A SURVEY OF GIARDIA AND CRYPTOSPORIDIUM SPP.IN RURAL AND URBAN COMMUNITYIN NORTH DELTA, EGYPT

By

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ABSTRACT

Background:*Cryptosporidium* spp. and *Giardia duodenalis* are 2 protozoan parasites that affect humans and a wide range of domestic and wild animals. These parasites are a major cause of diarrheal disease in humans and animals worldwide, causing high morbidity in their hosts, in immunocompromised hosts and children, they can lead to death

Objective: The purpose of this study was to assess the frequency of *Cryptosporidium*spp.and*Giardia* spp. in the northern part of Delta (Damietta governorate) and the risk of human infection of these protozoa related to personal data, socio-cultural and environmental characteristics, and the presence or absence of symptoms/signs among a rural and urban population.In order to assess the prevalence of these protozoa among population in the northern part of Delta and the risk of human infection, 330 people (175 females and 155 males)with or without symptoms who attended a Health Care Center were parasitologicallystudied.

Results: Of the surveyed population (330), 3.6% were infected with*Cryptosporidium*spp. only or 24.2% with*Giardia* spp. and 2.4% were infected with both protozoa. The frequency of infection according to sex; 2,7% of males were infected and 0.9% of females by*Cryptosporidium*spp, 12.7% and 11.5% by*Giardia* spp.and 1.5% and 0.9% by both parasites, respectively.*Cryptosporidium*spp.and *Giardia* spp. was frequentin children(under 12 year) than adults in both sexes, however,*Cryptosporidum*infections were most frequently diagnosed in children less than 12yearsold and prevalence decreased with age.

Conclusion: Theprevalences of these protozoa in this community are lower than those reported by otherstudies, which is probably associated with the low density of the studied population. Studiesanalysis revealed that a male sex, children,loss of weight, impropal waste disposal, diarrhea and abdominal pain were correlated with the presence of these parasites, which indicate the importance of these factors in rural communities.

Keywords:*Cryptosporidium*spp.,*Giardia* spp., epidemiology, rural and urban community, North Delta, Damietta Governorate.

INTRODUCTION

Cryptosporidium spp. and Giardia duodenalis are 2 protozoan parasites that affect humans and a wide range of domestic and wild animals [1-3]. These parasites are a major cause of diarrheal disease in humans and animals worldwide, causing high morbidity in their hosts, and in immunocompromised hosts, they can lead to death. The transmission of these 2 parasites is sustained by zoonotic (animal to human) and anthroponotic (human to human) cycles where several species and genotypes are enrolled [3-5].The protozoanflagellate Giardia lambliashares severalepidemiologic characteristics with C. parvum. Both organismsare water-borne and this route has been the cause oflike C. parvum, G.lambliais a cause of childhooddiarrhea and may be transmitted by close-contact and is oftenassociated with epidemics of diarrhea in day care facilities.16 The prevalence of

both G. lambliaand C. parvumisgenerally higher among very young children and this maybe related to more efficient fecal-oral transmission of the infective stages or enhanced susceptibility due to lack ofimmunity.17While the prevalence of cryptosporidiosis and giardiasisis well documented in patients and children with human immunodeficiencyvirus (HIV) and AIDS, data are not widelyavailable on the cross-sectional distribution of these infections.Water-borne outbreaks of infections with the parasiteshave highlighted the fact that morbidity may occur outsideof these focus groups in endemic areas. The infected hosts shed in the environment a large number of these transmissive and infective stages, contributing to an increase of environmental contamination. Cysts and oocysts not only remain infective for long periods in environment but are also resistant to the conventional treatment processes of water, representing a serious problem of public health [2,8-12]. This problem is also potentiated by the fact that the number of parasites required to induce infection is small, i.e., infectious dose of 83-123 oocysts for Cryptosporidiumspp.and 19-50 cysts for G. duodenalis[1,13].intestinal infections caused by Cryptosporidium and *Giardia* spp. are associated to climatic factors, basic sanitary conditions, and sociocultural characteristics[7]. Traditionally, the prevalence of these infections was considered a "stable endemic characteristic" resulting from the dynamics of repeated re-infection[1]. (According to Atías[1] and[7], the frequency at which repeated infection occurs in a population depends on the "infection pressure" and host susceptibility. "Infection pressure" is defined as the number of host exposures at a given location over a certain period of time. The factors involved in "infection pressure" are of two types: environmental and socio-economic, which are intimately linked since the environment has a certain influence on the socio-economic conditions of a population and human activities also affect the environment[15].Environmental conditions (e.g. temperature, humidity, wind, soil) and socio-economic factors are responsible for spreading and for developing infectious forms of Cryptosporidiumand *Giardia* spp., and for polluting the environment with these agents.Giardiasis is a cosmopolitan zoonotic infection, and predominates in mild humid climates. According to Crompton[4], two hundred million are infected with *Giardia* spp. worldwide. And, 15% of the rural population in Latin America is estimated to be infected with these parasites; with a higher prevalence among children[1]. In addition, the infection prevalence is lower in the upper strata of the population, and increases in day care centers attended by the children of poorer families[6]. On the other hand, Cryptosporidium is an intestinal parasite that infects both in humans and animals.Infection with Cryptosporidium spp. was reported in immunocompromised, as well as immunecompetent, children and adults[1], and in animals[15]. The disease occurs in most countries including Arabian countries[19], USA[9] and Egypt[1, 8, 9, 15&19]. It also has a higher prevalence in tropical regions, reaching infection levels of 20-50%, especially in rural areas[9]. Moreover, both protozoan infections are associated with non-specific gastrointestinal symptoms[10] diarrheaand weight loss.[3]. The purpose of this study wasto assess the frequency of *Giardia* spp. and Cryptosporidium in the northern part of Delta and the risk of human infection of these protozoa related to personal data, socio-cultural and environmental characteristics, and the presence of symptoms/signs among a rural and urban population.

