stool examination**.**

Conclusion

Cryptospridiosis is prevalent among all types of communities and population samples from both urban and rural regions of Iraq. Adults and children of both sexes are infected. Due to lack of effective chemotherapy or vaccine against cryptosporidiosis, an urgent and efficient preventive and control measures is essential.

Implementing a national control program should include a primary health care, health education, family planning, water supply, environmental sanitation, nutrition, avoid crowdness and improvement in agriculture practices. Well trained health workers chosen from the same community are valuable in the diagnosis and treatment especially in rural areas and far villages in the country.Zeihl-Neelsen stain method should be applied as a routine diagnostic tool in the laboratories in order to reduce the suffering often faced by those patients.

Table 1. Prevalence of human intestinal cryptosporidiosis among differentpopulation.

Province	Description	% prevalence	Ref.
Basrah	Males & females receiving corticosteroids. Ages ranged 5.5-54 years.Mixed infection was mainly found with*Blastocystishominis.*	100	31
Basrah	40 Males & females from3 hospitals in Basrah with sickle cell disease. Ages ranged <6-46 years.	5.0	32
Basrah	60 Animal handlers (veterinian, butchers & breeders) with mean age of27.16±16.86 years. Non-animal handlers rate: Highest infection rate in: Age <6 years. Age 16-25 years.	5.0 1.14 25.0 11.11	33
Basrah	43 children, 10 personnel and 35 household contacts of Day-Care Center. *Cryprosporidium*oocysts were found to be excreted in: Children. Household. personnel of the day-care center.	 9.0 7.2 0.0	34
Basrah	205 individuals aged 2months -65years old suffering from chronic diarrhea for at least 2 weeks& attending the Materity& Child Hospital. The highest infection rate in age group 26-35 years: Male rate. Female rate. Rate for people using commercial water (sterile). Rate for people using tap water. First report of 2 cases of *Cyclospora.*	9.7 Control: 1.1 17.6 30.7 22.5 22.7 8.2	35

Basrah	194 malnourished children. <5 years oldeither without diarrhea or with diarrhea were attending the Maternity and Child Hospital. Marasmus, marmasmus-kwashiorkor, Kwashiorkor and underweight were recorded at a rate of 84%, 8.24%, 6.18% and 1.55% respectively. The infection rate in: Malnourished with diarrhea. Malnourished without diarrhea. Well-nourished with diarrhea. Well-nourished without diarrhea.	6.85 14.89 11.0 2.0 0.0	36
Basrah	101 Male& female children with malignant disease attending the Oncology Center, Basrah Teaching Hospital. Ages ranged <4-16 years. Highest infection rate was found in patients with Hodgkin lymphoma: Male to female ratio was 1.5:1.0.	9.0 Control: 0.93 36.36	25
Basrah	134 apparently children with an ages of a month-15 years. The highest infection rate was among age group of a month-<1year (28%) & 5-15 years (25%). Males infection rate: Females infection rate:	23.8 24.2 23.5	37
Basrah	1026 Patients 6-30 years old attending General Hospital. The highest infection (69) cases in age 20-30 years: The lowest infection in age 6-10 years:	16.27 9.35 0.29	38
Baghdad	90 patients from private laboratories with age of 20-60 years Male rate: Female rate:	44.45 25.55 18.88	39
Diwaniya	100 diarrhoeic children were inspected in Maternity & Childhood Teaching Hospital. Ages <10 years.	29.0	30
Kirkuk	584 adults from internal displaced population aged 18-78 years. Poor hygienic residence: Good hygienic residence:	35.74 23.48 5.79	40
Kirkuk	417 Displaced people. Age <1-60 years. Age 1-10 years highly infected by *Giardia lamblia*. Gender was insignificant.	1.67	41
Duhok	1172 children attendingHivi Pediatric Hospital. High infection in summer and rural area. Males were infected more than females. Highest rate among children more than 9 years. Artificially feeding had higher rate of infection.	9.2	42
Dohuk	332 children were examined with an ages of <1-12 years. infection rate 44.68% was observed in	66.95	26

	immunocompromised and 22.27% in immunocompetent children. Among immunocompetent children, the prevalence was highest among <1 year of age (39.34%) in diarrheoicgroup, while in non-diarrheoic group, it was highest among 1-4 years' age (28.57%). The prevalence in males immunocompetent was 21.37% & females 23.14%. While in case of males immunocompromised was 38.1% and females 50%.		
Sulaimania	300 patients with cancer were attending the Hiwa Hospital. Ages ranged <10->51 years. No significant differences among age groups or residency. The highest rate was among >51 years old. Health control Males infection rate: Females infection rate:	17.0 3.0 10.0 7.0	27
Mosul	107 patients with malignant disease during 2002-2003.	18.37	43
Erbil	548 diarrheic children ofa month-13 years were attendingRaparinPediatric hospital. The highest infection rate in: Age 2-4 years. Male. Urban. August. The lowest infection rate in: Age >6 years. Female. Rural. March. Mixed infection was with *Blastocystishominis.*	10.77 14.28 13.86 12.01 21.33 7.87 7.05 10.17 1.51	44

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