

Brief communication (Original)

The prevalence of some gastrointestinal nematodes and cestodes in Iraqis

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Background: Infections with helminths are associated with deficient sanitary facilities, unsafe human waste disposal, inadequate and lack of safe drinking water, and low socioeconomic status.

Objectives: To determine the prevalence of some gastrointestinal helminths among Iraqi people, and association of infections with age, sex, and region in Iraq.

Methods: This study is retrospective, including reported cases of infections using an available surveillance database from January 2013 to December 2013 of all provinces of Iraq by the Ministry of Health.

Results: The overall prevalence of gastrointestinal helminthiasis was 1.39%. *Enterobius vermicularis* found to be the predominant helminth parasite. No significant ($P < 0.05$) relationship was found between sex and infection, although male individuals tended to show greater helminthiasis, while a significant relationship was found between age and infection. The common infections were more frequent among the 5-14 year age group. We found a lower prevalence of helminth infections in the northern (Ninevah, Suleimaniyah, Ta'mim, Erbil, and Dohuk) and middle Euphrates (Babil, Karbala, Najaf, Qadisiyah, and Muthanna) region provinces, compared with the middle (Baghdad, Anbar, Diyala, and Salahuddin) and southern (Wasit, Dhi-qar, Misan, and Basrah) region provinces where the prevalence was higher.

Conclusions: In this study, we found lower prevalence of infections in Iraq than similar studies conducted in other parts of Asia, which may be a consequence of the sample size, seasonal diversity, general personal hygiene, and public health services.

Keywords: Helminths, human, infectious, Iraq, prevalence

Infections with gastrointestinal helminths are associated with deficient sanitary facilities, unsafe human waste disposal, inadequate and lack of safe drinking water, and low socioeconomic status [1]. More than 2 billion people may be infected with helminths, mainly in the developing world [2]. At highest risk of morbidity are preschool and school-aged children, and pregnant women [3]. Negative effects of helminth infections include diminished physical fitness and growth retardation, and delayed intellectual development and cognition [2, 3]. Helminthiasis is of considerable public health importance in Iraq and throughout less developed Asia

[4-7]. However, the geographical distribution and regional burden remain to be determined and updated regularly. The aim of the present study was to assess the prevalence of some helminths among Iraqi people depending on the database of communicable diseases control centers of the Ministry of Health in Iraq.

Materials and methods

This retrospective survey consisted of a spatial and temporal analysis of reported cases of helminths using an available surveillance database from January 2013 to December 2013 taken by the Iraqi Communicable Diseases Control Center (CDC). Data included all provinces of Iraq. The number of patients examined was 2,761,990. The parasites studied and included were divided in to two categories: Nematoda: (*Ascaris lumbricoides*, *Trichuris trichiura*, *Ancylostoma duodenale*, *Enterobius*

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vermicularis and *Strongyloides stercoralis*) and Cestoda (*Taenia solium* and *Hymenolepis nana*). Data were arranged according to the geographical distribution of provinces from north to south; provinces were divided into 4 groups according to the database from the CDC (**Figure 1**).

Data for each parasite were arranged according to sex of patients, and seasonal variation from January to December. Data for each parasite were arranged

according to age groups as follows: group 1 <1 year old; group 2, from 1 to 4 years old; group 3, from 5 to 14 years old; group 4, from 15 to 45 years old; and group 5, >45 years old. We examined differences in prevalence among sexes, age, and region with a chi square test using the Statistical Package for the Social Sciences (SPSS Inc, Chicago IL, USA). $P < 0.05$ was considered significant.

