ARTICLE ORIGINAL / ORIGINAL ARTICLE

TRENDS AND PREVALENCE OF INTESTINAL PARASITES AT A TERTIARY CARE CENTER IN LEBANON OVER A DECADE

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Araj GF, Musharrafieh UM, Haydar A, Ghawi A, Itani R, Saliba R. Trends and prevalence of intestinal parasites at a tertiary care center in Lebanon over a decade. J Med Liban 2011 ; 59 (3) : 143-148.

ABSTRACT : Intestinal parasitic infections or infestation are amongst the most prevalent infections worldwide. This study aimed at revealing the changing trends over a decade duration of intestinal parasites identified at a major tertiary care center in Lebanon between 1997-1998 and 2007-2008. The total number of specimens tested were 14,771 for 1997-1998 *vs* 7477 for 2007-2008. The positive findings for parasites were 2077 (14%) *vs* 1047 (14%), respectively. The majority of recovered parasites in both study periods belonged to intestinal protozoa (91% and 95%), followed by cestodes (6% and 3%), and nematodes (3% and 2%), while trematodes were negligible in both periods.

The highest prevalence occurred among ages 16 to 35 years for 1997-1998, and without age predominance in the second period. The detected parasites from 1686 individuals (11.4%) in the first period *vs* 904 (12.1%) in the second period encompassed 18 species. The most common "pathogenic" parasite in both periods were: *Entamoeba histolytica* (14% *vs* 12%), *Giardia lamblia* (16% *vs* 6%), *Taenia* spp. (6% *vs* 3%), and *Ascaris lumbricoides* (2% *vs* 1%). Generally, these were detected more in males than females, in adults than in children, and during the summer (≈ 30%) and autumn (≈ 26%) than winter (≈ 20%) seasons for both periods. Despite some observable decrease in prevalence among the two study periods, sustainability of substantial intestinal parasites detection continues to exist. The latter is a valuable indicator for a state of collective ill-health, warranting more attention and efforts for public health awareness to improve hygiene and sanitation in order to minimize the prevalence of these parasites in this country.

Araj GF, Musharrafieh UM, Haydar A, Ghawi A, Itani R, Saliba R. Evolution et prévalence des parasites intestinaux identifiés à dix ans d'intervalle dans un centre hospitalier universitaire au Liban. J Med Liban 2011 ; 59 (3) : 143-148.

RÉSUMÉ : Les infections ou infestations parasitaires intestinales sont parmi les infections les plus répandues dans le monde. Cette étude vise à montrer la variation de la prévalence à dix ans d'intervalle des parasites intestinaux identifiés au Liban dans un centre hospitalier universitaire majeur en 1997-1998 et 2007-2008. Le nombre total d'échantillons testés en 1997-1998 s'élève à 14 771 contre 7477 en 2007-2008 avec respectivement 2077 (14%) et 1047 (14%) résultats positifs de parasites. La majorité des parasites découverts au cours des deux études appartiennent aux protozoaires intestinaux (91% et 95%), suivis par les cestodes (6% et 3%) et les nématodes (3% et 2%) ; le nombre de trématodes identifiés au cours des deux périodes a été négligeable.

La prévalence la plus élevée se rencontre entre 16 et 35 ans en 1997-1998 alors qu'il n'existe pas de prédominance d'âge en 2007-2008. Les parasites détectés chez 1686 individus (11,4%) dans la première période et 904 individus (12,1%) dans la seconde appartiennent à dix-huit espèces. Les parasites pathogéniques les plus communs dans les deux périodes sont : *Entamoeba histolytica* (14% *vs* 12%), *Giardia lamblia* (16% *vs* 6%), *Taenia* spp. (6% *vs* 3%) et *Ascaris lumbricoides* (2% *vs* 1%). En général, les parasites étaient plus fréquents chez les hommes que chez les femmes, chez les adultes que chez les enfants, et plus durant les saisons d'été (≈ 30%) et d'automne (≈ 26%) qu'en hiver (≈ 20%) pour les deux périodes considérées. Malgré une certaine diminution de la prévalence entre les deux périodes étudiées, la détection permanente de parasites intestinaux constitue un indicateur probant de la persistance de l'existence de ce type de pathogènes dans la communauté, requérant une prise de conscience accrue des instances de la santé publique et plus de vigilance et d'efforts pour améliorer l'hygiène et la sanitation afin de minimiser la prévalence de ces parasites au Liban.

