

Prevalence of intestinal parasitic infections in the Islamic Republic of Iran

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معدّل انتشار عدوى الطفيليات المعوية في جمهورية إيران الإسلامية

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الخلاصة: تم إجراء مسح وطني شامل حول معدّل انتشار عدوى الطفيليات المعوية في جمهورية إيران الإسلامية، وذلك من خلال اختيار عينة عشوائية من الأسر التي تتمتع بتغطية علاجية من قبل المراكز الصحية المحلية المرتبطة بكليات الطب الجامعية. ومن بين 53,995 شخصاً تبدأ أعمارهم من سنتين فما فوق يتمون إلى 12,495 أسرة (0.1% من جميع الأسر التي كانت موجودة في عام 1999)، تم تحليل 45,128 عينة براز باستخدام طريقة الترسيب بالفورمالين والأثير. وقد وجدت عدوى الطفيليات المعوية لدى 19.3% من الأشخاص الذين أُجريت عليهم الدراسة (19.7% من الذكور و19.1% من الإناث). وكانت العدوى بطفيليات الجيارديّة اللمبية (*Giardia lamblia*) (10.9%) والصّفّر الخراطيني (*Ascaris lumbricoides*) (1.5%) والمتحوّلة الحالّة للّسّج (*Entamoeba histolytica*) (1.0%) والسّرّمية الدّويدية (*Enterobius vermicularis*) (0.5%) هي الأكثر شيوعاً بين هذه الحالات. وقد بلغت العدوى أقصى معدل لها ضمن الفئة العمرية 2 – 14 عاماً (25.5%) ولدى سكان القرى (23.7%).

ABSTRACT A national survey of the prevalence of intestinal parasitic infections in the Islamic Republic of Iran was made on a random sample of families covered by local health centres affiliated to the medical universities. Out of 53 995 people aged 2+ years, from 12 495 families (0.1% of all families in 1999), 45 128 stool samples were analysed by formalin–ether precipitation. Intestinal parasitic infections were found in 19.3% of the study population (19.7% male, 19.1% female). *Giardia lamblia* (10.9%), *Ascaris lumbricoides* (1.5%), *Entamoeba histolytica* (1.0%) and *Enterobius vermicularis* (0.5%) were the most common infections. The infection rate was highest in the 2–14 years age group (25.5%) and in rural residents (23.7%).

Prévalence des parasitoses intestinales en République islamique d'Iran

RÉSUMÉ Une enquête nationale sur la prévalence des parasitoses intestinales en République islamique d'Iran a été réalisée dans un échantillon aléatoire de familles couvertes par des centres de santé locaux affiliés aux universités médicales. Sur les 53 995 sujets âgés de 2 ans et plus, dans 12 495 familles (0,1 % de toutes les familles en 1999), 45 128 échantillons de selles ont été analysés par précipitation (méthode formol-éther). Une parasitose intestinale a été trouvée dans 19,3 % de la population de l'étude (19,7 % de garçons, 19,1 % de filles). *Giardia lamblia* (10,9 %), *Ascaris lumbricoides* (1,5 %), *Entamoeba histolytica* (1,0 %) et *Enterobius vermicularis* (0,5 %) étaient les parasites les plus courants. Le taux d'infection était le plus élevé dans le groupe d'âge des 2-14 ans (25,5 %) et chez les ruraux (23,7 %).

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Introduction

Intestinal parasitic infection is a major health problem in many developing countries. By increasing standards of health and controlling the carriers or intermediate hosts, most industrialized countries have successfully decreased the rates of infestation. In developing countries, however, geographic and socioeconomic factors as well as unpredictable factors such as natural disasters contribute to the problem. These countries are mainly located in warm or hot and relatively humid areas that, combined with poverty, malnutrition, high population density, unavailability of potable water and low health status, provide optimum conditions for the growth and transmission of intestinal parasites. Insufficient research into infectious and parasitic diseases, lack of attention in developing countries to the problem and lack of follow-up treatment are also barriers to decreasing the rates of parasitic infestation.

The prevalence of infections varies in different parts of the world. The prevalence of *Entamoeba histolytica*, for example, ranges from 5% to 81% and is estimated to involve around 480 million people worldwide. *Giardia lamblia* is the most common intestinal parasite in the United States [1]. Of the 3% to 7% of the population with *G. lamblia* in Australia, 1.6% were asymptomatic [2]. In a study in China, *Enterobius vermicularis* (47.0%), *Trichuris trichiura* (18.8%) and *Taenia saginata* (17.2%) were the most frequent causes of intestinal parasitic infections [3]. Estimates of the global prevalence of intestinal nematode infections transmitted through soil are: 1000 million cases of *Ascaris lumbricoides*, 900 million of hookworms (*Ancylostoma duodenale* and *Necator americanus*) and 500 million of *Tr. trichiura* [4].

