PARASITES OF DOMESTIC ANIMALS AND THEIR POSSIBLE ZOONOSES – A STUDY FROM SELECTED SITES OF WESTERN PROVINCE, SRI LANKA

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ABSTRACT

Present study was based on a parasitic survey of captured domestic rat (*Rattus rattus*) at five selected study sites including, Gampaha, Dalugama, Kadawatha, Sedawatte-Bloemandhal and Wattala, of the Western Province, Sri Lanka. Study also included examination of enteric parasite stages in fresh fecal samples of residents, domestic cats and dogs of the Sedawatte-Bloemandhal, a shanty area. Results revealed the presence of intestinal helminthes, *Hymenolepis diminuta* and *Strongyloides* spp. In *R. rattus* captured from Sedawatte-Bloemandhal whereas, liver cysts of *Cysticercus fasciolaris* and intestinal worm like *Moniliformis moniliformis* and *Trypanosoma lewisi* from the sample captured from Dalugama. Rats captured from other three sites were not positive for any parasites. Trichurid and toxocarid types of egg were recorded in the fecal samples of domestic dogs and cats respectively. Human fecal samples were positive only for as carid type eggs but with mild infection. This study concludes that *R. rattus*, dogs and cats associated with human livings might be causing zoonoses in low sanitary conditions.

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1 Introduction

Many rodent families are reported from Sri Lanka, amongst them Family Muridae includes all the small rodents known as rats, mice and rat-like rodents viz Rattus rattus, Rattus norvegicus and Mus musculus (Phillips, 1980). Success of this family multiplication is probably due to the small size, short breeding cycle and ability to eat a wide variety of foods (Khanum et al., 2009). Rodents are known to transmit various diseases and act as reservoir hosts for many zoonotic pathogens including parasites that pose a health risk to humans (Rafique et al., 2009). Singleton, 2003 reported that about 40 diseases in humans are spread by rodents. Hymenolepiasis is the disease which caused by the infection of tapeworm H. diminuta that can also be acquired from rodents to human. It is estimated that nearly 36 million people in the world suffer from hymenolepiasis and the majority of them are in the tropics and subtropics (Peters & Pasvol 2002). Out of about 90 identified parasitic species from Sri Lanka, one third is proved or potential zoonoses (Dissanaike, 1993).

Lungworm, Parastrongylus (Angiostrongylus), is a parasite of rodents in Sri Lanka which has been caused ocular infections in humans on three occasions (Wariyapola et al. 1998). Therefore, increased rodent population in an area can be directly related to the increasing the chance of spreading zoonotic diseases in human population. Apart from human infections, helminth parasites of rodents are also responsible for causing disease in farm animals and these have resulted in great mortality. Cats and dogs are the most domesticated animals associated with human population. There are number of dogs and cats which associated with urban slum population in Sri Lanka. The high population coupled with poor hygienic practices and overcrowded condition of slum communities are at high risk of acquiring zoonotic parasites either directly through close contact with the dogs and cats, or indirectly through the highly contaminated environment. Some of the gastrointestinal parasites of canines are important for well known zoonotic diseases, including toxocariasis caused by Toxocara canis, ancylostomiasis caused by Ancylostoma spp., dipylidiasis caused by Dipylidium caninum, giardiasis caused by Giardia lamblia and cryptosporidiosis is caused by Cryptosporidium parvum (Palmer et al., 2011). The cat tapeworm, Taenia taeniaeformis and the cat hookworm, Ancylostomatidae formae, have been reported occasionally in humans in Sri Lanka (Ekanayake et al., 1999; Dissanaike et al., 2000).

Lack of veterinary attention and zoonotic awareness may exacerbate the risks of transmission of such infections to humans. Natural transmission of these parasites from animals to human may occur directly or indirectly via fecal or soil contamination. Hookworms of dogs and cats become a zoonose when the infective larvae are accidentally penetrating the skin of humans (Colville & Berryhill, 2007). There were very few studies carried out on parasitic zoonoses in Sri Lanka especially in the Gampaha and Colombo districts of the Western Province. Objectives of the present study included identification of parasites found in domestic rat, R. rattus, through a parasitic survey in five selected sites in the Western Province and the identification of the enteric parasites of cats and dogs of domestic association in Sedawatte-Bluemendhal, a shanty area and its’ residents in order to find out the possible parasitic zoonoses.

2 Materials and Methods

2.1 Parasitic survey of domestic rat (R. rattus)

A survey was carried out weekly from January 2010 to January 2011 at 15 trapping locations under five main sites i.e Gampaha; Kadawatha; Dalugama; Wattala and Sedawatta-Bloemendhal (Figure 1).