SUBJECTS,MATERIALS AND METHODS

Study area

North Delta, Damietta Governorate, Damietta city representing urban area and Kafrsaad villages representing rural area (10km apart from Damietta).Damietta is a governorate situated in the north region of Delta, which lies in northeastEgypt some 200 km from the capital city, Cairo (Fig. 1). Million five hundredthousand people reside in an area of 589km^2 (991,687inhab rural areas).The town has a commercial downtown or "urban region", surrounded by a rural area.

Fig. 1:Geographical location of North Delta of Egypt.

Selected population

The study extended from January 2010 to January 2011, stool samples were referred to Department of parasitology, Faculty of medicine(Damietta), Al-Azhar University, Egypt Total 330 people (175 females and 155 males), with or without symptoms, who attended a Health Care Center were studied. Of these, 191 people lived in an urban area (UA) (57.4%) and 139 in a rural area (RA) (42.6%); 239 were under 12 years old, and 134 lived in the UA. Each individual was surveyed for personal, environmental and socio-cultural data. Personal information - age, sex, and place of residence - was collected, as was socio-cultural and environmental information, garbage disposal (open pit, burning, burying or city garbage collection), water supply (running water, home pump, community pump), tap (inside/outside, public), body waste disposal (sewage, well with a chamber, cesspool, or latrine), overcrowding (presence or absence, presence was defined as more than three people sleeping to a room), and house flooding (never, sometimes, frequent). In addition, subjects were asked about the presence or absence of the following symptoms/signs: anal itching, abdominal pain, sleeping disorders, diarrhea, vomiting, appetite loss, weakness, and weight lost

Parasite analysis

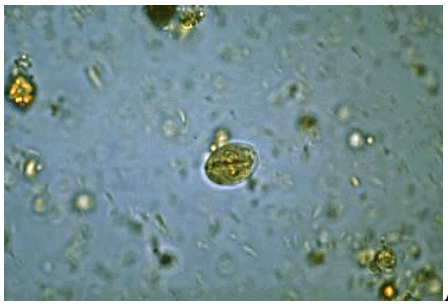
A serial parasitological analysis was performed, consisting of stool sampling from a daily spontaneous bowel movement, sample were stored in a jar containing 5% formaldehyde. To detect *Giardia* spp. and *cryptosporidium*, the samples were processed and subjected to direct wet smear method and Sheather's sugar flotationand acid-ether sedimentation techniques Technique[22].Processed pellets were stained with lugol and modifiedZiehl-Neelsenacid fast stain and observed under a microscope .

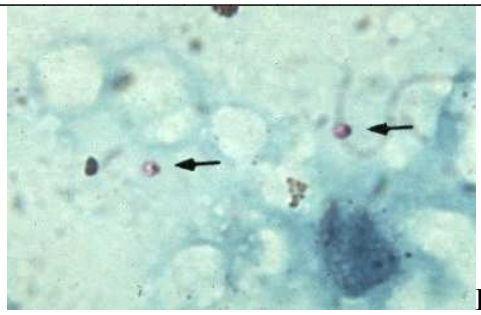
Statistical analysis

Significant associations were determined using the chi square test and Fisher's test. Socio-cultural and environmental characteristics, symptoms, age, and sex were used as (independent) explanatory variables. SPSS software, version 11.5 was used throughout.

