

Prevalence and seasonal variation of human intestinal parasites in patients attending hospital with abdominal symptoms in northern Jordan

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انتشار الطفيليات المعوية البشرية والتفاوت الموسمي للعدوى بها عند المرضى الذين يراجعون المستشفى بأعراض
بطنية في شمال الأردن
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الخلاصة: لقد أجريت هذه الدراسة لتحديد انتشار الطفيليات المعوية والتفاوت الموسمي للعدوى بها في شمال الأردن. فقد جمعت 21906 عينات براز على مدى 4 سنوات (2009-2013) من 5 مستشفيات حكومية في 3 مدن. وُجهزت العينات وفحصت مجهرياً وبطرق التركيز. فُعثر على عدوى طفيلية في 9611 عينة (44%). كانت الجياردية اللمبية أكثر الطفيليات انتشاراً (41%)، تلتها المتحولة الحالة للنسج (31%) والمتحولة القولونية (13%)، وكانت أقل الطفيليات انتشاراً الصفر الخراطيني (1%)، والمحرشفة القزمية وأنواع الشريطيات وشفوية السياط المنيلية (جميعها <1%). وقد اختلف انتشار الطفيليات المختلفة باختلاف الموسم، ففي المتوسط أظهرت أشهر الصيف أعلى حدوث للعدوى الطفيلية (62%) مقارنة مع أشهر الشتاء (16%). وكانت الجياردية اللمبية والمتحولة الحالة للنسج أكثر انتشاراً في أشهر الصيف.

ABSTRACT This study was carried out to determine the prevalence of intestinal parasites and their seasonal variation in northern Jordan. A total of 21 906 stool samples were collected over a period of 4 years (2009–2013) from 5 government hospitals in 3 cities. Samples were processed and examined microscopically and by concentration methods. Parasitic infection was found in 9611 samples (44%). *Giardia lamblia* was the most prevalent parasite (41%) followed by *Entamoeba histolytica* (31%) and *Ent. coli* (13%); the least prevalent parasites were *Ascaris lumbricoides* (1%), *Hymenolepis nana*, *Taenia sp.*, and *Chilomastix mesnili* (all < 1%). The prevalence of different parasites varied according to season, on average the summer months showed the highest incidence of parasitic infection (62%) compared with the winter months (16%). *Giardia lamblia* and *Ent. histolytica* were most prevalent in the summer months.

Prévalence et variations saisonnières de parasites intestinaux humains chez des patients consultant en hôpital pour des symptômes abdominaux dans le nord de la Jordanie

RÉSUMÉ La présente étude a été menée afin de déterminer la prévalence de parasites intestinaux ainsi que leur variation saisonnière dans le nord de la Jordanie. Un total de 21 906 échantillons de selles ont été collectés sur une période de 4 ans (2009-2013) dans cinq hôpitaux gouvernementaux de trois villes. Les échantillons ont été traités et examinés à la microscopie et à l'aide de méthodes de concentration. Une infection parasitaire a été trouvée dans 9611 échantillons (44 %). *Giardia lamblia* était le parasite avec la prévalence la plus élevée (41 %), suivi par *Entamoeba histolytica* (31 %) et *Entamoeba coli* (13 %). Les parasites ayant la plus faible prévalence étaient *Ascaris lumbricoides* (1 %), *Hymenolepis nana*, *Taenia sp.*, et *Chilomastix mesnili* (tous < 1 %). La prévalence des différents parasites variait en fonction de la saison : en moyenne, les mois d'été affichaient la plus haute incidence d'infections parasitaires (62 %) comparés aux mois d'hiver (16 %). *Giardia lamblia* et *Ent. histolytica* étaient les plus prévalents au cours des mois d'été.

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Introduction

Intestinal parasitic diseases are among the most common infections worldwide and more prevalent in the poorest communities of the developing world (1–4). These infections are regarded as a serious public health problem as they can cause iron-deficiency anaemia (5,6), malnutrition (7), growth retardation in children and other physical and mental health disorders (8,9). Most clinicians and health workers do not consider parasitic infections as life threatening and most of the time they go unnoticed or are misdiagnosed (10). Consequently, not much attention is given to treating these diseases.

Very few studies have been carried out in Jordan dealing with parasitic infections, and those that have been done only discussed specific cases or incidents involving diarrhoea. Studies that dealt with parasites either concentrated on infants and children or adults in specific carriers such as food handlers (11–14). The current study may be the first comprehensive study to determine the prevalence of intestinal parasites over a long period in a large sample of Jordanians.

The aim of this study was to determine the prevalence of human intestinal parasites and their seasonal variation in the north of Jordan, where approximately a third of the Jordanian population live. Patients attending major hospitals in Irbid, Jerash and Ajlun were studied.