INTRODUCTION

Intestinal parasitic infections are amongst the most common infections worldwide. This is particularly so among children and the immune-compromised individuals. The prevalence and dissemination of parasitosis problem in many countries is mostly attributed to individual, social and cultural habits, the local region's historical and political characteristics, deficiencies in sanitation, lack of hygienic practices and limited access to potable water [1-3]. In industrialized nations, on the other hand, populations at greatest risk for severe intestinal protozoan infections include immunocompromised patients such as AIDS and organ transplant recipients [2, 4-6].

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Along the above noted epidemiologic and geographic risk factors and aspects, the variation in intestinal parasite prevalence has been noted among different studies from different populations, countries and geographic locations. In our region, for example, a prevalence of 29.8% was reported among household members from Nuseirat refugee camp in Gaza [7], 4.7% among refugee people in Karaj, Iran [8], and 33.8% among Saudi children in Jeddah [9].

In Lebanon few studies reported on the prevalence of intestinal parasites, revealing a wide range between 5% and 57% [10-15]. This variation in prevalence rates can be attributed to the different settings, ages and geographic areas in which the studies were done. The prevalence ranges being 3.8% to 45.3% among hospital settings.

The aim of this study was to reveal the changing trends of intestinal parasitic infections over a decade among individuals submitting stool for analysis at the American University of Beirut Medical Center, a major tertiary care center in Lebanon (AUBMC), during the periods 1997-1998 and 2007-2008. Comparing the findings among both periods in the same setting may better shed the light on the changing prevalence of parasitic infections in this country.

METHODS

Study population

This study analyzed all stool specimens examined for intestinal parasites from people coming to AUBMC between 1997-1998 and 2007-2008. Results of stool examination were recorded and entered along with some demographic data of individuals under study i.e. age, gender, and season.

Stool analysis

Stool specimens were normally examined for intestinal parasites within 2 hours of collection. The examination took place in the parasitology section at the Department of Pathology and Laboratory Medicine at AUBMC, accredited by the College of American Pathologist (CAP). Stool specimens were first grossly checked for the presence of complete or part of adult parasites then by light microscopy using a concentration technique according to the manufacturer's instructions (Fecal Parasite Concentrator, FPC, Evergreen Scientific, Los Angeles, Ca, USA). Briefly, one spoonful of stool specimen was mixed with 9 ml of 10% formalin in a 15 ml sterile tube. The mixture

TABLE I OVERALL FINDINGS OF PARASITES AMONG TESTED INDIVIDUALS "PATHOGENIC" TYPES ARE IN BOLD

Parasite Name	Number (%) Positive (1997-1998)	Number (%) Positive (2007-2008)	*p* Value
Protozoa			
Blastocystis hominis	**0**	**178 (17)**	**NA**
Chilomastix mesnili	0	5 (0.5)	NA
Cryptosporidium	**3 (0.1)**	**0**	**NA**
Endolimax nana	298 (14)	236 (23)	< 0.05
Entamoeba coli	882 (43)	355 (34)	< 0.05
Entamoeba histolytica	**294 (14)**	**122 (12)**	**0.023**
Giardia lamblia	**327 (16)**	**67 (6)**	**0.05**
Iodamoeba butschlii	81 (4)	31 (3)	0.082
Cestodes			
Hymenolepis diminuta	**3 (0.1)**	**0**	**NA**
Hymenolepis nana	**10 (0.5)**	**3 (0.3)**	**NA**
***Taenia* species**	**116 (6)**	**27 (3)**	**< 0.05**
Nematodes			
Ascaris lumbricoides	**42 (2)**	**14 (1)**	**NA**
Enterobius vermicularis	**12 (0.6)**	**1 (0.1)**	**NA**
Hook worm	**1 (0.05)**	**1 (0.1)**	**NA**
Strongyloides stercoralis	**3 (0.1)**	**5 (0.5)**	**NA**
Trichuris trichiura	**4 (0.2)**	**0**	**NA**
Trematodes			
Dicrocoelium dentriticum	0	2 (0.2)	NA
Fasciola hepatica	**1 (0.05)**	**0**	**NA**
Total Number of parasites/Patients tested	2077/1686	1047/904	