RESULTS

Fig (1) showing detected Cyst of *G. Iamblia*in iodine preparation (A) and *Cryptosporidium* oocysts inMidified ZN acid fast stain preparation (B)


A


B

Sex, age, and place of residence in the analyzed population are shown in Table 1. In the studied population, 3 % (10/330) of subjects were infected with*Cryptosporidium*spp.only, 22.7% (75/330) with *Giardia* spp.only and 4.5% (15/330) were infected with both protozoa. Regarding Cryptosporidiumspp.infection, 5.6% (9/158) of males were infected and 1.7% (3/172) of females, similarly for Giardia spp., 26.5% (42/158) of males were infected and 22% (38/172) of females, and 3.1% (5/158) and 2.9% (5/172) were infected with both protozoa. These apparent differences between the sexes were not significant.

Tab 1: age,Sex and place of residence of the 330 people studied in North Delta, Damietta

Areas	Sex	Under 12 year No (%)	Over 12 year No (%)
Urbun	Male	78(23.6)	19(5.7)
	Female	61(18.5)	33(10)
	Total	139(42.1)	52(15.7)
Rural	Male	45(13.6.1)	16(4.8)
	Female	55(16.6)	23(6.9)
	Total	100(30.3)	39(11.8)

The prevalence ofCryptosporidiumspp.was 3.1% (6/191) in the UA and 4.0% (8/139) in the RA. *Giardia* spp. prevalence was similar in both areas, i.e., 23.5% (45/191) in the UA and 21.5% (30/139) in the RA. Of the 10 people parasitized by both protozoa, 5 (2.6%) lived in the UA and 5 (3.5%) in the RA.Distributions according age, sex, and place of residence are shown in Table 2. Analysis of the age distributions of both parasites in the populations revealed that the frequency of Cryptosporidiumspp.infection was highest among those aged 2 to 7 years, peaking at 4 years of age. On the other hand,*Giardia* spp. less age dependent and was found to be present in subjects up to 70 years old, peaking between the ages 4 and 12. When the data of both parasite infections were evaluated, mean age forCryptosporidiumspp. infection was 7 years and for *Giardia* spp. infection 24 to 35 years.

Table 2: Frequencies of *Cryptosporidium*spp. And*Giardia* spp. infections in the Damietta population, with respect to sex, place of residence and age

Parasites	Males				Females			
	Under 12 year		Over 12 year		Under 12 year		Over 12 year	
	RA %	UA %	RA %	UA %	RA %	UA %	RA %	UA %
*Cryptosporidium*spp	3(6.6)	6(7.6)	0(0.0)	0(0.0)	3(5.4)	0(0.0)	0(0.0)	0(0.0)
***Giardia*spp**	11(24.4)	22(28.2)	5(31.2)	4(21)	10(18.1)	16(26.2)	4(17.3)	8(24.2)
Cryptosporidim+Giardia	0(0.0)	3(3.8)	1(6.2)	1(5.2)	2(3.6)	0(0.0)	1(4.3)	0(0.0)

Association between clinical manifestation of*Cryptosporidium* and *Giardia lamblia* infection with socio-cultural and environmental data of the study population When these variables and the presence/absence of symptoms/signs were correlated with parasite frequencyare shown in Table 3.

Tab 3: Socio-cultural and environmental variables of the 330 study subjects

Occupation		**Education**		**Socioeconomic**		**Housing& Waste disposal**		**Water supply**		**Clinical symptoms**	
	No. (%)		**No. (%)**		**No. (%)**		**No. (%)**		**No. (%)**		**No. (%)**
House wife	95 (28.7)	Illiterate	135 (40.9)	Low	145 (43.9)	Modern building	135 (40.9)	Piped	60 (18.1)	Asympto -matic	198 (60)
Farmer	75 (22.7)	Primarysch ool	95 (22.7)	Moderate	130 (39.3)	Primitive building	195 (59)	River nile	95 (28.7)	Diarrhea	36 (10.9)
Manual warker	75 (22.7)	preparatory school	65 (19.6)	High	55 (16.6)	Overcr-od	235 (71.2)	Shallo-w wells	105 (31.8)	Weight loss	15 (4.5)
Students	55 (16.6)	Secondary school	35 (10.6)			Sewage disposal	155 (46.9)	Deep wells	70 (21.2)	Abd. Pain	57 (17.2)
Educated (High)	30 (9.0)	Above second				Well with chamber disposal	175 (53)			Nausea & Vomiting	24 (7.2)

