Intestinal parasitic infections in hosted Saharawi children

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Abstract. Literatures on intestinal parasitic infections in Saharawi children were scarce and distributed in non parasitological journals. This was the first article that specifically highlighted on the prevalence of these infections in 270 Saharawi children aged from 6 to 12 years hosted in Spain. Six different intestinal parasites were identified in this study and 78, 46, 40, 24, 13 and 5 were positive for Giardia lamblia (29%), Entamoeba coli (17%), Blastocystis hominis (15%), Endolimax nana (9%), Hymenolepis nana (5%) and Enterobius vermicularis (2%), respectively. Mixed intestinal parasitic infections were seen in 12 (4.4%) studied children. Six (2.2%) double infections for G. lamblia and B. hominis were seen in these children while in four (1.5%) had G. lamblia and H. nana. Triple intestinal parasitic infections of G. lamblia, B. hominis and H. nana were observed in two (0.7%) of the children studied. In the other hand, about 14.8% of the studied children had a mild anaemia and 15.5 and 16.6% had iron deficiency and eosinophilia, respectively.

INTRODUCTION

Saharawi populations originally lived in the Western Sahara in both settled and nomadic communities. Following political changes in 1970s; approximately 150,000 Saharawis left their territory and settled in Tindouf, Algeria, in a harsh desert environment characterized by high temperatures, low rainfall and little productive soil. Until now they are still camped in this area (Soriano, 2008). The living areas were organized into five large camps called wilaya. Four camps were named after main towns in Western Sahara and they were Ausserd (Aussard), El Aaiun (Al-Uyun), Smara (Smara) and Dajla (Dakhla). The 5th camp was a school which started as a boarding school for women situated close to camp of Smara. With time it grew and became residential area (Branca, 1997; UNHCR/CISP/NRIFN, 2001; Spiegel, 2003; Soriano et al., 2010; UNHCR/WFP/ICH, 2010). There was a wide spread assumption of food aid dependence and the water in the refugee camps was either of borderline quality or unfit for human consumption. The water was also highly contaminated with faecal matter (Branca, 1997; Mora-Castro, 1997; Mason, 2002). Due to that, most water supply points in the camps suffered from design and construction faults and were in a poor state of repair. Apart from some wells equipped with manual pumps, few were suitably protected at ground level and were either left open permanently or were equipped with ineffective covers that were not always put back in place. Thus, the water was polluted by sand and other impurities carried by the wind, by the people who collected water, and by people and animals passing by. Since there were no latrines and people defecated outside near their homes, which were not far from the water supply points, the wells and the aquifer were easily contaminated with faecal matter (Dukic & Thierry, 1998). To date, few articles had been
published on intestinal parasitic infections in this risk population. Nutritional status which included the anthropometrical measurements of the children were studied during 'holidays in peace' program (Refugee Studies Centre, 2005). This programme was established in 1988 by almost 300 solidarity associations in partnership with the Union of Polisario Youth in the camps. This annual holiday programme allowed between 7,000 and 10,000 Saharawi children to Europe to receive medical examinations and treatment, as well as gifts of clothes, toys, and money which they took back with them to the camps. Many of them returned back year after year to the same host homes (Crivello et al., 2006). This study investigates the occurrence of intestinal parasitic infections in Saharawi children hosted in Valencia, Spain.

MATERIALS AND METHODS

The study was undertaken in Valencia, Spain and conducted in collaboration with a local nongovernmental organization (NGO) for a two-month period during the summer in 2007 according to the 'Holidays in Peace' programme. Two hundred and ninety-five children participated during the study period but single stool specimens were obtained from 270 Saharawi children (130 boys and 140 girls), which were aged from 6 to 12 years. The study protocol was approved by the Ethical Committee of University of Valencia and each head of household gave their verbal consent after the study had been fully explained to them.

Initial assessment included collection of demographic information by questionnaire, followed by a standard medical history and examination. Investigation protocols included in this study were a full blood count, serum ferritin and faecal microscopy examination. Venipuncture was performed, and blood was collected into Vacutainer tubes (Becton Dickinson, Franklin Lakes, NJ) containing EDTA as an anticoagulant (for hemograms) or serum separator gel (for serum assays). A complete hemogram was obtained on a Serono Baker 9000 hematology analyzer (Serono Baker Diagnostics-Allentown, PA). Serum samples were aliquoted and stored at -80°C. Serum ferritin were assayed with the ADVIA Centaur Ferritin system (Bayer HealthCare, Tarrytown, NY). Each faecal sample was provided in a sterilized sample collection container. The stool samples were examined by direct smear examination, Ritchie concentration technique and trichrome staining method, whereas the Kinyoun's modified staining was used to detect Cryptosporidium oocysts (Guerrett et al., 1999; Wakid, 2006). The frequencies of intestinal parasitic infections among children of different ages and sexes were compared by means of the chi-square test, using a significance level of 5%. For statistical analysis, the SPSS, for Windows version 10.0, software was used for statistical analysis of the results.