Studies have shown that the prevalence of intestinal parasitic infection is higher in younger people, especially children [5]. For example, an extensive survey in Malaysia reported the overall prevalence of intestinal parasitic infections as 39.6% with as many as 89.0% in children between the ages of 2 and 12 years [6]. Data from Burma showed that 1185 of 2057 patients admitted to the surgical wards of a children's hospital with acute abdominal problems during 1981–83 were suffering from ascariasis [7].

Geographical conditions and poor nutritional and socioeconomic status contribute to making the Islamic Republic of Iran a favourable area for parasitic infections. A review of 300 cases of intestinal parasitic infection showed that *A. lumbricoides* was the most common nematode and *G. lamblia* and *E. histolytica* the most common unicellular microorganisms causing intestinal parasitic infections [8]. The prevalence of intestinal parasitic infections has been found to vary in different parts of the country, with 47.2% in Kerman [8], 22.4% in Shahrekord [9], 21.9% in Mazandaran [10], 65.5% in Amol [11] and 32.2% in Tabas [12].

This study of a random sample of the Iranian population aimed to determine the demographic factors favouring infestation. The results of this study could then be used by health authorities to improve environmental health throughout the community, thereby preventing the spread of intestinal parasitic infections in the Islamic Republic of Iran.

Methods

This study was carried out between May 1999 and February 2000. The population sample was chosen by randomized cluster sampling from the normal population cov-

ered by all health centres affiliated to the medical universities throughout the Islamic Republic of Iran. According to the 1996 census, the total number of families in the country was 12 359 298 (7 948 928 urban and 4 410 370 rural dwellers). In this study 1097 clusters from urban areas (8776 families) and 590 from rural areas (4720 families) were selected, such that each cluster comprised 8 families and the sample contained around 0.1% of the total number of families in the country in 1999.

Data about age, sex, site of residence (urban/rural) for each person and the state of health of the family were obtained from a questionnaire interview. The interviews were begun simultaneously in 3 centres from each province. Families were interviewed at their homes by a trained team consisting of a male and female doctor, a laboratory technician, an interviewer (a medical resident) and a driver.

After obtaining personal information, a small container for a stool sample was given to each family member, which was returned the following day. After sending the specimens to the laboratory, the stools were tested for parasites by the formalin-ether precipitation method. The presence of *Enterobius vermicularis*, *A. lumbricoides*, *G. lamblia*, *E. histolytica*, *Ancylostoma duodenale*, *Necator americanus*, *Ta. saginata*, *Tr. trichiura*, *Trichostrongylus colubriformis* and other types of parasites in the stools were noted. Stool samples were obtained for all family members aged 2 years or over.

The data were compiled by a team of 2 general physicians, an interviewer and a laboratory technician. The executive groups in each province were supervised by epidemiologists from the Faculty of Health and Nutrition Research Institute of Tehran University.

The data were analysed using *Epi-Info* and *SPSS* software.

Results

Among the 53 995 subjects studied, 45 128 stool specimens (83.6%) were collected. Of these, 20 663 (45.8%) specimens were from males and 24 465 specimens from females. People living in urban areas provided 27 513 specimens and in rural areas 17 615.

Table 1 shows that, overall, 19.3% of the subjects had intestinal parasitic infections (19.7% of males, 19.1% of females). *G. lamblia* (10.9%), *A. lumbricoides* (1.5%), *E. histolytica* (1.0%) and *Enterobius vermicularis* (0.5%) were the most common infections. Only *G. lamblia* was more frequent in males than females, while the prevalence of other parasites was higher in females than males (with the exception of *Trichostrongylus colubriformis*, which had a similar frequency in both sexes).

The frequency of various intestinal parasitic infections by age is shown in Table 2. The prevalence of intestinal parasitic infections was higher in the younger than the older age groups, with a quarter of all infections (25.5%) in those aged 2–14 years.

Table 3 shows the frequency of intestinal parasitic infections by area of residence. Intestinal parasitic infections overall were more common in rural (23.7%) than urban (16.2%) dwellers.

Discussion

This study shows that intestinal parasitic infections are a major public health problem in the Islamic Republic of Iran, affecting one-fifth of the population. The findings of studies performed in other countries such as Brazil, China, Egypt and Pakistan are comparable to the results of this study [13,14].