Study are at Gampaha site consisted ordinary residential houses. Site of Kadawatha mainly consisted of residential houses and luxury type bungalows. Trapping location situated at Dalugama was around a food processing plant and a restaurant and the site at Wattala was surrounded with residential houses. In contrast, Sedawatta-Bloemendhal mainly consisted of slums and shanty area associated with a heap of garbage collected throughout the municipal area of Colombo and dumped there. Single catch metallic rat trap (25.5 x 11.75 x 11.5 cm) was installed inside a single house on each 15 location weekly on rotation basis. Trapped rats were collected in live in a cotton bag.

All the caught rats were taken to the laboratory and killed immediately by plugging a bud of cotton wool dipped in chloroform in the snout. Data regarding aex, weight of each individual and place of collection were recorded. Killed rats were placed on a wax tray and ecto-parasites were searched by moving a fine-toothed comb against the direction of the fur and by moving a fine brush between the paws, and ears. Escaped parasites were also examined inside the bags where rats were initially kept. Blood samples of rats were collected from heart puncture and a thin smear was prepared. It was stained using Giemsa stain and observed under light microscope with × 400 magnifications for blood parasites (Rosenblatt, 2009).

Rat body cavity was slit opened using a pair of scissors inserted from the throat to the anus, revealing the esophagus, stomach, intestine, liver and urinary bladder. Gastro intestinal (GIT) contents were examined grossly for the presence of adult helminthes. GIT contents were put into petri dishes containing 0.95% mammalian saline solution. Wet mounts were prepared from the gut contents and observed under microscope for helminth eggs. Measurements (length and width) of the eggs were also taken. Nematodes and tapeworms were collected by hand picking and preserved in lacto glycerol. Nematodes were processed through a dehydration series and permanent slides were prepared as described by Hooper (1990).
Cestodes were stained by using acetocarmine prior and then mounted them in canada balsam. Head width, head length, total body length and the tail length of minimum five individuals of nematodes and the length of scolex, length and width of proglottides of minimum three individuals of cestodes were measured. Shape of the eggs also was used to identify the cestode species. The parasites were identified by using available parasitic keys (Anderson et al., 1975; Khalil et al., 1994). Tissue samples obtained from internal organs were pressed in between two glass slides and the smears were examined for any internal parasitic stages.

Figure 1 Map of study area of Western Province, Sri Lanka.
2.2 Fecal analysis of cats, dogs and occupants of Sedawatta-Bloemandhal site

Fresh fecal samples were collected from 50 individuals that include infants and children. Verbal consent from the parent was obtained prior to collection of samples. Furthermore, fecal matter from 25 domestic dogs and 15 domestic cats were also collected during the study period. Individual sample was collected into individual clean glass vials filled with saline. Salt floatation technique was used to separate parasitic eggs present in 1 g of individual fecal samples (http://www.fao.org/Wairdocs/ILRI/x5492E/x5492e05.htm). Wet mounts were prepared from individual sample and were observed under light microscope with × 100 magnification. Severity of helminth infection in human was calculated based on the number of parasitic eggs present in 1 g of feces viz mild infection < 10 x 10^3 eggs / 1g feces; moderate 10 x 10^3 - 50 x 10^3 eggs / 1g of feces and; sever > 50 x 10^3 eggs / 1g of feces (De silva et al., 1984).

2.3 Risk and possible methods of transmission of zoonose

An oral questionnaire was carried out from selected residents (n=147) of Sedawatte-Bloemandhal to find out the risk and possible methods of transmission of zoonoses.

2.4 Data analysis

Two sample student t-test and one-way ANOVA were performed using Minitab 14.

3 Results

3.1 Parasitic survey of Rat

Fifty three (n=53) individuals of Rats were captured from all 5 sites (Fig. 1) throughout the study period. However, none of them were evident with any ecto parasites. Rat captured from Dalugama and Sedawatte-Bloemandhal sites were only positive for endo-parasites (Table 1).

At Dalugama site, single rat was reported with the infection of T.lewisi while two individuals were reported with liver cysts of C.fasciolaris (Cestoda) and two were positive for the intestinal worm M .moniliformis (Acanthocephala). One individual recorded with the mixed infection of liver cysts (C. fasciolaris) and intestinal worm, (M. moniliformis).

From Sedawatta-Bloemandhal site, total eleven positive rats were reported. These parasites include enteric helminths, H. diminuta and Strongyloides spp. Results of present study reveal the total of 35 individuals of Hymenolepis diminuta in 5 rats and 82 individuals of Strongyloides spp. In 6 rats that rated to the prevalence of infestation to 45.5% and 54.6% respectively. Among them, three individuals had the infection of both H. diminuta and Strongyloides spp. All enteric parasites were mostly abundant in the duodenum and cecal area. No any parasites were found in the stomach or in peritoneal cavity.

