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Prevalence of Intestinal Parasitic Infections in Iraq during a Period from 2000-2020.

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Abstract: The prevalence history for intestinal protozoal and helminthic infections among Iraqi people is reviewed from 2000-2020. The distribution of the intestinal parasites is mentioned in different communities including hospital patients, primary school children, food handlers, general population, immunocompromised patients, malnourished patients, sicklers and day-care centers attendance in both rural and urban regions. The prevalence rates are also illustrated in relation to age and sex parameters. Protozoal infections are the most common infections in Iraq. Other parasitic infections are of a local public health problem. Even parasitic infections could cause malabsorption, malnutrition and blood loss but also might cause physical and mental growth retardation especially among children. Therefore, Implantation of a national control program is essential to apply.

Keyword: Communicable diseases, Intestinal parasites, Iraq, Prevalence.

Introduction

Intestinal parasites are prevalent throughout the world particularly in tropical and subtropical countries where deficiency in water and sanitation (1). The high prevalence recorded in some regions possibly by introduction of infections through refugee camps and migration due to war and insecurity (2). Many investigations have shown various prevalence rates of infections. The distribution of the parasites depends on the presence of suitable hosts, habits and favorable environmental conditions. Intestinal protozoa require only slight carelessness in habits leading to cosmopolitan distribution all over the world. They have a major public health importance due to their relation to socioeconomic, environmental factors, sanitation level and education in the community. Intestinal helminthiases contribute to poor nutritional status in infected children due to their adverse effects on food intake, normal nutrient absorption and immunity (3-5).

Nutritional impairment is often associated with chronic helminthiasis, as with those suffering from protein-energy malnutrition, iron-deficiency anemia and vitamin A deficiency (6,7). The pathogenic protozoa are a common cause of diarrhea and have a worldwide distribution (6-8). This remain an important cause of deaths among children less than 5 years old (9). This is due to poorly developed immune systems. Therefore, severity of infection depends on virulence of the strain, host susceptibility and immune status as well as mixed infections (10).

Estimation of the global prevalence of the soil-transmitted helminths; 1000 million cases for *Ascaris lumbricoides*, 900 million for hookworms and 500 million for *Trichuris trichiura.* It has been reported that, probably 480 million people carried *Entamoeba histolytica* and 36 million develop invasive forms of amoebiasis. In addition, 200 million occur per year in Africa, Asia and Latin America (7,11).

In Iraq, studies on intestinal parasites started as early as 1939 (12). Then, surveys were conducted recently and involved rural areas, school children in both sexes but mainly in and around the capital Baghdad. The prevalence diseases in Iraq differ from one region to another.

The present work illustrates the prevalence of intestinal parasites in relation to age, sex and socioeconomic factors.

Results and Discussion

The prevalence rates of intestinal protozoa and helminths parasites are reviewed according to the types of communities including general and selected populations in different Iraqi provinces (Figure 1).

Figure 1. Map for Iraqi provinces.

Hospital patients:

In and out patients are easier to investigate for parasitic infections. Ten surveys among all age groups were done in the middle part of the country, 4 in the Southern part and 7 in the Northern part (Table 1). However, medical history, morbidity and mortality of various parasitic infections are lacking in Iraq. Prevalence rates ranged from 7.36% to 84.67% and 0% to 18.01% of the protozoa and helminth infections respectively.

School children:

School children (6-12 years old) were chosen by many workers because they are easier to deal with, represent the actual population of the communities and in various standards of living (Table 2). These data are concerned with the prevalence rates of infections among school children and not the household members of infected children.

Animal-handlers:

Animal handlers including veterinian, butchers and breeders could also acquire the parasitic infection at a rate of 50% in comparison to 14.8% for non-animal handlers. (Table 3).

General population:

The prevalence of intestinal protozoa and helminths among general populations in the middle part of the country including the capital Baghdad is illustrated in Table (4). The large samples surveyed were fairly representative of the general population. Even the prevalence rates of intestinal protozoa and helminths recorded during 2000-2020, were markedly lower than those reported in 1939 (73.9 and 41.0 for protozoal and helminths respectively) (12) but they are still representing a significant level from the public health point of view. Even so, it implants an improvement in sanitation, health and medical services.