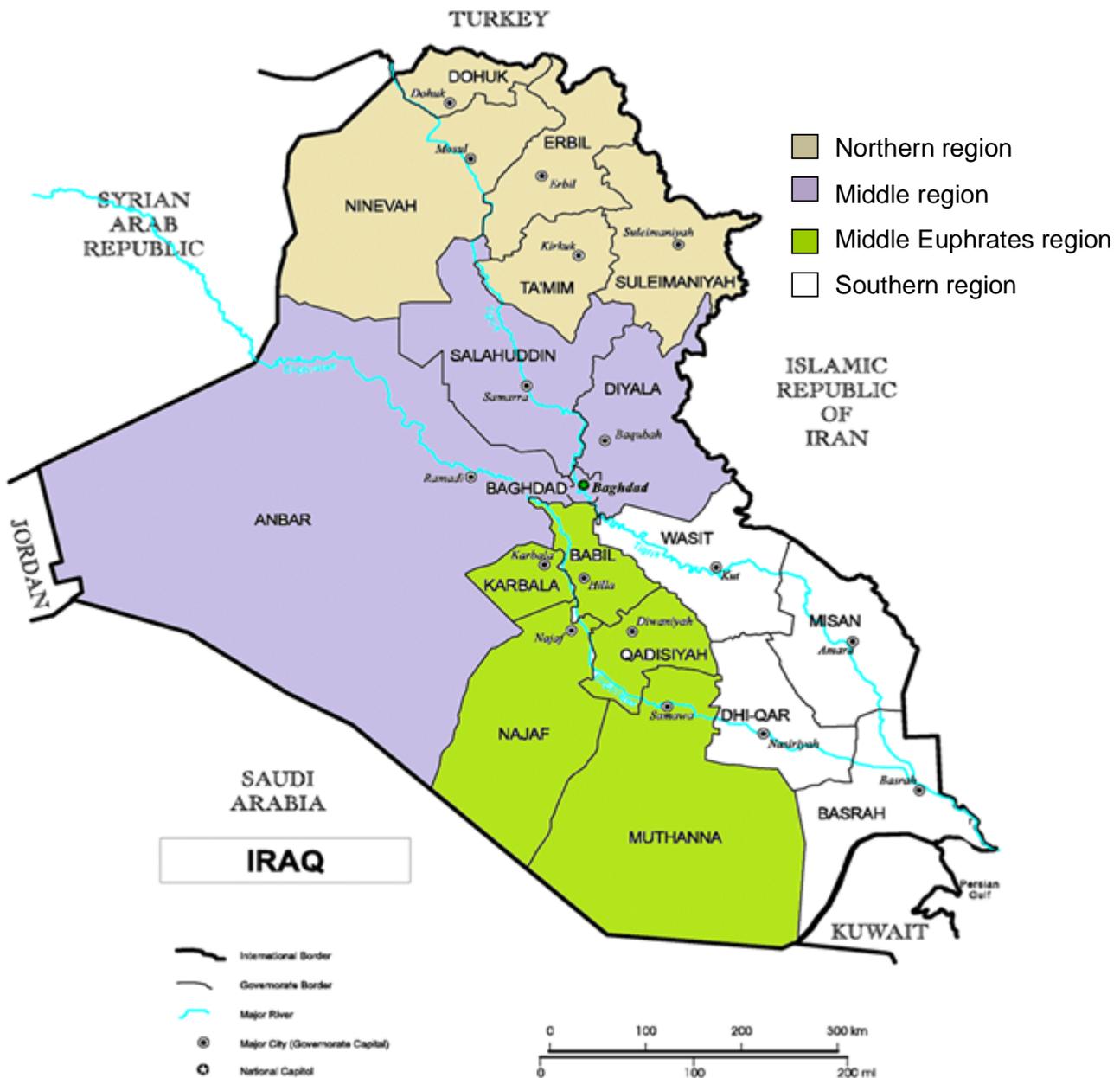


Figure 1. A map of Iraq showing the four different regions. **Northern region:** Ninevah, Ta'mim, Suleimaniyah, Erbil, and Dohuk; **Middle region:** Baghdad, Anbar, Diyala, and Salahuddin; **Middle Euphrates region:** Babil, Karbala, Najaf, Qadisiyah, and Muthanna; **Southern region:** Wasit, Dhi-qar, Misan, and Basrah. Permission to use the map granted by MemNav as a courtesy (Source: https://i2.wp.com/www.memnav.com/im/Iraq_map.jpg)

Results

The overall prevalence of gastrointestinal helminthiasis was 1.39%. The number of infected individuals was 38,547 of 2,761,990 examined. *Enterobius vermicularis* infected the highest number of individuals followed by *Hymenolepis nana*, and *Ascaris lumbricoides*, with other helminths showing lower numbers of cases (Table 1). Northern and middle Euphrates regions showed lower prevalence of infections with all helminths, compared with the middle and southern regions, which showed a higher prevalence of infections (Table 2). There were significant differences in infection rates between age groups in this survey for all surveyed helminths (Table 3). The maximum numbers of infections for all helminths were seen in two age groups: 5-14 and 15-44 years. The majority of Ascariasis, Ancylostomiasis, Trichuriasis, Strongyloidiasis, and Enterobiasis were noticed in the 5-14 year age group. Most of Hymenolepiasis and Taeniasis were reported in the 15-44 year age group. Age group <1 year showed no worm infection except 799 patients infected

with *E. vermicularis*. The least number of infected cases was seen in: group <1 year for *E. vermicularis*, age group 1–4 years for Ascariasis, Ancylostomiasis and, Trichuriasis, and age group >45 years for Taeniasis.

