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Occurrence of enteric parasites and their risk factors among the female inhabitants of lower socioeconomic groups in Dhaka city

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Abstract: The present study was conducted to investigate the intestinal parasites. A total of 900 female inhabitants of lower socioeconomic groups in Dhaka city were examined during Sep 2013 to Aug 2015, prevalence of gastrointestinal parasitic infestation was 66.22% and 26 parasite species were identified, of which ten species were protozoans, six cestodes, four trematodes and six nematodes. Prevalence of nematoda was the highest (57.55%), then cestode (38.67%), protozoa (19.22%) and lowest was found in trematode (4.11%). *Entamoeba histolytica* (10.44%) indicates severe faecal contamination among protozoan parasites, while in cestodes *Hymenolepis nana* (22.78%), in trematodes *Fasciolopsis buski* (2.11%) and in nematodes *Ascaris lumbricoides* (38%) were highly prevalent. In twelve study areas, the highest prevalence was found in Kamrangichar (87.5%) and children of age group 1-15 years (75.65%) were mostly affected by intestinal parasite.

Keywords: intestinal parasites; lower socioeconomic groups; prevalence; intestinal parasites

1. Introduction

Intestinal parasitic infections are the most prevalent in the world, with an estimation of 3.5 billion people infected and 450 million ill (WHO, 2001). While mortality from enteric helminths and protozoa is relatively low, morbidity and the indirect effects of apparently asymptomatic infections have a substantial impact on health and quality of life. The World Bank (1993) estimates the global burden of disease from geohelminth infections (*A. lumbricoides*, *T. trichiura* and hookworm) to be 2.4 million DALYs. In Latin America, the Pan American Health Organization (PAHO) (1997) estimates that helminth infections affect between 20% and 30% of the general population, with prevalence as high as 60–80% in endemic areas. In Bangladesh, among the helminthes and protozoan parasites, *A. lumbricoides*, *A. duodenale*, *T. trichiura*, *E. vermicularis* and *E. histolytica*, *G. lamblia* are common (Kuntz 1960; Islam *et al.*, 1975; Saha and Chowdhury, 1981; Banu *et al.*, 2003; D'Silva *et al.*, 2003; Uddin *et al.*, 2005; Khanum *et al.*, 2008).

Parasitic diseases continue to cause significant morbidity and mortality throughout the world irrespective of the patient's immune status. It is estimated that in developing regions of the world, there are approximately 340 parasite species capable of infecting humans (Garcia, 2001). Diarrhoeal diseases are extremely common in the developed and developing worlds, affecting millions of individuals each year (Guerrant *et al.*, 1990). In Bangladesh, one third of the total child death burden is due to diarrhoea (Victora *et al.*, 1993). Every year, a rural child suffers on average from 4.6 episodes of diarrhoea, from which about 230,000 children die (Mitra, 1994). The intestinal parasitic infections persist and flourish wherever poverty, improper hygiene, lack of access to clean drinking water, low standards of community and individual sanitation and poor health education, insufficient health care and overcrowding are entrenched (Khanum *et al.*, 2010). Intestinal protozoan infections are even more prevalent; *Entamoeba histolytica* is one of the deadly species and is associated with pathological abnormalities in liver and large bowel in human body (Khanum *et al.*, 2010), and is estimated to cause severe

disease in 48 million people, killing 70 thousand each year (WHO, 2002). *G. intestinalis* is the most common protozoan infection of the intestinal tract. Many countries, especially developing countries, show a high infection rate of giardiasis (Sprong *et al.*, 2009). Trichuriasis is a potentially serious disease that can cause colitis (inflammation of the colon), chronic iron deficiency anaemia and chronic dysentery (Bundy and Cooper, 1989). *Hymenolepis nana* is the most common parasitic cestode prevalent globally (Pillai and Kain, 2003). There were around 1000 million cases of ascariasis due to *Ascaris lumbricoides*, and 500 million cases of *Trichuris trichiura* infection worldwide (WHO, 1990 and Bundy *et al.*, 1992).

The aim of this study is to estimate the prevalence of intestinal parasitic infestation. In developing countries like Bangladesh intestinal worms are really threats to child and adolescents health. Although the intestinal helminthiasis is extremely wide spread in Bangladesh, they do not always cause immediate fatalist, acute illness or disabilities, so their presence has long been ignore and neglected to the people's mind (Khanum *et al.*, 2008, 2010).

2. Materials and Methods

2.1. Study design

A cross sectional study was carried out during September 2013 through August 2015 among 900 female inhabitants of lower socioeconomic groups in twelve areas of Dhaka city. The age groups were categorized into 4 major groups: Children (1 to 15 yrs), Adult (16 to 35 yrs), Middle age (36 to 50 yrs) and Old age (51 to 70 yrs). To study the prevalence of intestinal helminthes, stool samples were collected and processed by Formol-ether concentration technique.

