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


Georg F. ARAJ1, Umayya M. MUSHHARAFIEH1, Ayat HAYDAR1, Amal GHAWI1, Raja ITANI1, Ramez SALIBA1

ABSTRACT : Intestinal parasitic infections or infestations 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 lumbricoïdes (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.

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

<table>
<thead>
<tr>
<th>PARASITE NAME</th>
<th>Number (%) Positive</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protozoa</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blastocystis hominis</td>
<td>0 (0)</td>
<td>NA</td>
</tr>
<tr>
<td>Chilomastix mesnili</td>
<td>0 (0)</td>
<td>NA</td>
</tr>
<tr>
<td>Cryptosporidium</td>
<td>3 (0.1)</td>
<td>NA</td>
</tr>
<tr>
<td>Endolimax nana</td>
<td>298 (14)</td>
<td>236 (23)</td>
</tr>
<tr>
<td>Entamoeba coli</td>
<td>882 (43)</td>
<td>355 (34)</td>
</tr>
<tr>
<td>Entamoeba histolytica</td>
<td>294 (14)</td>
<td>122 (12)</td>
</tr>
<tr>
<td>Giardia lamblia</td>
<td>327 (16)</td>
<td>67 (6)</td>
</tr>
<tr>
<td>Iodamoeba butschlii</td>
<td>81 (4)</td>
<td>31 (3)</td>
</tr>
<tr>
<td>Cestodes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hymenolepis diminuta</td>
<td>3 (0.1)</td>
<td>0</td>
</tr>
<tr>
<td>Hymenolepis nana</td>
<td>10 (0.5)</td>
<td>3 (0.3)</td>
</tr>
<tr>
<td>Taenia species</td>
<td>116 (6)</td>
<td>27 (3)</td>
</tr>
<tr>
<td>Nematodes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ascaris lumbricoides</td>
<td>42 (2)</td>
<td>14 (1)</td>
</tr>
<tr>
<td>Enterobius vermicularis</td>
<td>12 (0.6)</td>
<td>1 (0.1)</td>
</tr>
<tr>
<td>Hook worm</td>
<td>1 (0.05)</td>
<td>1 (0.1)</td>
</tr>
<tr>
<td>Strongyloides stercoralis</td>
<td>3 (0.1)</td>
<td>5 (0.5)</td>
</tr>
<tr>
<td>Trichuris trichiura</td>
<td>4 (0.2)</td>
<td>0</td>
</tr>
<tr>
<td>Trematodes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dicrocoelium dentriticum</td>
<td>0</td>
<td>2 (0.2)</td>
</tr>
<tr>
<td>Fasciola hepatica</td>
<td>1 (0.05)</td>
<td>0</td>
</tr>
</tbody>
</table>

**Total Number of Parasites/Patients Tested**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2077/1686</td>
<td>1047/904</td>
<td></td>
</tr>
</tbody>
</table>

**NA:** Not applicable analysis due to small numbers to calculate.
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 rpm for 10 minutes. The supernatant was decanted, and 3 drops of 10 ml of 10% formalin were added and mixed with the sediment.

Quality control measures include proficiency challenges on regular basis by the CAP through the examination of unknown specimens. Moreover, each 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.

**TABLE II**

<table>
<thead>
<tr>
<th>PARASITE</th>
<th>1997/8 (n = 1048)</th>
<th>2007/8 (n = 523)</th>
<th>p value</th>
<th>1997/8 (n = 638)</th>
<th>2007/8 (n = 381)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ascaris lumbricoides</td>
<td>21 (2)</td>
<td>7 (1.3)</td>
<td>NA</td>
<td>17 (3)</td>
<td>6 (1.6)</td>
<td>NA</td>
</tr>
<tr>
<td>Entamoeba coli</td>
<td>130 (12)</td>
<td>122 (23)</td>
<td>&lt; 0.05</td>
<td>108 (17)</td>
<td>88 (23)</td>
<td>0.052</td>
</tr>
<tr>
<td>Entamoeba histolytica</td>
<td>424 (40)</td>
<td>152 (29)</td>
<td>&lt; 0.05</td>
<td>299 (47)</td>
<td>154 (40)</td>
<td>0.051</td>
</tr>
<tr>
<td>Giardia lamblia</td>
<td>134 (13)</td>
<td>65 (12.4)</td>
<td>0.42</td>
<td>53 (8)</td>
<td>29 (8)</td>
<td>NA</td>
</tr>
<tr>
<td>Iodamoeba butschlii</td>
<td>206 (20)</td>
<td>45 (8.6)</td>
<td>&lt; 0.05</td>
<td>98 (15)</td>
<td>18 (5)</td>
<td>&lt; 0.05</td>
</tr>
<tr>
<td>Taenia spp.</td>
<td>33 (3)</td>
<td>13 (2.4)</td>
<td>NA</td>
<td>16 (3)</td>
<td>7 (1.8)</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td>80 (8)</td>
<td>16 (3)</td>
<td>&lt; 0.05</td>
<td>30 (5)</td>
<td>8 (2.1)</td>
<td>NA</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>AGE BRACKET (yr)</th>
<th>≤ 5</th>
<th>6-15</th>
<th>16-25</th>
<th>26-35</th>
<th>36-45</th>
<th>46-55</th>
<th>56-65</th>
<th>≥ 66</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>G. lamblia</td>
<td>E. histolytica</td>
<td>E. coli</td>
<td>E. nana</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1997/8</td>
<td>19 (6)</td>
<td>3 (2)</td>
<td>2 (0)</td>
<td>99 (33)</td>
<td>79 (26)</td>
<td>15 (5)</td>
<td>9 (3)</td>
<td>4 (1)</td>
<td>304 (21)*</td>
</tr>
<tr>
<td>2007/8</td>
<td>9 (14)</td>
<td>0 (0)</td>
<td>10 (11)</td>
<td>39 (14)</td>
<td>10 (16)</td>
<td>7 (1)</td>
<td>4 (6)</td>
<td>3 (5)</td>
<td>63 (9)*</td>
</tr>
</tbody>
</table>

* 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 (poly-parasitism/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 pauchy 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.

REFERENCES

4. Okyay P, Ertug S, Gultekin B, Onen O, Beser E. Intestinal parasites prevalence and related factors in

G. ARAJ et al. – Intestinal parasite trend over a decade
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