Immunocompromised patients:

Higher prevalence rates were recorded among patients with malignant diseases due to immunosuppression caused by either the disease itself or the cytotoxic drugs or both of them (Table 5).

Malnutrition:

Only one work has been done in Basrah on 2005 where the malnourished children with diarrhea showed a higher prevalence rate (15.4%) for protozoal infections in comparison to malnourished children without diarrhea (10.75%) for protozoa and 2% for helminths (Table 6).

Sickle-cell anemia:

Higher prevalence rate of parasitic infection (62.5%) was observed among patients with sickle-cell anemia in comparison with non-sicklers (14.8%) (Table 7).

Day-care centre:

Almost similar prevalence rates were reported in Basrah (42.5%) and Dohuk (43.3%) as far as protozoal infections are concerned (Table 8).

Rural districts:

Prevalence of intestinal parasitic infections is expected to be higher in rural districts and villages especially among children (Table 9). This can be attributed to the lower standard of hygiene, over-crowdness, sanitation and probably food and/or water-borne infection. Agricultural practices and animal breeding are also responsible for the recorded prevalence rates. In marsh region of South Basrah 36.4% of water samples were contaminated with intestinal parasites (13). Nevertheless, due to the progress in establishing

and developing a good water supply, electricity, paved roads and education, the prevalence rates were dropped in 2002 for helminthiasis but not for protozoan infections.

Urban districts:

In contrast to the rural districts, the prevalence rates of intestinal parasites are markedly lower (Table 9). The recorded low prevalence rates are probably attributed to the adequate standards of living and conditions of the environmental sanitation.

Distribution according to sex:

No significant differences were noticed in the prevalence rates of males and females (Table 9). But nevertheless, some works have reported the prevalence rate of infection was higher among females in comparison to males. This may be due to fact that these females are housewives responsible for a house work, agricultural practices and animal breeding (14).

Distribution according to age:

Lack of published papers was observed in relation to the distribution of infection among people with an age more than 21 years (Table 10). This is possibly due to sampling difficulty for the population with this wide range of ages.

Prevalence of intestinal parasites:

The presented data presented in Table (11). The protozoan parasites are highly prevalent in all examined groups including general population, hospital patients, school children in urban and rural districts reaching a rates of infection of 61.6 (15) and 88% (16). The highest rate of infection reported for the emerging opportunistic *Cryptosporidium* was 18.94% (17). A significant association was found between giardiasis and water contamination. About 31.6% of the inhabitants use storage water, while only 1.3% use sterile water bottles (18). In addition, the use of waste water to irrigate vegetables or organic manure as a fertilizer that are eaten raw without proper washing leads to food-borne parasitic infections (19,20). Ascariasis was detected at a lower rates of infection (Table 11). In contrast, prevalence of hymenolepiasis nana was getting higher in 15 studies out of 21 indicating a public health problem specially among children. Thus, it needs more attention for application of control measure. *Enterobius vermicularis* was detected only accidently because stool examination is of no value in its specific diagnosis (7).

Some workers have reached a decision that the concentration stool examination methods are better than direct smear method in the diagnosis of helminthiases which 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

Although the prevalence rates of intestinal parasitic infections are varied from one area to another according to the degree of personal and community hygiene, sanitation and climatic factors are relatively common in Iraq. Intestinal protozoan, helminthic or mixed infections are 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. Therefore, an urgent and efficient preventive and control measures is essential.

Even an adequate treatment for amoebiasis and giardiasis, which are the common causes for diarrhea, is available, the morbidity is still high. The complications of invasive amoebiasis are potentially fatal and giardiasis may cause malabsorption in children (4,6,7).

Several intestinal helminthiases contribute to the general and persistence of malnutrition and reduced productivity (6,7). Careful evaluation of the individual parasite should be continued in different regions and among different societies.

Implementing a national control program should include a primary health care, health education, family planning, water supply, paved roads, environmental sanitation, nutrition, mass treatment by new broadspectrum antihelminthics, avoid crowdness and improvement in agriculture practices. Anti-protozoal and broad-spectrum antihelminthics are available and effective at a regular mass treatment. Well trained health workers chosen from the same community are valuable in the diagnosis and treatment of various parasitic infections especially in rural areas and far villages in the country.