NA: Not applicable analysis due to small numbers to calculate.

was kept at room temperature for 30 minutes for fixation. Three drops of Triton X-100 (surfactant) were added, followed by 3 ml of ethyl acetate to dissolve fat and reduce the bulk of stool. The mixture was transferred to a 15 ml centrifuge tube through the FPC strainer attached to the tube. This FPC strainer has a precision molded filter matrix (0.6 x 0.6 mm holes) that allows helminth eggs and larvae, protozoan cysts, and coccidian oocysts to pass but will retain the coarse particulate matter (excess fecal debris). After completing this filtration step, the tube was capped and centrifuged at 2000 ppm for 10 minutes. The supernatant was decanted, and 3 drops of 10 ml of 10% formalin were added and mixed with the sediment. Part of the latter was transferred to a slide and examined for parasites under the light microscope. In addition "watery stool" was also examined microscopically without concentration looking for trophozoites of parasites. Coccidian parasites e.g. *Cryptosporidium* and *Isospora* were looked for using modified Acid Fact Stain [6]. The staff involved in the examination of parasites were the same during the two study periods, and each had a minimum of 15 years experience in this discipline. The FBC method used for detection of parasites was the same in both study periods.

Quality control

Quality control measures include proficiency challenges on regular basis by the CAP through the examination of unknown specimens. Moreover, each new lot of reagents is checked with a known stock of positive stool specimens for intestinal parasites.

Statistical analysis

A computer program, Minitab 15, was used for data analysis. The descriptive data was given in mean ± standard deviation (SD). Test and confidence interval for proportions and Fischer's exact test were used for the analytical assessment. The differences were considered to be statistically significant when the *p*-value obtained was less than 0.05.

RESULTS

The overall findings among tested specimens in this decade comparative intestinal parasites for the two study periods 1997-1998 versus 2007-2008 revealed the following • total number of tested specimens : 14,771 *vs* 7477 • positive parasite findings among these specimens : 2077 (14%) *vs* 1047 (14%). These detected parasites were recovered from 1686 (11.4%) *vs* 904 (12.1%) individuals, encompassed 18 species as shown in Table I where the pathogenic ones are marked in bold font. The majority of recovered parasites in both study periods belonged to intestinal protozoa constituting 91% in 1997-1998 and 95% in 2008-2009. Cestodes represented 6% and 3%, nematodes 3% and 2%, and trematodes were negligible in both periods (Table I).

Excluding the duplicate parasites, the findings recovered among males and females from the 1686 *vs* 904 individuals are presented and analyzed in Table II. The most common parasites in the two study periods belonged to seven species: *Ascaris lumbricoides, Endolimax nana, Entamoeba histolytica, E. coli, Giardia lamblia, Iodamoeba butschlii* and *Taenia* spp. (Table II). In addition, *Blastocystis hominis* were cited only for the study period 2007-2008, since it was not looked for in the first period (Table I). It was mostly detected among a wide spectrum of age groups ranging from16 yrs to ≥ 66 yrs with a detection rate of 10%-26% among the different age brackets.