2.2. Data Collection

Standard questionnaire was developed and the data were collected by face to face interview. After filling the questionnaire, an empty plastic container was provided to the all of female inhabitants for collecting stool. The stool samples were processed and prepared for microscopic examination in the laboratory of the Department of Zoology, University of Dhaka.

2.3. Laboratory analysis

To find out the prevalence of intestinal parasites, stool samples were collected and were examined in laboratory. The Formol-Ether concentration technique was performed according to the method described by Cheesbrough (1987). 1 g of faecal sample was mixed with 4 ml of formol water, again 3-4 ml of 10% formol water was added and mixed by shaking for about 20 seconds then strained it. 3-4 ml formol ether was added with sieved suspension in a conical tube and mixed for 1 minute, it was then centrifuged at 3000 rpm for 1-2 min, the parasites were sedimented to the bottom of the tube. The sediment was examined using 10X objective with the condenser. The 40X objective was used to identify the small cysts and eggs. And the data generated was analyzed by the SPSS Software-17 for mean analysis.

3. Results and Discussion

3.1. Prevalence of intestinal parasites

During the present investigation out of 900 samples, 66.22% females were found to be infected with intestinal parasites which was lower than the findings of Muttalib *et al.* (1976) (99.03%), Suguti *et al.* (1985) (86.8%) in Nepalese people, Uddin and Khanum (2008) (84.21%) in Comilla and Dhaka. Alternatively the present prevalence is higher than the findings of Peruzzi *et al.* (2006) (13.24%), Chandrashekhar *et al.* (2005) (21.3%), Al-Madani and Mahfouz (1995) (46.5%), and Ahmed and Hady, (1989) (10.94%). Ikeh *et al.* (2006) found 50.5% prevalence, Rao *et al.* (2003) reported 57%, Tang and Luo (2003) recorded 51.7%, Reinthalter *et al.* (1988) reported 62%, Farag (1985) found 53%, Chowdhury (1978) showed 52.76% and Huq and Shaikh (1976) found 65% prevalence, above these studies which were closely related with our findings. Hygienic conditions are very poor in slum area that's why prevalence was found highest.

A total of twenty six parasite species were identified from the samples. Among them ten were protozoans such as *Entamoeba histolytica*, *Entamoeba coli*, *Endolimax nana*, *Iodamoeba butschlii*, *Chilomastix mesnili*, *Trichomonas hominis*, *Enteromonas hominis*, *Giardia intestinalis*, *Isospora hominis*, *Balantidium coli*. Six cestodes such as *Diphyllobothrium latum*, *Taenia saginata*, *Echinococcus granulosus*, *Hymenolepis nana*, *Hymenolepis diminuta*, *Dipylidium caninum*. Four trematodes such as *Fasciola hepatica*, *Fasciolopsis buski*, *Clonorchis sinensis*, *Paragonimus westermani*. And six nematodes such as *Ascaris lumbricoides*, *Trichuris trichiura*, *Ancylostoma duodenale* (egg), *Ancylostoma duodenale* (larvae), *Strongyloides stercoralis* (larvae), *Enterobius vermicularis* (egg), *Capillaria spp.* Begum and Rahman (1975) found five species of protozoa (*E.*

histolytica, *E. coli*, *Endolimex nana*, *Iodamoeba butschlii*, *G. lamblia*) and four species of helminth (*A. lumbricoides*, *A. duodenale*, *T. trichiura* and *E. vermicularis*) predominant in Bangladesh. Khaled (1983) found eight species of intestinal parasites in members of Bangladesh rifles. These were: *Entamoeba histolytica*, *Giardia intestinalis*, *Ascaris lumbricoides*, *Trichuris trichiura*, *Strongyloides stercoralis*, *Humenolepis nana*, *Enterobius vermicularis* and Hookworm. In Indonesia, Higgins *et al.* (1984) studied human intestinal parasitic infections. They listed *Entamoeba coli*, *Entamoeba histolytica*, *Entamoeba hartmanni*, *Endolimax nana*, *Iodamoeba butschlii*, *Chilomastix mesnili*, *Giardia lamblia*, *Ascaris lumbricoides*, *Trichuris trichiura* and *Necator americanus*. In Nigeria, Alakija (1986) reported *E. coli*, *T. hominis*, *E. nana*, *E. histolytica*, *I. butschlii*, *G. lamblia*, *B. coli*, *A. lumbricoides*, hookworm, *T. trichiura*, *S. stercoralis*, *Taenia* and *S. mansoni* from rural people.