Table 1. The prevalence of intestinal protozoa and helminths among hospital's patients.

Reference	Np. Examined	Patients	% infected	
			Protozoa	Helminth
Yilmaz & Abdullah, (21)	77	Diarrhoeic patients from Duhok and Erbil.	16.02	0
Al-Joudi & Ghazal, (22)	6330	Patients of 1-10 years old from Ramadi. Giardiasis is the most common infection.		
		During 1992-94.	42.5	6.8
		During 1995-97.	64.26	5.62
Rhadi et al., (23)	1026	Patients 6-30 years old attending General Hospital in Basrah.	46.44	1.7

		Cryptosoridium parvum Recorded the highest infection (69) cases in age (20-30) years		
Al-Kubaisy et al., (24)	2033	Patients from Baghdad. Parasitic diarrhea was 22%.	34.49	7.53
Hussein & Meerkhl, (25)	1178	Children attending Hivi Pediatric Hospital, Duhok Province. 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.	84.67	18.01
AL-Khikani et al., (26)	3176	patients with different ages attending the Al-Shomally General Hospital in Babil Province, ages 15-44 years are highly infected. Males and females are almost equal.	11.0	0
Hasan et al., (27)	615	Patients attended Tikrit Teaching Hospital, 1-16 years old. The highest rate of infection in rural area and among age group 4-6 years. Males showed higher rate than females.	14.3	0
Salman et al., (28)	1071	Children attending Paediatrics hospital in Al-Kadhimia, Al-Karkh side, Baghdad city, aged from seven days to 12 years. No difference between males and females.	15.2	0.55
Bazzaz et al., (29)	780	They were admitted to Samarra General Hospital. The highest rate of infection was among 1-20 years old.	8.35	0
Murad et al., (30)	3967	They were attended Azadi Teaching Hospital in Duhok City, Kurdistan Region. Males were more affected than females.	14.7	0.07
Al-Taei, (16)	2877	Al-Hashimyah hospitals, Babylon province / Iraq, among the ages from less than one year to 71 years old. The largest percent of infection reported in the (1-10) age group which was (44.35%). male and female were 56.96 % and 43.03 %, respectively.	49.4	0.2
Al-Saad & Issa, (31)	428	children presenting at the pediatric hospital with a complaint of gastroenteritis. The age group 10–12 years showed the highest rate of infection (81.1%), and the lowest rate was in children 7–9 years (22.9%).	31.3	0

Al-Ibrahimi & Al-Waaly, (32)	109	Surgical appendectomy in Women and Children Hospital in Al- Diwaniya showed *E. vermicularis* only.	- 11.92
Alomashi & Al-Shabbani, (33)	974	Patients with anemia attending Al-Diwaniyah Teaching Hospital (Al-Qadisiyah province	64.0 for both protozoa & helminths.
Kanabe & Darogha, (17)	548	Children of both sexes 3 months to 10 years were attending Raparin Pediatric hospital in Erbil city	7.36 0.18
Mahdi & Ali, (34)	205	Population aged 2months -65years old suffering from chronic diarrhoea for at least 2 weeks & attending the Materity & Child Hospital in Basrah. 9.7% excreting *Cryptosporidium* oocysts.	44.87 4.8
Farhan, (15)	1804	Males and females attending the Al Gailani-Central Medical Laboratory, Al-Ramadi/Al-Anbar, West of Iraq.	38.25 3.35
Husein et al., (35)	730	People attending the Protecting Hospital for Pediatrics and Al-Zahrawy Hospital in Baghdad.	90.1 17.5
Al-Hamairy et al., (36)	389	Anemic patients of 1-50 years old were attended the primary health centre in Al-Doullab village-Babylon.	31.4 9.29
Al-Morshidy, (37)	243	Patients attending the specialized Marjan Hospital for Internal and Cardiac Diseases in Hilla City-Babylon. Higher incidences were reported in patients using river water (80.8%) and low incidence among patients drinking tap water (43.8%).	20.9 3.5
Ali & Mohammed, (38)	307	Children attending the Pediatric Teaching Hospital in Sulaimani city.	22.15 0

Table 2. The prevalence of intestinal protozoa and helminths among primay school children.