Concerning gender, generally, for the two periods *E. histolytica* and *G. lamblia* were detected more in males than females, while the opposite was found for *E. coli*. *Taenia* spp. was detected more in males for the first period only. *Ascaris* was detected in the same low frequency among males and females in both periods (Table II). Comparison of the prevalence of parasites among the same gender in the two study periods showed that significantly higher prevalence of parasites was observed among males in the period 1997-1998 *vs* 2007-2008 for *E. coli*, *G. lamblia*, and *Taenia* spp., while almost similar prevalence was noted for *Ascaris*, *E. histolytica* and *I. butschlii*.

TABLE II COMPARISON OF PARASITES PREVALENCE BASED ON GENDER

Parasite	Number (%) Males			Number (%) Females		
	1997/8 (n = 1048)[a]	2007/8 (n = 523)[a]	*p* value	1997/8 (n = 638)[a]	2007/8 (n = 381)[a]	*p* value
Ascaris lumbricoides	21 (2)	7 (1.3)	NA	17 (3)	6 (1.6)	NA
Endolimax nana	130 (12)	122 (23)	< 0.05	108 (17)	88 (23)	0.052
Entamoeba coli	424 (40)	152 (29)	< 0.05	299 (47)	154 (40)	0.051
Entamoeba histolytica	134 (13)	65 (12.4)	0.42	53 (8)	29 (8)	NA
Giardia lamblia	206 (20)	45 (8.6)	< 0.05	98 (15)	18 (5)	< 0.05
Iodamoeba butschlii	33 (3)	13 (2.4)	NA	16 (3)	7 (1.8)	NA
Taenia spp.	80 (8)	16 (3)	< 0.05	30 (5)	8 (2.1)	NA

a : The differences in total numbers belonged to patients showing very small numbers of parasites from different species, as noted in Table I.
NA : Not applicable analysis due to small numbers to calculate.

TABLE III DISTRIBUTION OF PROTOZOA BASED ON AGE BRACKETS

AGE BRACKET (yr)	Number (%) of parasites at study years									
	G. lamblia		*E. histolytica*		*E. coli*		*E. nana*		**Total**	
	1997/8	2007/8	1997/8	2007/8	1997/8	2007/8	1997/8	2007/8	1997/8	2007/8
≤ 5	*19 (6)*	9 (14)	*3 (2)*	0	*3 (0.4)*	3 (1)	*4 (2)*	1 (0.4)	***29 (2)***	**13 (2)**
6-15	*41 (13)*	12 (19)	*4 (2)*	0	*25 (3)*	5 (2)	0	4 (2)	***70 (5)***	**21 (3)**
16-25	*99 (33)**	8 (13)*	*43 (23)**	10 (11)*	*170 (24)**	32 (10)*	*69 (29)**	29 (14)*	***381 (26)****	**79 (12)***
26-35	*79 (26)**	10 (16)*	*72 (39)**	21 (22)*	*221 (31)**	58 (19)*	*62 (26)*	47 (22)	***434 (30)****	**136 (20)***
36-45	*38 (13)*	10 (16)	*26 (14)*	23 (24)	*115 (16)*	51 (17)	*27 (11)*	35 (17)	***206 (14)***	**119 (18)**
46-55	*15 (5)*	7 (11)	*20 (11)*	20 (21)	*83 (11)*	58 (19)	*35 (15)*	36 (17)	***153 (11)***	**121 (18)**
56-65	*9 (3)*	4 (6)	*14 (7)*	12 (13)	*82 (11)*	40 (13)	*27 (11)*	36 (17)	***132 (9)***	**92 (14)**
≥ 66	*4 (1)*	3 (5)	*5 (3)*	8 (9)	*24 (3)**	59 (19)*	*14 (6)*	22 (10)	***47 (3)****	**92 (14)***
Total	***304 (21)****	**63 (9)***	***187 (13)***	**94 (14)**	***723 (50)***	**306 (45)**	***238 (16)***	**210 (31)**	***1452 (100)***	**673 (100)**

* Indicates ($p < 0.05$) for the detected parasites among the two study periods, the others did not show significant difference OR inaccurate analysis due to small numbers.