DISCUSSION

Intestinal parasites are very common in developing countries and *Cryptosporidium* and *Giardia*have been revealed as one of the most common parasites.*Cryptosporidium* sp. is a primary pathogen causing acute diarrhea and the most evident symptom of cryptosporidiosis is diarrhea. Non-specific signs such as dehydration, fever, anorexia, weakness, and progressive loss of weight may be accompanied. Diarrhea is usually self-limiting in immunocompetent humans; however, it can be life-threatening in children and immunocompromised humans. Its prevalence varies according to different regions [5]. In developed countries, massive *Cryptosporidium* food-borne and water-bomeoutbreaks have been reported, while in developing countries, *Cryptosporidium*is associated with significant morbidity and mortality, especially among infants and children[27]. In Egypt, human

cryptosporidiosis been reported with variable prevalence ratesby [1, 8, 9, 15&19].

The overall frequency of *Giardia* spp. infection found in the present study was higher than those reported for similar studies in Italy (3.5%,[13] ; but it is lower than those reported in Venezuela (28%,[16] , Chennai (26%, [11]), Pakistan (28.78%, in [23], and in Brazil (27.4%,[18]. Similar results were obtained in studies carried out in Thailand (5.3%,[28] , and Spain (5.05%,[20] .Other studies carried out in Argentina have reported higher rates of these parasitizes. Thus, Gamboa et al.[12] reported 34% for a shantytown, Guignard et al.[14] 23% in a population living in temporary homes, and Borda et al.[4] who reported 29% in shantytown.As regards studies carried out on the prevalence of *Cryptosporidium* in similar populations in other countries, our results are higher than those published by Wang et al.[29] in China (1% and 3.96%), Windsor et al.[31] in the United Kingdom (2.9%),[6] in Spain (1.5%),[28] in Thailand (0.8%), and[17] in Venezuela (1.6%).Percentages similar to those of the present study were found by [26] in members of the Thai Army and their families (4.1%). As regards data collected in Argentina,[12]report 48% in a shantytown, [14] 44.4% among those living in temporary homes,[21] 65.8% among a suburban population, and [24] 24.6%.A compared with previous Argentinean figure our prevalence rates for both parasites are notably lower. This may be due to the rural nature of our study population, and socio-economic, cultural, and demographic (fewer inhabitants per square km) differences, which would be expected reduce infection pressure. Regarding sex, these protozoa were markedly more prevalent among males in the UA group, with an outstanding higher frequency in under 12-year olds. This is probably because the direct transmission of these parasites is related to higher population densities in the urban area, and because of the different hygiene habits of males and females in the same setting, which is reflected by the relatively low/high prevalence observed in the infant population.The category less than12 years old was a risk factor for this infection. These results agree with the development of acquired immunity to both parasites consequent to repeated infections in childhood [10]. Of the socio-cultural and environmental variables studied, frequent flooding, dirt floor inside the home, cardboard/tin homes, and body waste disposal by latrine were associated with the prevalence of these parasites. and/or blastocystis. Therefore, the presence of these conditions could be used to estimate the risk of infection by these parasites. These data reinforce the existing strong relation between deficient sanitary conditions and intestinal parasitism, as has been mentioned by several Argentinean authors[4,12&24].Several authors reported a correlation between diarrhea, abdominal pain, flatulence, itching, vomiting, or appetite loss, and the presence of both protozoan infections[6&17]. In this study only abdominal pain was found to be significantly associated with the presence of *Cryptosporidium* and/or *Giardia* spp.The present study is one of the first to associate the prevalence of *Giardia* spp. and/or*Cryptosporidiumwith* socio-cultural and environmental conditions, and with the clinical features of a North Delta population. We conclude that the low population density of the area studied substantially creates a lower infection pressure, and explains the lower infection prevalence's of the present study. The risk factors for acquiring *G.* sppand *C.*sppin Damietta are apparently similar and this is reflectedin their age-prevalence profiles. Alternately, age-relatedacquisition of immunity to infection or loss of infectionmay be different for the parasites and this may contribute tothe

observed patterns that most infections with the parasiteswere in children, and clinical diagnosis was not an accurate indicator of infection. Factors such as malnutrition and bottlefeeding as seen in some Rural areas may beimportant in determining the epidemiology of the infectionsin North Delta. The prevalence of *G.* spp.infections increasedwith age and this may be reflective of the increasing exposure as children attend schools and day-care facilities.Perhaps feeding or infection from untreated water maybe more important for transmission of *C.* sppin youngchildren.

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