Methods

Study design

The study was conducted over a period of 4 years (2009–2013) with the co-operation of major hospitals in 3 cities. The fieldwork involved the collection of stool samples from all patients attending these hospitals complaining of abdominal pain or stomach complaints.

The study was carried out at hospitals in 3 main cities in northern Jordan, Irbid, Jerash and Ajlun, 3 hospitals in Irbid (Princess Badea, Princess Basma and Princess Rahma Children's Hospital), 1 hospital in Jerash and 1 hospital in Ajlun. These are all governmental hospitals and serve a large population of Jordanians, 1 626 300 in total (including 1 112 300 in Irbid, 187 500 in Jerash and 143 700 in Ajlun) according to the latest census in 2015. North Jordan is home to people living in diverse socioeconomic conditions, from refugee camps (lower socioeconomic conditions) to modern cities with a high standard of living.

The climate of north Jordan varies from very hot and dry during the summer months (June–September) to cold and wet during the winter months (November–February). Stool samples were obtained from patients attending the hospitals with stomach or abdominal complaints (21 906 samples in total). The patients were divided into groups according to age, adults (> 15 years, samples obtained from Princess Badea, Princess Basma, Jerash and Ajlun hospitals) and children (0–15 years,

samples obtained from Princess Rahma Children's Hospital, Jerash and Ajlun hospitals).

Sample collection and analysis

Stool samples were collected in clean plastic containers and transferred to the microbiology laboratory at Al al-Bayt University, where the experimental work was done. Patients were asked to provide fresh faecal samples. Stool specimens were examined for intestinal parasites using the standard routine methods used by hospitals and microbiological laboratories for diagnosing parasites (15). A direct saline smear preparation was made and examined by light microscopy. For differential diagnosis of protozoa cysts, another preparation was made using Lugol's solution. Samples which did not show any intestinal parasites by direct smear were examined using the zinc sulphate flotation concentration technique. For the detection of *Enterobius vermicularis* cellophane tape preparation were used and examined either directly or by placing 1–2 drops of xylene between tape and slide. Samples that were not examined on the same day were kept at 4 °C.

Statistical analysis

The chi-square test was used for comparing data. The level of significance was set at $P < 0.05$.

Table 1 Distribution of patients testing positive for intestinal parasite infection from hospitals in three cities in northern Jordan according to sex and age, 2009–2013

City	Sex ($P = 0.673$)				Age (years) ($P = 0.04$)				Total
	Male		Female		0–15		>15		
	No.	%	No.	%	No.	%	No.	%	
Irbid	1614	51	1551	49	1070	33.8	2095	66.2	3165
Jerash	2391	48.1	2576	51.9	902	18.8	3890	81.2	4967
Ajlun	724	49	755	51	515	34.8	964	65.2	1479
Total	4729	50.3	4882	49.7	2487	26.4	6949	73.6	9611

Table 2 Distribution of intestinal parasite species in three main cities in northern Jordan, 2009–2013

Parasite	Irbid	Jerash*	Ajlun*	Total
<i>Giardia lamblia</i>	1234	2405	314	3953
<i>Entamoeba histolytica</i>	1312	1325	384	3021
<i>Entamoeba coli</i>	420	562	272	1254
<i>Enterobius vermicularis</i>	115	292	227	634
<i>Trichomonas hominis (vaginalis)</i>	140	240	153	533
<i>Hymenolepis nana</i>	17	38	37	82
<i>Taenia</i> sp.	12	27	9	48
<i>Ascaris lumbricoides</i>	24	42	18	84
<i>Chilomastix mesnili</i>	2	–	–	2

* $P < 0.05$.

Results

A total of 21 906 stool samples were collected over the study period of 4 years, of which 9611 samples tested positive for parasitic infection (44%). The sex and age distribution of patients that showed positive results are shown in Table 1. Sex of the patient did not show any statistical significance in relation to the presence of intestinal parasites, ($P = 0.673$); however, the relationship with age was statistically significant ($P = 0.043$).

Patients attending hospital in Irbid and Jerash had significantly higher

prevalence of parasitic infection than those from Ajlun ($P < 0.05$) (Table 2).

Giardia lamblia was the most prevalent parasite (41%), followed by *Ent. histolytica* (31%) and *Ent. coli* (Table 3).

The prevalence of different parasites varied in different seasons: on average the summer months (June–September) showed the highest incidence of parasitic infection (62%), with a peak in September, compared with the winter months (November–February) (16%), with a peak in January; this was statistically significant ($P < 0.05$). *Giardia lamblia* and *Ent. histolytica* were the most

prevalent in the summer months (Table 3).