NOTE: *I. butschlii* was excluded as it showed very small numbers in both periods.

Among females, *G. lamblia* was significantly more detected in 1997-1998 *vs* 2007-2008, while *E. nana* was significantly more detected in 2007-2008 *vs* 1997-1998. The other parasites were generally of low prevalence among females in the two periods and could not be analyzed for statistical significance (Table II).

The distribution of intestinal protozoa findings based on age brackets for the two study periods are presented in Table III. In the first study period (1997-1998) the highest prevalence of parasite occurred among ages 16 and 35 years. In the second period (2007-2008), the detected parasites spanned over a wide range without predominance at any age bracket, notably from age 16 and above. Overall, and in both periods, adults showed more prevalence of parasites than children. Among the age group of 16-35 years, a general significant decrease in the prevalence of protozoan parasites was observed in 2007-2008 compared to 1997-1998. Interestingly, in the first study period (1997-1998), the higher prevalence of parasites was observed as compared to the 2007-2008 study period from childhood up to 35 years. This, however, was reversed whereby in the second study period the prevalence of parasites was higher for ages 36 and above compared to the first one (Table III).

Combination of parasites in the same specimen (polyparasitism/mixed, ≥ 2 parasites) was encountered in 11% of individuals (190 of 16860) in 1997-1998 and in 8% of individuals (69 of 904) in 2007-2008. These combinations mostly consisted of "pathogenic" plus "commensal", and "commensal plus commensal" with least encounter of "pathogenic plus pathogenic" parasites.

The seasonal distribution of parasites *vs* tested individuals did not show significant difference among the two study periods. However, significant differences ($p < 0.05$) were noted between the summer (≈ 30%) and the autumn (≈ 26%) seasons *vs* the winter (≈ 20%) season for both study periods.

DISCUSSION

The overall 14% prevalence rate of intestinal parasitic infections for both study periods, reflects the relatively high sustainability of recovered parasites over the 10-year span of time for these studies from the same major tertiary care institution in Lebanon. This rate falls within the 3.8% to 57.8% rates previously reported among different populations in different studies from this country as follows: 8.45% - 45.35% among samples tested at hospital settings [10-12], 12.4% among healthy individuals applying for visas [13], 57.8% among pastry workers in North Lebanon [14], 5% among households in semi-urban North Lebanon [15], and 3.8% among patients treated at UNIFIL hospital in South Lebanon between 1993 and 2000 [11]. Such rates in no way reflect the countrywide rate, as this would require a comprehensive nationwide study employing one standardized test methodology, and known experienced individuals to examine the samples. Nevertheless, such findings point to the persistence of parasitic infections in our community, a concern that needs to be addressed.

In both study periods, 1997-1998 and 2007-2008, the most prevalent intestinal parasites encountered were the protozoa (91% and 95%), followed by cestodes (6% and 3%), nematodes (3% and 2%), with only a couple of trematodes detected. Among the protozoa, *E. coli*, *E. nana* and *Blastocystis hominis* cysts (34%, 23% and 17%, respectively). Although regarded as non-pathogenic, the presence of these intestinal protozoa indicates intense fecal-oral transmission, deficient sanitation and plausible drinking water contamination [2]. Interestingly, immunosuppression secondary to HIV contributed to high prevalence rates of *B. hominis* and *E. nana* in Zambian children [16]. *B. hominis* which is a parasite common all over the world, has been ascribed to cause different diseases including gastroenteritis, nausea, abdominal pain, ulcerative

colitis, eosinophilia and anemia [17]. For the last few years, emphasis on reporting *B. hominis* was requested by our gastroenterologists due to reports stressing its pathogenicity [18]. Our rate for *B. hominis* was found to be 17%, being higher than that reported from China (7.6%) and lower than those reported from Taiwan and Philippines (20.6% and 19.3% respectively) [19].

