PREVALENCE AND CONTROL OF FOOD BORNE PARASITIC ZOONOSIS IN PAKISTAN

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ABSTRACT

Parasitic infections are prevalent in areas of poor sanitation or where night soil is commonly used as fertilizer. People in endemic areas do not wash food thoroughly with clear water before eating and faeces are not disposed far from food or water sources. A survey of some parasitic diseases was made in 12 various localities (6 urban and 6 rural) of Lahore. A total of 3600 human faecal samples were examined by direct smear, floatation and sedimentation techniques. Of these 960 (26.66%) harboured parasitic ova, oocysts and/or cysts. From 960 infested samples 510 (53.12%), 215 (22.39%), 165 (17.18%) and 70 (7.29%) showed one, two, three and four types of parasitic ova, oocysts or cysts respectively. Overall helminth infection rate was 612 (63.75%) and protozoan 348 (36.25%). Helminthic infestation included *Ascaris lumbricoides* 245 (40.03%), *Enterobius vermicularis* 100 (16.33%), *Ancylostoma duodenale* 70 (11.43%), *Trichuris trichiura* 38 (6.20%), *Hymenolepis nana* 20 (3.26%), *Echinococcus granulosus* 67 (10.94%), *Taenia* spp. 45 (7.35%) and *Fasciolopsis buski* 27 (4.41%). Amongst 960 cases, 348 showed protozoan infection indicating *Giardia* spp. 180 (51.72%), *Cryptosporidium* spp. 96 (27.58%) and *Isospora* spp. 72 (20.68%). In another study, the efficacy of herbal drugs was compared with each other and with modern anthelmintic i.e. mebendazole (vermox). *Lagenaria siceraria* seeds at the dose rate of 200 mg/kg body weight was 92.3% effective against nematodal infection whereas it was 92% against cestodal infection. *Caesalpinia crista* was 84% effective against nematodal infection and 88.9 % effective against cestodal infection. Mebendazole at the recommended dose rate was found to be 96.3% and 92% effective respectively against nematodal and cestodal infections. This work indicates the prevalence of important causes of parasitic zoonosis in Pakistan environment and also suggests control programme.

Key words: Food borne parasites, Zoonosis, Prevalence, Pakistan

INTRODUCTION

Man is a potential host for a wide variety of protozoan and helminth parasites (Peng *et al.* 1998). Parasitic infections are doubtlessly a serious threat to human health and constitute one of the major public health problems of the world. Incidence of intestinal helminth parasitism is of paramount importance especially in the developing and underdeveloped countries because of its direct contribution to malnutrition (Pawlowski and Lindberg, 1996). The parasitic infections, which subvert health, growth and physical capabilities of persons are very common (Brooks *et al.* 1982; Ludwig *et al.* 1999).

According to a world survey, 650 million cases of *Ascaris lumbricoides* were reported, among these 335 million cases were recorded in China. The estimated value for hook worms reported as 460 million of these 200 million were present only in India, whereas Trichuriasis infect roughly 25% of the world population (Walsh and Warren, 1979; Smith *et al.* 2001).

Parasitism is one of the greatest problem in developing and underdeveloped countries including Pakistan where population explosion, low per capita income, lowest health facilities, poor nutrition in joint family system particularly in rural localities with maximum chances of contact, provide ideal conditions for intestinal helminthic and protozoan infections (Messou *et al.* 1997). In addition, lack of education, personal and community hygiene and poverty has further enhanced the incidence of parasitic infections. This situation is further worsened due to ignorance about the hazards of parasitic infections.

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The present study is of particular interest and importance because it gives a complete picture of the prevalence of human helminthic parasites and protozoan in the most developed and underdeveloped areas of Lahore (Pakistan). The current study has included a comparison of the efficacy of *Lagenaria siceraria* seeds, *Caesalpinia crista* seeds and mebendazole against major nematodal and cestodal infections.