RESULTS

Table 1 summarized the findings of the parasitological survey. Giardia lamblia (29%) and Entamoeba coli (17%), were the most common intestinal protozoa seen in Saharawi children; followed by Blastocystis hominis (15%) and Endolimax nana (9%). Only two helminth species were detected in this study were Hymenolepis nana (5%) and Enterobius vermicularis (2%). Chi-square tests did not show statistically significant differences between sexes in the prevalence of intestinal parasitic infections. The pattern of double (3.7%) and triple (0.7%) mixed infections were observed in this study. Double infection of G. lamblia and B. hominis

<table>
<thead>
<tr>
<th>Parasites</th>
<th>No. children affected (% total)</th>
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<tbody>
<tr>
<td>Giardia lamblia</td>
<td>78 (29)</td>
</tr>
<tr>
<td>Entamoeba coli</td>
<td>46 (17)</td>
</tr>
<tr>
<td>Blastocystis hominis</td>
<td>40 (15)</td>
</tr>
<tr>
<td>Endolimax nana</td>
<td>24 (9)</td>
</tr>
<tr>
<td>Hymenolepis nana</td>
<td>13 (5)</td>
</tr>
<tr>
<td>Enterobius vermicularis</td>
<td>5 (2)</td>
</tr>
<tr>
<td>Cryptosporidium oocysts</td>
<td>Not detected</td>
</tr>
</tbody>
</table>
was seen in six (2.2%) of the children and combination of *G. lamblia* and *H. nana* infections were seen in four (1.5%) of the children. Triple infection of *G. lamblia*, *B. hominis* and *H. nana* were detected in two (0.7%) of the children. All the infected children were treated with antiprotozoal and antihelminthic drugs provided by Valencian Community Health Service. About 14.8% of the children had mild anaemia; 18.5% of older children aged between 10-12 year-old were anaemic compared to 11.1% in the younger group aged between 6-9 year-old. This study also showed that 15.5 and 16.6% of the children had iron deficiency and eosinophilia, respectively. All children identified with iron deficiency anaemia were treated with supplemental oral iron, provided with dietary advice and reviewed in health service to ensure improvement.

**DISCUSSION**

Different sources of scientific information had reported the prevalence of intestinal parasitic infections in Saharawi children as reflected in Table 2. All of the findings tabulated in Table 2 stated that intestinal protozoa either single or mixed infections were commonly seen among Saharawi children as compared to helminth infections (Paricio Talayero et al., 1998; Lopriore et al., 2004; Sarquella et al., 2004; Domènech et al., 2008; Martínez et al., 2010). The findings were again seen in this present study. These findings were different from studies conducted in the other parts of tropical countries where reported soil-transmitted helminth such as *Ascaris lumbricoides*, hookworm and *Trichuris trichiura* were the common intestinal parasitic infections seen followed by intestinal protozoa. Saharawi children presented single, double, triple and even quadruple infections. Cox (2001), Drake & Bundy (2001) suggested that this prevalence of multi-infections is affected by malnutrition, by differences in the behavior of children, by irregular distributions of infecting stages in the environment, by differences in the ability to generate an adequate immunological response, by basic biological differences between parasites, and by host genetic differences. Furthermore, Brooker et al. (2000) reflected in Africa that individuals with multiple infections tend to display higher intensities of infection than that expected for each infection separately and infection by one of the pathogens may be influenced by concurrent or earlier infections with the other. According to Sarquella et al. (2004), our study reflected low values in the prevalence of *E. vermicularis*. In our viewpoint it may be due to the fact that the worm’s eggs are sticky and adhere to the