		Primary school children	
Al-Saad & Issa, (31)	451	Children from primary school in Dohuk city.	41.2 0
Al-Ibrahimi & Al-Waaly, (32)	419	Children of 1-12 years old of both sexes from schools and kindergartens in Al- Al Diwaniya. They reported *E.vermicularis* only.	- 43.67

Table 3. The prevalence of intestinal protozoa and helminths among animal handlers.

Reference	No examined	Animal handlers	% infected	
			Protozoa	Helminth
Mahdi & Ali, (39)	60	Animal handlers (veterinian, butchers & breeders) with mean age 27.16±16.86 years.	20.0	9.0

Table 4. The prevalence of intestinal protozoa and helminths among general population.

Reference	No. examined	General population	% infected	
			Protozoa	Helminth
Saheb, (40)	-	Males and females from Baghdad, Karkh region.	16.46	0
Salman et al., (41)	417	Displaced people in Kirkuk. Age 1-60 years. Age 1-10 years highly infected by *G.lamblia*. Gender was unsignificant.	3.42	0.23
Salman et al., (42)	780	Displaced people in Kirkuk. Age 1-78 years. Gender was unsignificant.	37.05	0.51
Khudhair, (43)	5258	among Residents of Hawler, Soran and Chamchamal Cities, North of Iraq. Males were infected more than females.	4.2	0
Al-Shirifi & Abdullah, (44)	325	foodhandlers and foodsellers in Kirkuk city. The highest infection rate among restaurant workers (12%).	8.0	2.5
Al-Naemy et al., (45)	422	children of Bashika District, suburb of Mosul city and 12 Km northeast of it. Males are affected more than females.	32.6	5.7
Mero & Hussein, (46)	1132	Children of various sexes and ages in Dohuk and nearby villages.	27.1	26.1
Al-Daoody et al., (47)	4062	People of Erbil city. Females were infected more than males.	0.23	4.04
Jarallah, (13)	294	children (159 males and 135 females) from 1< to 14years old in two rural villages (Abu-Malah and Harer) in Basrah marshlands regions	27.4	17.87

Table 5. The prevalence of intestinal protozoa and helminths among immunocompromised patients.

Reference	No. examined	Immunocompromised patients	% infected	
			Protozoa	Helminth
Mahdi et al., (48)	101	62 Males and 39 females with malignant diseases attending Oncology Centre of Basrah Teaching Hospital. Age 9months-16 years old.	28.7	10.9
Mahdi & Al-Saadoon, (49)	58	Males (37) and females (21) attending the Oncology centre of	32.75	0

		Basrah Maternity & Child Hospital. Microsporidium was at a rate 10.34%among Hodgkin and non-hodgkin lymphoma (83.3%)	

Table 6. The prevalence of intestinal protozoa and helminths among malnourished people.

Reference	No. examined	Malnutrition	% infected	
			Protozoa	Helminth
Mahdi et al., (50)	194	Malnourished children <5 years old attending Basrah Maternity & Child Hospital. Malnutrition with diarrhea. Malnutrition without diarrhea.	15.4 10.75	0 2.0

Table 7. The prevalence of intestinal protozoa and helminth among patients with sickle-cell anemia.

		Sickle -cell anemia		
Mahdi & Ali, (51)	40	Stool samples were obtained from individuals admitted to three hospitals in Basrah with sickle-cell anemia. The first report for isolation of Isospora belli from a sickle-cell patient in Iraq and the Mediterranean region.	55.0	7.5

Table 8. The prevalence of intestinal protozoa and helminths among the attenders of day-care center.

		Day-Care Centre		
Mahdi & Ali, (52)	40	31 (72%) children were found to be infected for intestinal parasites compared to 1 (10%) positive personnel and 19 (34.5%) positive household contacts of the children. *Cryprosporidium* oocysts were found to be excreted in 4 (9%) children compared to 4 (7.2%) household contacts. No single positive case was recovered among the examined personnel of the day-care centre.	42.5	27.5
Al-Saad & Isaa, (31)	382	Boys and girls attending the day-care center in Dohuk.	43.3	0

Table 9. Distribution of intestinal parasites according to district and sex.