**MATERIALS AND METHODS**

**Faecal sample examination**
To record the prevalence of various zoonotic helminthes, survey of 12 localities, 6 rural and 6 urban of Lahore was carried out by visiting these places once a month. Rural localities are situated in density-populated areas and had substandard sanitary environment; whereas urban localities are having standard sanitary conditions and hygienic environment. A total of 3600 faecal samples (25 from each locality per month) were collected separately. The date, the number of total and infected along with their age and sex were also recorded.

During the study, month wise and seasonal prevalence was recorded. For this purpose the year was apportioned into 4 seasons i.e. spring (March-April), summer (May to August), autumn (September-October) and winter (November to February). The prevalence of various helminths in relation to age was also recorded.

**Parasitological Techniques**
Faecal samples were processed within 1-2 hours of receipt by the formalin-ether concentration method (Ash and Orihel, 1987). For each concentrated specimen, the microscopy involved the full examination under low and high powers (X100 and X400 magnifications) of two cover slip areas (22 x 22 mm) after staining with lugal’s solution. When water or bloody stools were encountered, direct examination of specimen by microscopy was performed in addition to the normal procedure of examining the concentrated specimens. Flotation and sedimentation techniques were also used (Beaver et al., 1984; Anonymous, 1991). *Trichuris trichiura* eggs were diagnosed using scotch tape test. Presence of eggs of *Ancylostoma duodenale* was confirmed by direct microscopic examination and by identification of infective larvae cultured in faeces. *Echinococcus granulosus* was diagnosed by ELISA whereas Scanning technique was used to locate the cyst.

**Therapeutic Trials**

**Medicinal Plants**
The best quality seeds of *Lagenaria siceraria* and *Caesalpinia crista* were purchased from local herbal stores. These were made free of dust and other foreign materials. They were dried in the shade for a few days and were powdered finely with and electric grinder and stored in airtight bottles at room temperature for future use.

A total of 60 school going children of Lahore, naturally infected with nematodes and cestodes were selected for therapeutic trials. These children were randomly divided into 8 groups i.e. A, B, C, D, E, F, G and H. All these children were kept under routine environmental and managemental conditions.

**Antinematodal screening**
Group A was given *L. siceraria* (Kaddo) seeds powder at dose rate of 200 mg/kg body weight orally in gelatin capsules. Group B was given *C. crista* (Karanjwa) seed powder at the rate of 200 mg/kg body weight orally in gelatin capsules. Similarly the group C was given mebendazole (vermox) at the dose rate of 10 mg/kg body weight orally. This group acted as treated control. However, the 10 children in group D were not given any treatment and served as untreated control.

**Anticestodal screening**
Group E was given *L. siceraria* (Kaddo) seeds powder at dose rate of 200 mg/kg body weight orally in gelatin capsules. Group F was given *C. crista* (Karanjwa) seed powder at the rate of 200 mg/kg body weight orally in gelatin capsules. Group G was given mebendazole (vermox) at the dose rate of 10 mg/kg body weight orally. This group acted as treated control whereas group H was kept as untreated and also served as control.

Faeces examination and counting of eggs by Mc Master egg count (Coles, 1986) was made on zero, 3rd, 7th, and 15th day post treatment. Egg per gram (EPG) of faeces and clinical performance was used to judge the efficacy of the drug and was calculated by formula described by Moskey and Hardwood (1941). Side effects of the drug if any were also noted.

**RESULTS**
During the study year (October 2002 to September 2003) a total of 3600 faecal samples were examined. Of these 960 (26.66%) harboured parasitic ova, oocysts and/or cysts. From 960
infected samples 510 (53.12%), 215 (22.39%), 165 (17.18%) and 70 (7.29%) showed one, two, three and four types of parasitic ova, oocysts or cysts respectively. Overall helminth infection rate was 612 (63.75%) and protozoan 348 (36.25%).