Table 3 presents the sex distribution for all surveyed helminths. Results illustrated that the prevalence of infection with helminths in male individuals was higher than in female individuals. No significant ($P < 0.05$) difference for infection prevalence was found between sexes, although the percentage of infection was higher in male individuals compared with female individuals for the following: Ascariasis, Ancylostomiasis, Trichuriasis, and Taeniasis, while a higher infection prevalence in female individuals was seen for Enterobiasis, Hymenolepiasis, and Strongyloidiasis. An apparent seasonal tendency was recognized in the monthly prevalence of worms in Iraq (from the beginning January to the end of December 2013) as shown in Table 4.

Table 1. The distribution of helminths infections among 18 districts surveyed

Province (Governorate)	Number of positive cases (%) among districts						
	<i>Ascaris lumbricoides</i>	<i>Ancylostoma duodenale</i>	<i>Trichuris trichiura</i>	<i>Strongyloides stercoralis</i>	<i>Enterobius vermicularis</i>	<i>Hymenolepis nana</i>	<i>Taenia saginata</i>
Ninevah	0	0	0	0	2,205 (6.01)	29 (2.39)	3 (5)
Ta'mim	34 (6.59)	5 (3.1)	0	0	1,371 (3.73)	7 (0.71)	0
Suleimaniyah	0	10 (6.1)	0	0	101 (0.28)	0	0
Erbil	4 (0.78)	0	0	0	332 (0.90)	13 (1.31)	12 (16)
Dohuk	83 (15.90)	8 (4.9)	0	7 (70%)	713 (1.94)	466 (47.00)	1 (1)
Baghdad	51 (9.88)	0	57 (34.1)	1 (10%)	3,183 (8.67)	48 (4.48)	21 (28)
Anbar	37 (7.17)	63 (38.4)	0	0	4,014 (11.2)	0	0
Diyala	2 (0.39)	0	0	0	4,066 (11.1)	0	0
Salahuddin	0	7 (4.3)	0	0	744 (2.03)	2 (0.20)	1 (1)
Babil	0	4 (2.4)	0	0	728 (1.98)	138 (13.90)	0
Karbala	2 (0.39)	0	1 (0.6)	0	797 (2.17)	68 (6.86)	0
Najaf	120 (23.30)	0	4 (2.4)	0	1,223 (3.33)	33 (3.33)	4 (5)
Qadisiyah	43 (8.33)	2 (1.2)	0	2 (20%)	1,382 (3.76)	35 (3.53)	7 (10)
Muthanna	0	0	20 (12.0)	0	1,164 (3.17)	13 (1.31)	3 (4)
Wasit	90 (17.40)	0	78 (46.7)	0	2,516 (6.85)	0	0
Dhi-qar	3 (0.58)	1 (0.6)	0	0	2,752 (7.50)	60 (6.05)	11 (15)
Misan	0	0	0	0	2,016 (5.49)	2 (0.20)	0
Basrah	48 (9.30)	64 (39.0)	7 (4.2)	0	7,317 (19.90)	77 (7.77)	11 (15)
Total	517	164	167	10	36,624	991	74

Table 2. The distribution of helminth infections among the four surveyed regions

Region	Infected	Total examined	Prevalence %
Northern	5,404	670,217	0.80
Middle	12,297	1,135,051	1.08
Middle Euphrates	5,793	253,646	2.28
Southern	15,053	703,076	2.14
Total infections	38,547	2,761,990	1.39

Table 3. The distribution of helminth infections according age groups and sex

	<i>Ascaris lumbricoides</i>	<i>Ancylostoma duodenale</i>	<i>Trichuris trichiura</i>	<i>Strongyloides stercoralis</i>	<i>Enterobius vermicularis</i>	<i>Hymenolepis nana</i>	<i>Taenia saginata</i>
Age							
<1	0	0	0	0	799	0	0
1-4	26	17	19	3	6,605	121	19
5-14	208	63	61	6	11,004	309	20
15-44	179	47	53	1	10,916	362	24
>45	104	37	34	0	7,300	199	11
Sex							
Male	311	91	94	4	16,453	422	39
Female	206	73	73	6	20,171	569	35