<table>
<thead>
<tr>
<th>Place (year)</th>
<th>Amebae</th>
<th>Flagellates</th>
<th>Cestodes</th>
<th>Coccidia</th>
<th>Nematodes</th>
<th>Ref.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tindouf (1998-1999)</td>
<td>60% being mostly <em>Giardia lamblia</em> and <em>Escherichia coli</em> (?) with a few cases of <em>Entamoeba histolytica</em> and <em>Hymenolepis nana</em></td>
<td><em>Cryptosporidium parvum</em> (10%)</td>
<td><em>Enterobius vermicularis</em> (15%)</td>
<td>Lopriore et al. (2004)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tindouf (2006)</td>
<td>45% being mostly <em>Giardia lamblia</em>, <em>Blastocystis hominis</em> and <em>Hymenolepis nana</em></td>
<td></td>
<td></td>
<td>Domènech et al. (2008)</td>
<td></td>
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</tr>
<tr>
<td>Spainb (1993-1997)</td>
<td><em>Blastocystis hominis</em> (21.8%)</td>
<td><em>Giardia lamblia</em> (17.6%)</td>
<td><em>Hymenolepis nana</em> (10.6%)</td>
<td>Oxiuros (4.7%)</td>
<td>Paricio Talayero et al. (1998)</td>
<td></td>
</tr>
<tr>
<td>Spainb (1999-2002)</td>
<td><em>Blastocystis hominis</em> (24%)</td>
<td><em>Entamoeba coli</em> (38.2%)</td>
<td><em>Hymenolepis nana</em> (10.6%)</td>
<td>Oximj (15%)</td>
<td>Martínez et al. (2010)</td>
<td></td>
</tr>
<tr>
<td>Spainb (2003)</td>
<td>19.6% of parasitological infestations being mostly <em>Giardia lamblia</em> and <em>Entamoeba coli</em></td>
<td></td>
<td></td>
<td>Sarquella et al. (2004)</td>
<td></td>
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</tbody>
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nd: not detected.

*bacteria, strangely classified as parasitic infections by the authors. It surely was Endamoeba coli

*Saharawi children hosted in Spain
perianal skin or clothing, so that few become incorporated in faecal matter and are therefore seldom recorded in faecal analyses.

The occurrence of intestinal protozoa, such as *B. hominis*, *E. nana*, *E. coli* and *Iodamoeba bütschlii*, together with *G. lamblia* are important bioindicators for the persistence of unhygienic behaviors of the population in the camps and continual water contamination by human faeces that may also increase the risk of getting other infectious diseases. This information can be useful for monitoring compliance with community health and hygiene programmes carried out in the camps. It may also indicate the need to intensify educational efforts for the prevention of diarrhoea associated with enteric pathogens that cannot be controlled only by drugs (Orlandi *et al.*, 2001).

In our study, children surveyed had mild anaemia; with 16.8% and 15.5% had iron deficiency anaemia and eosinophilia respectively. About 14.8% of the children had mild anaemia; 18.5% of older children aged between 10 and 12-year-old were anaemic compared to 11.1% in the younger group aged of 6 and 9-year-old. This study also showed that 15.5 and 16.6% of the children had iron deficiency and eosinophilia, respectively. All children identified with iron deficiency anaemia were treated with supplemental oral iron, provided with dietary advice and reviewed in health service to ensure improvement. Children with intestinal parasites identified in their stool were older than their counterparts, but surprisingly had a lower prevalence of anaemia. This finding was reflected in the study of Rice *et al.* (2003). According to this author, a potential explanation is that, given that intestinal parasites can be carried for months or years, their presence indicates cumulative acquisitions of parasites over a prolonged period; therefore the parasite load is likely to be greater in the stools of older than younger children. Furthermore, protozoa have life span and exposure to the source of infection is the better explanation of this, in fact, older children are more exposed to the environment as compared to the young children. The prevalence of anaemia in Saharawi children ranged from 18.2%, in the age from 60 to 119 months (UNHCR/CISP/NRIFN, 2001), to 70% for <60 months (Lopriore *et al.*, 2004), being several parasitic infections discharged as risk factor to the development of anaemia in these children according to Seal *et al.* (2005). According to WHO (2000), populations in which there is a high prevalence of anaemia, protocols for iron supplementation of children and adults are established but were not used in the surveyed camps and are rarely found in refugee or emergency situations in which compliance, logistics, and cost may be limiting factors. There is no malaria in Tindouf due to the very dry Saharan desert environment (Rice *et al.*, 2003; UNHCR/WFP/ICH, 2010). Furthermore, there is no evidence of significant levels from helminth infections (UNHCR/WFP/ICH, 2010). Lopriore *et al.* (2004) demonstrated that the antiparasitic metronidazole treatment did not produce any significant differences in the reduction of anaemia in stunted children aged 3 and 6 years.

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