Species wise prevalence
The data is shown in Table 1. Evidence was found in stool samples for the presence of 3 protozoan and 8 helminthic infections. The helminthic infection included nematodes infection i.e. *Ascaris lumbricoides* 245 (40.03%), *Enterobious vermicularis* 100 (16.33%), *Ancylostoma duodenale* 70 (11.43%), *Trichuris trichiura* 38 (6.20%). Among cestodes i.e. *Echinococcus granulosus* 67 (10.94%), *Taenia spp.* 45 (7.35%), *Hymenolepis nana* 20 (3.26%), while among trematodal infection i.e. *Fasciolopsis buski* 27 (4.41%). There was a total of 348 cases of protozoan infection harboured *Giardia spp.* 180 (51.72%), 96 (27.58%) *Cryptosporidium spp.* and 72 (20.68%) *Isospora spp.*

Overall prevalence of each helminthic species in urban and rural localities of Lahore is shown in Table 2. It was noted that prevalence percentage of infection of each parasite is higher in rural localities than urban localities of Lahore. Among these helminthic parasites *Ascaris lumbricoides* was to be the most prevalent helminth with 245 (40.03%) followed by *E. vermicularis* 100 (16.33%). In Cestodes highest (10.94%) *E. granulosus* infection and lowest (3.26%) *H. nana* infection was recorded. Among the protozoan, giardiasis had the highest prevalence (51.72%) and the lowest was isosporiasis (20.68%).

Multiple infection
Many of children were found to harbour more than one infection at any one time (Table 3).

Age wise prevalence
Overall prevalence of infection in people of different age groups in urban and rural localities

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**Table 1.** Overall prevalence of various zoonotic parasites of humans

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Parasite</th>
<th>Species</th>
<th>Number</th>
<th>% age of infection</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Nematodes</td>
<td>i. <em>Ascaris lumbricoides</em></td>
<td>245</td>
<td>40.03</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ii. <em>Enterobious vermicularis</em></td>
<td>100</td>
<td>16.33</td>
</tr>
<tr>
<td></td>
<td></td>
<td>iii. <em>Ancylostoma duodenale</em></td>
<td>70</td>
<td>11.43</td>
</tr>
<tr>
<td></td>
<td></td>
<td>iv. <em>Trichuris trichiura</em></td>
<td>38</td>
<td>6.20</td>
</tr>
<tr>
<td>2</td>
<td>Cestodes</td>
<td>i. <em>Echinococcus granulosus</em></td>
<td>67</td>
<td>10.94</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ii. <em>Taenia spp.</em></td>
<td>45</td>
<td>7.35</td>
</tr>
<tr>
<td></td>
<td></td>
<td>iii. <em>Hymenolepis nana</em></td>
<td>20</td>
<td>3.26</td>
</tr>
<tr>
<td>3</td>
<td>Trematodes</td>
<td>i. <em>Fasciolopsis buski</em></td>
<td>27</td>
<td>4.41</td>
</tr>
<tr>
<td>4</td>
<td>Protozoa</td>
<td>i. <em>Giardia spp.</em></td>
<td>180</td>
<td>51.72</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ii. <em>Cryptosporidium spp.</em></td>
<td>96</td>
<td>27.58</td>
</tr>
<tr>
<td></td>
<td></td>
<td>iii. <em>Isospora spp.</em></td>
<td>72</td>
<td>20.68</td>
</tr>
</tbody>
</table>