Discussion

Parasitic infections occur most commonly in poor areas with low standards of hygiene. In Jordan, parasitic infection has been found to be most prevalent in rural areas and refugee camps (16). The current study shows that intestinal parasitic infections are common in urban areas of Jordan (44%), with *Giardia lamblia* the most prevalent parasite (41%), followed by *Ent. histolytica* (31%). This is in agreement with a 2007 study by

Table 3 Seasonal distribution of intestinal parasites in stool specimens in three main cities of northern Jordan, 2009–2013

Month	No. of specimens examined	No. (%) infected	No. (%) of parasite species identified in infected stool samples								
			GL	EH	EC	TH	EV	Ts	HN	CM	AL
January	1056	103 (10)	25 (24)	34 (33)	32 (31)	12 (12)	–	–	–	–	–
February	2023	238 (12)	95 (40)	77 (33)	63 (27)	–	–	–	3	–	–
March	1875	598 (32)	236 (39)	214 (36)	69 (12)	25 (4)	32 (5)	5 (1)	8 (1.4)	–	9 (1.6)
April	1798	999 (56)	482 (48)	238 (24)	216 (22)	–	30 (3)	7 (<1)	11 (1)	–	15 (1.5)
May	2594	1194 (46)	540 (45)	404 (33)	108 (9)	–	112 (9)	8 (<1)	9 (<1)	–	13 (1)
June	2592	1412 (54)	632 (45)	414 (29)	127 (9)	105 (7)	105 (7)	6 (<1)	12 (<1)	–	11 (<1)
July	2620	1397 (55)	591 (42)	526 (38)	94 (7)	75 (5)	81 (6)	8 (<1)	12 (<1)	–	10 (<1)
August	2356	1299 (55)	602 (46)	463 (36)	117 (9)	43 (3)	38 (3)	7 (<1)	13 (1)	2 (<1)	14 (1)
September	1234	1032 (84)	315 (30)	267 (26)	208 (20)	126 (12)	96 (9)	–	8 (<1)	–	12 (1)
October	1345	836 (62)	235 (28)	203 (24)	107 (13)	140 (17)	138 (16)	7 (<1)	6 (<1)	–	–
November	1379	294 (21)	115 (39)	103 (35)	76 (26)	–	–	–	–	–	–
December	1034	209 (20)	85 (41)	78 (37)	37 (18)	7 (3)	2 (1)	–	–	–	–
Total	21906	9611 (44)	3953 (41)	3021 (31)	1254 (13)	533 (6)	634 (7)	48 (<1)	82 (<1)	2 (<1)	84 (1)

GL = *Giardia lamblia*; EH = *Entamoeba histolytica*; EC = *Entamoeba coli*; TH = *Trichomonas hominis (vaginalis)*; EV = *Enterobius vermicularis*; Ts = *Taenia* sp.; HN = *Hymenolepis nana*; CM = *Chilomastix mesnili*; AL = *Ascaris lumbricoides*.

Chazal and Adi (14), who reported that *Ent. histolytica* was the most frequent intestinal parasites followed by *Giardia lamblia*. They also reported low incidence of *Ascaris lumbricoides*, *Enterobius vermicularis*, *Strongyloides stercoralis* and *Trichomonas hominis*. They also noted higher incidence of infections with *Ent. histolytica* in spring and summer months compared with autumn and winter, which is also in agreement with the findings of the current study. In another study done in Jordan in 2006, *Giardia lamblia* (61.5%) and *Ent. histolytica* (19.6%) were the most prevalent intestinal parasites in the Amman area (central Jordan) (17). In Saudi Arabia a 2011 study showed that the majority of patients were infected by *Ent. histolytica* (4.7%) and *Giardia lamblia* (1.3%) (18); *Ancylostoma duodenale* exhibited the lowest prevalence. A study carried out at Al-Najah University in the West Bank in 2011 also found that the most prevalent intestinal parasite was *Ent.*

histolytica (9.7%) followed by *Giardia lamblia* (4.1%) (19). The difference between our results and theirs may be a reflection of the difference in sample size and duration of the study. Comparing our results to other studies in Turkey, which has colder winters and milder summers, the most prevalent intestinal parasite was *Enterobius vermicularis* (13.8%) followed by *Giardia intestinalis* (6.1%) and *Ent. coli* (4.6%) (20,21). In general *Giardia lamblia* and *Ent. histolytica* were found to be the most prevalent intestinal parasites compared with helminth infestation.

Some clinicians and public health workers do not consider intestinal parasites to be an important problem so infected people are commonly not treated or improperly treated, especially for worm infections (21). Our findings should change the view of most clinician in Jordan: intestinal parasitic infections are important issues facing the population and more attention should

be paid to the problem. Treating these infections is of the utmost importance along with prevention by giving advice to patients on hygiene and general cleanliness. Attention should be focused on public health education.

Our research had shed light on the prevalence of parasitic infection in northern Jordan; for a better understanding of the problem in Jordan as a whole, and for more reliable data to consolidate the results, a further survey is needed, which should involve most of the hospitals and clinics in the country.

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