<table>
<thead>
<tr>
<th>Site</th>
<th>No of rats captured</th>
<th>No of rats positive for</th>
<th>Types of parasite reported</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dalugama</td>
<td>12</td>
<td>6</td>
<td>T.lewisi</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>C.fasciolaris</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>M.moniliformis</td>
</tr>
<tr>
<td>Gampaha</td>
<td>9</td>
<td>0</td>
<td>--</td>
</tr>
<tr>
<td>Kadawatha</td>
<td>7</td>
<td>0</td>
<td>--</td>
</tr>
<tr>
<td>Sedawatte-Bloemandhal</td>
<td>18</td>
<td>11</td>
<td>H.diminuta</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Strongyloides spp.</td>
</tr>
<tr>
<td>Wattala</td>
<td>7</td>
<td>0</td>
<td>--</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Age group (Years)</th>
<th>No. positive</th>
<th>Average and range of fecal egg count*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-5</td>
<td>6 out of 20</td>
<td>4.8 x10^3 (1x10^3 - 7.5x10^3)</td>
</tr>
<tr>
<td>6-10</td>
<td>9 out of 23</td>
<td>7.2 x10^3 (4.5x10^3 - 8.5x10^3)</td>
</tr>
<tr>
<td>11-17</td>
<td>2 out of 7</td>
<td>7.5 x10^3 (6x10^3 - 9x10^3)</td>
</tr>
</tbody>
</table>

* Values give for range are in parenthesis
3.2 Fecal analysis of cats, dogs and occupants of Sedawatta-Bloemandhal site, for the presence of enteric parasite eggs

The eggs present in cats and dogs were identified as toxocarid type and trichurid type respectively. Human fecal samples were only positive for ascarid type eggs. Total human fecal egg count for 1 g of content of each occupant was calculated and presented as an average and a range according to three age groups in Table 2.

The average fecal egg count for all age groups was less than $10^3$. Therefore, the ascarid infection is considered as a mild infection in this study (De silva et al, 1984). Regression analysis performed between mean number of log transformed fecal eggs and three age groups shows that there is an increase of parasitic egg count with increment of age group (Figure 2).

3.3 Risk and possible methods of transmission of zoonoses

Collection of data from 147 households of Sedawatta-Bloemandhal by well designed questionnaire revealed that number of rats roaming around and in house varies from 2-6 individuals every day. The rats mostly tend to bite food in the kitchen concurrently, they used to urinate and defecate. Human bites also were common during night.

Discussion

During the present study Cysticercus fasciolaris, H. diminuta, M. moniliformis, Strongyloide species and T. lewisi were reported from rats. H. diminuta generally need various intermediate hosts such as insects, fleas and cockroaches for their development. However, through autoinfection, the eggs of this parasite species hatch in the intestine of the host without being passed outside and grow into adult worms. This causes the number of adult worms in the host to increase, causing severe pathological problems. However, Hymenolepiasis is considered a mild parasitic disease at present in Sri Lanka (Dissanaike, 1993). In the present study prevalence of parasites was high in the domestic rats associated with garbage dumping site at Sedawatte-Bloemandhal compared to other study sites. Reason may be that open dumping of waste in this site enhances proliferation of rat population and facilitate the completion of parasite cycle through contaminated grounds. A low sanitary condition of this area further enhances the parasite multiplication. Cysticercus fasciolaris which is reported from Dalugama site is the cisticercus stage of Taeniafasciolaris, the intestinal tapeworm of cat (Singleton et al. 2003). It is possible that domestic cats in this site help to complete the life cycle of this tapeworm species. However, this parasite was not reported to infect humans. M. moniliformis is a common intestinal worm found in rats, cats as well as dogs, but accidentally infects humans too by ingestion of its immature stages found in small arthropods. However, it is strange that ecto parasites were not detected from any of the captured rats in this study. However, single rat was positive for blood parasite, T. lewisi. A previous study done in the Central Province, Sri Lanka, reported that a single rat was positive for Xynopsylla cheopis, the tropical rat flea, the vector of T. lewisi (Sumangali et al. 2012) while Echinolaelaps, the spiny rat mite, was reported from wild dwelling Rattus rattus in Sri Lanka (Ratnaweera et al.,2009). However, Sumangali et al. 2012 further reported that none of the rat hosts in their study were positive for T. lewisi.
Fecal samples of children and infants were analyzed in order to rule out the presence of parasitic stages that could possibly have transmitted from rats, cats or dogs in domestic association in Sedawatta Bloemandelhal site. Results revealed presence of only ascarid type eggs to a level of mild infection. However, none were positive for tapeworm eggs or other helminth eggs. Most of the people living in this site were reported to take worm treatments but, in irregular manner. There is a strong possibility for wandering rats in and around houses to contaminate left opened food and water sources with their droppings which might harbor with helminth parasite eggs. This poses a public health threat. The close association of reservoir host species to human activities may facilitate the transmission of zoonotic parasites. Rat control measures should be applied to control domestic rats as it has a public health risk.

References

Anderson RC, Chabaud AG, Willmott S (1975) CIH Keys to the nematode parasite of vertebrates, Commonwealth Institute of Helminthology, UK