**Table 2.** Prevalence of parasites in urban and rural localities of Lahore

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Name of Parasite</th>
<th>Number infected</th>
<th>Urban localities</th>
<th>Rural localities</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>No.</td>
<td>%</td>
<td>No.</td>
</tr>
<tr>
<td>1</td>
<td><em>Ascaris lumbricoides</em></td>
<td>245</td>
<td>65</td>
<td>180</td>
</tr>
<tr>
<td>2</td>
<td><em>Enterobious vermicularis</em></td>
<td>100</td>
<td>35</td>
<td>65</td>
</tr>
<tr>
<td>3</td>
<td><em>Ancylostoma duodenale</em></td>
<td>70</td>
<td>24</td>
<td>46</td>
</tr>
<tr>
<td>4</td>
<td><em>Trichuris trichiura</em></td>
<td>38</td>
<td>15</td>
<td>23</td>
</tr>
<tr>
<td>5</td>
<td><em>Hymenolepis nana</em></td>
<td>20</td>
<td>7</td>
<td>13</td>
</tr>
<tr>
<td>6</td>
<td><em>Echinococcus granulosus</em></td>
<td>67</td>
<td>24</td>
<td>43</td>
</tr>
<tr>
<td>7</td>
<td><em>Taenia saginata and T. solium.</em></td>
<td>45</td>
<td>18</td>
<td>27</td>
</tr>
<tr>
<td>8</td>
<td><em>Fasciolopsis buski</em></td>
<td>27</td>
<td>10</td>
<td>17</td>
</tr>
<tr>
<td>9</td>
<td><em>Giardia spp.</em></td>
<td>180</td>
<td>66</td>
<td>114</td>
</tr>
<tr>
<td>10</td>
<td><em>Cryptosporidium spp.</em></td>
<td>96</td>
<td>39</td>
<td>57</td>
</tr>
<tr>
<td>11</td>
<td><em>Isospora spp.</em></td>
<td>72</td>
<td>30</td>
<td>42</td>
</tr>
</tbody>
</table>
of Lahore has been shown in Table 4 which indicated that peak incidence was found in children of age group 0-4 years in rural localities, followed by 5-9 years age group in same localities. In urban localities higher incidence was noticed in children of age group 5-9 years with infection rate of 36% followed by age group of 0-4 years (35.55%) whereas lowest infection rate was noted in age group 30 years and above i.e. 4.09% in urban and 6.80% in the rural localities.

**Therapeutic trials**

The efficacy of herbal drugs was compared with each other and with modern anthelmintic i.e. mebendazole (vermox) (Tables 5 & 6). *L. siceraria* seeds at the dose rate of 200 mg/kg body weight was 92.3% effective against nematodal infection whereas it was 92% against cestodal infection. *C. crista* was 84% effective against nematodal infection and 88.9 % against cestodal infection. Mebendazole at the recommended dose rate was found to be 96.3% and 92% effective respectively against nematodal and cestodal infections.

**DISCUSSION**

Helmintic infections are widely prevalent in the world. However, the distribution is likely to differ according to the climatic and environmental conditions as well as local habits and customs both in rural and urban localities. Lahore (Pakistan) has a large population of human especially children that move free within the city coming into contact with urban, suburban and rural people of their own. Therefore, we intended to throw some light on the parasitic infestations in children faeces.

In the present study, overall prevalence of parasitic infestation was 26.66 percent. These findings are closely related to Amin *et al.* (2003), Pal and Subhani (1989) and Ludwig *et al.* (1999). In the present study, species of helminthes were identified in 612 samples out of 3600 samples. *Ascaris lumbricoides* was the most prevalent i.e. 40.03% (245) in both types of localities of Lahore. These findings are in accordance to the findings of Akhtar *et al.* (1993), Rockiene (1995), Messou *et al.* (1997) and Atukorala and Lanerolle (1999).
The prevalence of ascariasis is enormous with an assumed billion people infected at the present time (Walsh and Warren, 1979; Peng et al., 1998). Ascaris is a soil-transmitted helminth (Theine et al., 1984) and its embryonated eggs are resistant to cold and dry weather. It is likely that the majority of infections occur while children are at play (Kilama, 1985) and not washing their hands before eating meals. The high prevalence of ascariasis in Lahore in fact, is observed in rural areas not in urban areas. In rural areas, low education level of people keeps them away from awareness about the importance of community, personal and household level hygiene. Joint family system permits the overcrowded situations and faecal pollution of the premises in small muddy houses provides the environment to increase the prevalence of A. lumbricoides. Apart from that unavailability of sanitary and underground drainage system further enhances the rate of ascariasis and other intestinal helminths (Pal and Malik, 1979; Ali, 1993; Qureshi, 1995; Messou et al. 1997 and Atukorala and Lanerolle 1999; Ludwig et al. 1999).