Table 1 Prevalence of intestinal parasitic infections in the Islamic Republic of Iran by sex

Parasite	Male (n = 20 663)		Female (n = 24 465)		Total (n = 45 128)	
	No.	%	No.	%	No.	%
<i>Giardia lamblia</i>	2387	11.6	2516	10.3	4903	10.9
<i>Ascaris lumbricoides</i>	289	1.4	372	1.5	661	1.5
<i>Entamoeba histolytica</i>	175	0.8	264	1.1	439	1.0
<i>Enterobius vermicularis</i>	102	0.5	109	0.4	211	0.5
<i>Taenia saginata</i>	30	0.1	38	0.2	68	0.2
<i>Trichostrongylus colubriformis</i>	42	0.2	50	0.2	92	0.2
<i>Trichuris trichiura</i>	15	0.1	23	0.1	38	0.1
<i>Ancylostoma duodenale</i>	5	<0.1	7	<0.1	12	<0.1
Other	1023	5.0	1284	5.2	2307	5.1
Total	4068	19.7	4663	19.1	8731	19.3

n = number of participants.

Table 2 Prevalence of intestinal parasitic infections in the Islamic Republic of Iran by age

Parasite	2–14 years (n = 15 613)		15–39 years (n = 19 240)		40–69 years (n = 8758)		≥ 70 years (n = 1517)	
	No.	%	No.	%	No.	%	No.	%
<i>Giardia lamblia</i>	2495	16.0	1695	8.8	637	7.3	76	5.0
<i>Ascaris lumbricoides</i>	238	1.5	270	1.4	135	1.5	18	1.2
<i>Entamoeba histolytica</i>	142	0.9	191	1.0	96	1.1	10	0.7
<i>Enterobius vermicularis</i>	99	0.6	89	0.5	21	0.2	2	0.1
<i>Taenia saginata</i>	36	0.2	28	0.1	3	<0.1	1	0.1
<i>Trichostrongylus colubriformis</i>	34	0.2	34	0.2	20	0.2	4	0.3
<i>Trichuris trichiura</i>	16	0.1	18	0.1	4	<0.1	0	<0.1
<i>Ancylostoma duodenale</i>	5	<0.1	4	<0.1	3	<0.1	0	<0.1
Other	916	5.9	929	4.8	397	4.5	65	4.3
Total	3981	25.5	3258	16.9	1316	15.0	176	11.6

n = number of participants.

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Table 3 Prevalence of intestinal parasitic infections in the Islamic Republic of Iran by area of residence

Parasite	Urban (n = 27 513)		Rural (n = 17 615)	
	No.	%	No.	%
<i>Giardia lamblia</i>	2602	9.5	2301	13.1
<i>Ascaris lumbricoides</i>	295	1.1	266	1.5
<i>Entamoeba histolytica</i>	270	1.0	169	1.0
<i>Enterobius vermicularis</i>	113	0.4	98	0.6
<i>Taenia saginata</i>	26	0.1	42	0.2
<i>Trichostrongylus colubriformis</i>	39	0.1	53	0.3
<i>Trichuris trichiura</i>	10	<0.1	28	0.2
<i>Ancylostoma duodenale</i>	9	<0.1	3	<0.1
Other	1088	4.0	1219	6.9
Total	4452	16.2	4179	23.7

n = number of participants.

The prevalence of intestinal parasitic infections was slightly higher in males than females, which is in agreement with the findings of a study in Nigeria [15] and previous studies in local regions of the Islamic Republic of Iran, in Tabas [12], Kerman [8] and Shahrekord [9]. Population studies of the northern part of the Islamic Republic of Iran in Nour, Beshehr [16] and Amol [11] showed a higher prevalence of infection in females than in males. This may be explained by environmental factors as more women are occupied in farming in this area compared with other parts of the country.

G. lamblia (10.9%) was the most common species among unicellular organisms and *A. lumbricoides* (1.5%) the most common among nematodes causing disease. This finding is in accordance with studies in other parts of the world as well as the Islamic Republic of Iran [16]. In Mexico City, up to 18% of cases of acute diarrhoea

and dysentery in children requiring hospitalization were found to be associated with *G. lamblia* as well as 10% with *E. histolytica* and 7% with *Blastocystis hominis* [17]. In 1983, in the United States of America, *G. lamblia* was identified as the cause of 68% of waterborne outbreaks of diarrhoea in which an etiologic agent was unknown [18].