Table 4. The seasonal distribution of helminths infections among the surveyed population

Month	Number of positive cases							Total
	<i>Ascaris lumbricoides</i>	<i>Ancylostoma duodenale</i>	<i>Trichuris trichiura</i>	<i>Strongyloides stercoralis</i>	<i>Enterobius vermicularis</i>	<i>Hymenolepis nana</i>	<i>Taenia saginata</i>	
January	34	0	0	5	2,393	50	6	2,488
February	40	33	2	0	3,115	47	6	3,243
March	14	0	4	2	2,781	45	3	2,849
April	53	17	40	0	2,714	37	3	2,864
May	126	10	6	0	3,001	66	3	3,212
June	35	21	3	0	2,875	42	5	2,981
July	32	13	39	3	2,974	35	6	3,102
August	25	5	61	0	3,456	36	3	3,586
September	55	6	10	0	3,697	198	7	3,973
October	41	15	2	0	2,843	154	21	3,076
November	25	19	0	0	3,761	146	5	3,956
December	37	25	0	0	3,014	135	6	3,217
Total	517	164	167	10	36,624	991	74	38,574

Discussion

The overall presence of helminthic infections in this survey was 1.39%, this prevalence is considerably lower than previous reports from other surveys in Asia [8]. The prevalence of gastrointestinal helminth infections varies according to geographical location, education, use of raw salads and vegetables, age of patients, socioeconomic criteria, nutritional status,

immunological status, and personal hygiene [9]. The most common helminth infections in this survey was Enterobiasis, followed by Hymenolepiasis. *E. vermicularis* and *H. nana* are cosmopolitan in distribution, and more common in warm climates. They are the most prevalent helminths worldwide, and easily transmitted directly from person to person, and by autoinfection [10]. These findings were consistent

with other reports and showed that the majority of helminthic infections were with *E. vermicularis* and *H. nana* [11] and differed from other reports from Asia, which showed that the majority of helminthic infections were with *H. nana* and *A. lumbricoides* [12]. Less common helminthic infections found in this survey were with *T. saginata* and *S. stercoralis*. This results are consistent with Al-Taie et al. [13] and differed from Raza et al. [11] who had shown that the lowest prevalence was for *A. lumbricoides*. Some investigators differentiated between domestic (household) and public (public places of work, street, fields, and school) transmission sites [14], these data were not reported in the survey data and this may cause some differences [15]. Most of the helminths included in this survey were reported as having high prevalence in the middle Euphrates and southern districts, except *H. nana*, which was reported as having high prevalence in northern Iraq. The southern and middle regions showed significantly high prevalence of all helminths. The middle region is more urbanized and Baghdad is located there. Parasitic infections are more prevalent among urban people, particularly during social upheavals and because of migration when urban centers become important loci for the transmission of infectious diseases [16].

The overall prevalence of intestinal parasitosis is greater among 5-14 year olds. This is because at such age school children indicate changes in exposure to conditions that favor the transmission of the infective stages of most of the helminths especially geohelminths; other investigators showed that hand-washing habit of the this age group is very poor [17]. This finding is consistent with the result of Arinola and Fawole who showed that the prevalence and intensity of some intestinal helminths were predominant in the same age group [18]. Although there was no significant relationship between sex and helminth infection, most infections were seen in male individuals, this is probably because males are more exposed to unhygienic conditions in fields during outdoor activity [19], especially in a country like Iraq. High prevalence of Enterobiasis is seen in female individuals, also Hymenolepiasis and Strongyloidiasis and this inconsistent with findings by Al-Qadhi et al., who showed that prevalence of *E. vermicularis* infection was higher in girls than in boys [15]. Finally our findings from the current survey revealed high prevalence of pin worm in the surveyed population and warrants long-term control measures to improve sanitary

and living conditions, including treatment of infected individuals. The impact of these measures would be further enhanced via an organized health education programs, which may encourage healthy behavior and lead to a reduction of helminth infections in general and Enterobiasis specifically.

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Conflict of interest statement

The authors have no conflicts of interest to declare.

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