Second most prevalent helminthic parasites diagnosed in 100 faecal samples were E. vermicularis (16.33%). This percentage is higher than most of the surveys conducted in this region, 6.5% (Nagaty et al., 1978) and 2% (Qureshi, 1995). But our observed incidence rate is very close to the prevalence rate shown by Gulendam and Omer (1995) 16.7% and Obiamive and Nmrosi (1992) 12.7%.

It was noticed that eggs of this parasite can be found on the hand, toilet seats, clothing, bed sheets, towels, soaps, tooth brushes, furniture, door knobs and even in house dust (Pal and Malik, 1979). Lack of basic health facilities and large population of the premises also contributes as major causes for the higher prevalence of E. vermicularis in rural localities. Total incidence observed for A. duodenale was 11.43% and T. trichiura is 6.2% in the present study. This prevalence can be compared with the results of Pal and Subhani (1989) who reported 4.86% incidence of whipworm in school children. The results were closely related to that of Kightlinger et al. (1995). They reported 16% prevalence.

It was noticed that highest prevalence was noted in children between 0-4 years age group followed by 5-9 years (51.66%), then 10-14 years (23.30%) whereas lowest in 30 years and above age groups. Ludwig et al. (1999) reported that 3-12 year age group showed the highest parasitic prevalence. Kightlinger et al. (1995) also reported that A. lumbricoides, T. trichiura and hookworm in children are age dependent. With the advancement of age their incidence decreases. It was noticed that there is an evidence of association between pairs of infections particularly those involving hookworm and T. trichiura as was also reported by Akweley et al. (1986).

Another prevalent helminth species by the present survey was Hymenolepis nana, which was observed in 20 (3.26%) was also reported by Cho et al. (1991).

In the present study, prevalence of Echinococcus granulosus was 10.94%. Nearly similar results were also reported by Campos et al. (2000) As far as the prevalence of Taenia is concerned its prevalence is 7.35% during the
present investigation. This value is nearly close to that of Hall et al. (1981) in Kenya and Anwar et al. (1984) in Pakistan.

Higher prevalence was noted in rural localities in the present study. Similar results were also reported by Atukorala and Lanerolle (1999) in Sri Lanka and Ludwig et al. (1999) in Sao-Paulo (Brazil). They also noticed that there was correlation between basic sanitary conditions and the prevalence of parasites. Torres et al. (1995) reported that prevalence of ascariasis and trichuriasis was higher in people from houses with no sanitary facilities. No relationship between infection prevalence and host sex was found. Torres et al. (1995) also noted similar results.

In the present study the high incidence of giardiasis, cryptosporidiosis and Isosporiasis recorded were also reported by Akweley et al. (1986), and Sharaifi and Keshavarz (1997).

*L. siceraria* seeds at the rate of 200 mg/kg body weight was 92.3% effective against nematodal infection whereas it was 92% effective against cestodal infection. Similar results were also reported by Amin et al. (2003). *C. crista* seeds at the dose rate of 200mg/kg body weight was 84% effective against nematodal infection whereas it was 88.9% effective against cestodal infection. The results of our studies are closely associated with the findings of Amin et al. (2003). Mebendazole was found to be 96.3% and 92% effective against nematodal and cestodal infections respectively. Its effectiveness has been reported in the field trials by Laurence and Bennett (1994), Maqbool et al. (1997) and Amin et al. (2003). It was noticed that the plant drugs were found to be cheaper and free of any toxicity. It is indicated that a high prevalence rate of parasitic diseases constitutes a public health hazard. This would suggest that the zoonotic cycle of parasitic disease is well established in the country and there is an urgent need to break the cycle of zoonotic diseases in Pakistan.

REFERENCES