We found that intestinal parasitic infections are more common in rural than urban areas. People living in rural areas may lack sanitary water supplies and live close to sources of parasites in social and environmental conditions that predispose to intestinal parasitic infections.

According to this study, the common intestinal parasitic infections were more frequent in children, which suggests that screening tests for this age group may be useful. Because the prevalence of parasitic infections is high in developing countries, it

is suggested that local or regional researchers undertake studies on such infections in these countries, perhaps with the technical support of the World Health Organization.

In view of the distribution of intestinal parasitic infections in this study, preventive measures should be taken for high-risk populations by increasing their level of knowledge about personal and community health and hygiene. By comparing the findings of this study with those of the National Health and Disease Survey of 1993 [19], we conclude there has been a noticeable decline in the prevalence of parasitic diseases in the Islamic Republic of Iran, which may be due to improvements in environmental and personal health which

have occurred through public education campaigns, improved sanitation facilities, proper waste and wastewater disposal and control of drinking-water and food safety.

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References

1. Kappus KD et al. Intestinal parasitism in the United States: update on a continuing problem. *American journal of hygiene and tropical medicine*, 1994, 50(6):705–13.
2. Lacroix M, Sorensen B. Forekomst af *Enterobius vermicularis* hos børn indlagt på et centralsygehus. [Occurrence of *Enterobius vermicularis* in children hospitalized at a central hospital]. *Ugeskrift for læger*, 2000, 162(9):1236–8.
3. Xu LQ et al. Soil transmitted helminthiasis: nationwide survey in China. *Bulletin of the World Health Organization*, 1995, 73(4):507–13.
4. Tchuem Tchuente LA et al. Polyparasitism with *Schistosoma haematobium* and soil-transmitted helminth infections among school children in Loum, Cameroon. *Tropical medicine & international health*, 2003, 8(11):975–86.
5. Hellard ME et al. Prevalence of enteric pathogens among community based asymptomatic individuals. *Journal of gastroenterology and hepatology*, 2000, 15(3):290–3.
6. Levy J. Epidemiological survey of intestinal parasitic infections in children of Sabah, Malaysia. *Community medicine*, 1988, 10(3):240–9.
7. Chandiwana SK, Makaza D. Some epidemiological aspects of intestinal helminth infections in a farmworker community in Burma Valley. *Central African journal of medicine*, 1983, 29(9):173–7.
8. Naser ZA, Jafar M. Prevalence of intestinal parasites in the city of Kerman. *Iranian journal of parasitology*, 1997, 11:129a.
9. Koroosh MN. Prevalence of intestinal parasitic infestations in patients attending the parasitology laboratory in Shahrekord. *Iranian journal of parasitology*, 1997, 11:131a.
10. Azam S. *Frequency distribution of intestinal worms in Behshar and Norr cities*. Tehran, Tehran University School of Health Sciences and Research Institute, 1995.

11. Ali HZO. *Prevalence of intestinal parasites in Amol city*. Tehran, Tehran University School of Health Sciences and Research Institute, 1999.
12. Saied HM. *Prevalence of intestinal parasites in Tabas city*. Tehran, Tehran University School of Health Sciences and Research Institute, 1999.
13. Kobayashi J et al. Prevalence of intestinal parasitic infection in five farms in Holambra, Sao Paulo, Brazil. *Revista do Instituto de Medicina Tropical de São Paulo*, 1995, 37(1):13–8.
14. Murray CJL, Lopez AD, Mathers CD, eds. *The global epidemiology of infectious diseases. Global burden of disease and injury series. Volume IV*. Geneva, World Health Organization, 2004.
15. Agi PI. Pattern of infection of intestinal parasites in Sagbama community of the Niger Delta, Nigeria. *West African journal of medicine*, 1995, 14(1):39–42.
16. Ashrat Bighom K, Hossin H, Erag M. *Assessment of human intestinal parasites in Iran during the last 50 years*. Abstracts of the 2nd National Congress of Parasitic Diseases, Tehran, Islamic Republic of Iran, October 19–22, 1997:137.
17. Diaz E et al. Epidemiology and control of intestinal parasites with nitazoxanide in children in Mexico. *American journal of hygiene and tropical medicine*, 2003, 68(4):384–5.
18. Weniger BG et al. An outbreak of waterborne giardiasis associated with heavy water runoff due to warm weather and volcanic ashfall. *American journal of public health*, 1983, 73(8):868–72.
19. Deputy of Research of Ministry of Health and Medical Education. *Health and disease in Iran*. Tehran, Moavenat Pajooheshi Publications, 1993 (Report No. 25).

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