Among the "pathogenic" parasites, *G. lamblia*, and *E. histolytica* have been the most prevalent in both study periods. Although they are not serious life-threatening parasites, they are still important infectious agents due to their morbidity and mortality and the nature of the diseases they cause i.e. being recurrent and refractory to treatment [20-23]. *E. histolytica* ranked second after *G. lamblia* among the well-known intestinal parasitic pathogens. Though still high, its current prevalence is significantly lower compared to those in 1998 (12% *vs* 14%, $p < 0.023$). Such rates are still lower, for example, than the 23.7% rate reported from Morocco [24]. Concerning gender, males were more predisposed than females for this parasite during both periods. This observation is consistent with others showing gender to be an important factor for cyst production of *E. histolytica*. For example, in a study comprising 340 asymptomatic cyst passers, it was shown that males produced 6-fold more cysts than their female counterparts [25].

Consistent with the worldwide trend [1], giardiasis remains an important infection despite its significant decline in 2007-2008 prevalence compared to the 1997-1998 study (6% *vs* 16%, $p < 0.05$). Different prevalence rates of *G. lamblia* have been reported from different geographic locations, for example, 22.3% from Morocco [25], 7.9% from Turkey [26], and 8.1% from Syria [3]. Despite variations in the prevalence of *G. lamblia* among different studies, the majority revealed higher levels in the urban area, among the poor communities, and among males. Observation among the latter gender is consistent with findings in our study. Though *G. lamblia* is not a life-threatening parasite, nevertheless, it is still considered as the most common waterborne diarrhea-causing disease [27]. The possibility of a change in the predisposing factors to acquiring giardiasis was entertained in a recent study from Germany. This study conducted on children in kindergartens revealed no association between socioeconomic status and giardiasis [28].

Taenia spp. showed also a significantly decreasing trend (3% *vs* 6%, $p < 0.05$). This rate is still higher than 0.75% rate reported from Morocco [24]. Concerning gender, males were more predisposed than females in both study periods. This is different from a study on human taeniasis in Western Romania where females were among the most affected categories [29].

Seasonal variations in the prevalence of parasites occurred for both periods with increase during summer months similar to what was reported for this country [10]. In this season water availability is at its nadir in the country and the use of water for drinking and for communal swimming predominates.

The finding of 8%-11% combination of parasites (polyparasitism/mixed, ≥ 2 parasites) among tested individuals can reflect a marker of poor sanitation and economic conditions as well as a possible increased susceptibility to infection among these individuals.

Outbreaks of gastrointestinal diseases occur in Lebanon and are mainly due to the faecal contamination of drinking water resulting from deficiencies in water tanks and cross-connections of sewer pipes with domestic or public water [30]. Even vended water which is an alternative that Lebanese turn to when in shortage of water supply proved to cause waterborne diseases [31]. However, elevation of the sanitary measures in a region together with the improvement of both drinking and waste water facilities, as well as education of local people, contribute to the lowering of the prevalence rates [32-34].

Similar to many countries, Lebanon share the problems of both developing and developed countries. The increased public awareness regarding parasitic infections might be counterbalanced by several aspects:

1) the increasing number of immunosuppressed patients receiving chemotherapy, more registered cases of AIDS patients receiving treatment, and the escalating number of transplanted recipients in the country [35];

2) the continuous influx of expatriates and foreign workers from highly endemic areas working as households and home helpers and

3) the emergence of travel medicine in an era of marked globalization and population mix [36].

Those factors may predispose to a diversity of opportunistic parasitic infections and contribute to alterations in epidemiology. Globally, it has been reported that the prevalence of parasitic diseases depends on environmental, social and economic factors, to the extent that presence of intestinal parasites is an indicator of a vast state of collective ill-health [3, 7-8, 37].

In conclusion despite a declining trend, intestinal parasitic infections are still important public health problems in Lebanon. Strategies of control programs such as improving sanitary conditions, emphasis on health education and awareness of personal hygiene will help health authorities in this country and others to minimize and eliminate intestinal parasites infection in the community.

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