Reference	No. examin Ed	Province	Locality		Sex	
			Urban	Rural	Male	Female
Hasan et al., (27)	615	Tikrit	11.54	20.87	17.3	11.22
Bazzaz et al., (14)	780	Samarra	-	-	46.3	53.6
Al-Taei, (16)	2877	Al-Hashimyah	-	-	56.96	43.03 ,
Husein & Meerhkan, (25)	1172	Dohuk	34.09	65.9	63.98	36.02
AL-Khikani et al., (26)	3176	Babil	-	-	50.65	49.35
Khaudhair, (43)	5258	Hawler	-	-	4.6	3.4
Kanabe & Drogha, (17)	548	Erbil	-	-	13.68	7.05
Hamad & Ramzy, (53)	200	Erbil	34.69	25.49	27.35	33.73
Al-Nawmy et al., (45)	422	Bashika, Mosul	-	-	60.6	39.33
Salman et al., (41)	417	Kirkuk	-	-	4.55	5.75
Farhan, (15)	1804	Al-Anbar	-	-	19.1	20.7
Hussein et al., (35)	730	Baghdad	-		59.9	56.2
Mero & Hussein, (46)		Dohuk	22.9	28.7	29.6	22.1
Al-Hamairy et al., (36)	389	Babylon	-	60.15	60.9	58.7
Ali & Mohammed, (38)	307	Sulamini	22.64	20.55	20.9	23.8

Table 10. Distribution of intestinal parasites according to age.

Reference	0-10	11-20	21-30	31-40	41-50	51-60
Salman et al., (41)	15.15	6.97	9.33	6.12	4.54	6.97
Farhan, (15)	31.25	18.1	10.1	17.0	7.7	5.3
Hussein et al., (35)	51.5	55.1	-	-	-	-
Al-Hamairy et al., (36)	83.0	91.0	25.0	25.0	10.0	-
Ali & Mohammed, (38)	24.05	48.84	-	-	-	-
Hamad & Ramzy, (53)	37.06	50.0	-	-	-	-

Table 11. Distribution of intestinal protozoa and common helminths in Iraq.

Reference	E.histolytica	G.lamblia	B.hominis	A.lumbricoides	E.vermicularis	H.nana
Salman et al., (28)	27.0	11.0	7.6	-	0.3	0.8
Bazzaz et al., (14)	12.8	3.9	-	-	-	-
Al-Taei, (16)	88.0	10.8	-	-	0.03	0.76
Yilmaz & Abdullah, (21)	24.45	7.6	-	-	-	-
Rhadi et al., (23)	15.3	5.94	7.01	Crypto.16.27	3.21	0.29
Al-Kubaisy et al, (24)	23.44	-	-	2.2	12.7	9.8

Hussein and Meerkhan, (25)	38.7	25.67	4.6	9.2 Crypto	18.01	-
Salman et al., (41)	1.67	9.35	4.17	1.43 Crypto	-	0.23
Al-Khikani et al., (26)	17.91	4.09	-	-	-	-
Kanabe and Darogha, (17)	0.18	9.72	9.72	18.94 Crypto	-	0.18
Al-Daoody et al., (47)	0.12	0.34	-	-	-	4.04
Al-Shirifi and Abdullah, (44)	3.69	12.31	-	1.85	3.38	5.85
Al-Nawmy et al., (45)	28.2	37.0	-	3.8	15.3	6.5
Al-Bazzaz et al., (14)	12.8	3.9	-	-	-	-
Al-Taei, (16)	12.14	4.9	-	0.37	0.38	2.45
Farhan, (15)	61.6	14.9	-	6.7	9.8	1.7
Hussein et al., (35)	24.3	31.0	-	9.7	-	4.7
Mero and Hussein, (46)	10.15	11.92	0.08	-	0.35	0.53
Al-Morshidy, (37)	27.9	13.9	-	2.8	2.4	5.3
Al-Hamairy et al., (36)	36.7	26.1	-	1.3	32.9	-
Jarallah, (13)	23.87	30.93	-	2.58	47.46	3.59
Mahdi & Ali, (39)	7.5	28.0	36.0	5.0 Crypto	2.5	-

Crypto = *Cryptosporidium* species.

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