Among parasitic groups, nematode showed the highest prevalence (57.55%), then cestode (38.67%), protozoa (19.22%), and lowest was found in trematode (4.11%) (Figure 1). So helminth infections were recorded to be higher compared to protozoan infection which is incompatible with the previous published result such as Hafez *et al.* (1986) reported 14.9% of prevalence for protozoans and 9.5% for helminth in Riyadh, Saudi Arabia and Alakija (1986) also found higher (44.2%) prevalence of protozoa than helminth (22.4%) in Nigeria. Highest prevalence of helminth found in some study like Muazzam and Ali (1968) showed 67% of prevalence among children of East Pakistan and Saha and Chowdhury (1981) reported 75% of children (unde 5 years) of Rangpur and Dinajpur districts. Reinthaler *et al.* (1988) stated that contaminated drinking water is clearly the main source of the high levels of protozoan infection. But in the present study higher rate of parasitization with helminth suggest that these parasites have highly effective distribution and contact mechanism from one person to another.

The prevalence of different species of intestinal parasites varied from one another. In the present investigation, prevalence of cyst of *Entamoeba histolytica* was highest (10.44%) and common *Giardia intestinalis* was 4% (Figure 2). The prevalence seems to be high in some study such as Aza *et al.* (2003) recorded 21%, Azian *et al.* (2007) noted 26.2% *E. histolytica* in Pahang, Malaysia. Some result was found comparatively lower than the present study such as Hamimah *et al.* (1982) found 2.3% prevalence in Kuala Lumpur, Malaysia, Azam *et al.* (2007) observed 3.6% in Gazipur and Khanum *et al.* (2014) estimated 4.61%. The prevalence of *G. intestinalis* found in the present study, was also relatively low compared to 25% in Turkey (Ozcelik *et al.* 1995), 18.5% in Nepal (Reddy *et al.* 1998) and 11.67% in Thai orphans (Popruk *et al.* 2011). But Hamimah *et al.* 1982 (2.6%) and Khaled, 1983 (0.4%) recorded lower rate of infection of *G. intestinalis* than this study. Khanum *et al.* (2014) estimated 3.71% prevalence of *G. intestinalis* and Reinthaler *et al.* (1988) found 4.2%, which were close to present study.

Among cestodes, *Hymenolepis nana* recorded as the highest (22.78%) prevalent parasite, then *Taenia saginata* (10.33%) (Figure 3). This was higher than the findings of Omar *et al.* (1991) (3.0% prevalence of *H. nana* in Abha, Saudi Arabia), Jalili and Cerven 1993 (6.0% in the province of Afghanistan), Machado and Costacruz (1998) (6.7%), Azazy and Aitiar 1999 (2% in Yemen), Mirdha and Samantray (2002) (9.9% in India) and Muscat *et al.* (2004) (4.9% in Bangladesh). Rim *et al.* (2003) investigated that the prevalence of *Taenia spp.* was only 0.6% in Laos that was lowest than present study.

Among trematodes, prevalence of *Fasciolopsis buski* was observed the highest (2.11%) (Figure 4). Idris (1979) showed that the prevalence of *F. buski* was 36.16% in a village named Maradia near Dhaka, whereas Nahar (1973) showed that the prevalence was only 0.31% in Dhaka city. This observation reflects that the infection by *F. buski* might have focal endemicity. According to Graczyk *et al.* (2001), lower incidences with focal endemicity are observed in Taiwan, Bangladesh, India and Thailand.

Among the nematode parasites, *Ascaris lumbricoides* showed the highest (38%) and *Trichuris trichiura* was the second highest (30%) common parasite (Figure 5). Thuriaux (1973) reported 22% *Ascaris lumbricoides* in Yemen Arab Republic, Obiamiwe (1977) recorded 19.5% in Benin City, Nigeria, both results were found comparatively lower than the present findings. Elkins (1984) found 94% in Madras, Osazuwa *et al.* (2011) determined 75.6% in Nigeria which was quite different from the findings of the present work; Alam and Khanum (2005) found 34.38% in Dhaka, Uddin and Khanum (2008) showed 37.5% in Gazipur, Bangladesh, these results were close to present findings. The highest prevalence of *A. lumbricoides* is mainly attributed to high rate of egg production by the females, longevity of the eggs, use of night soil, poor personal hygiene and consumption of unclean vegetables. Shield *et al.* (1981) showed 15.9% *Trichuris trichiura* in Papua New Guinea, Hafez *et al.* (1986) reported 2.5% of people in Saudi Arabia, these prevalence were lower than the present finding. According to Ejazie (1981) 75.8% and Kobayashi *et al.* (1996) 43.8% was suffering from trichuriasis, both were higher than present study. Reinthaler *et al.* (1988) recorded 23.2% in Nigeria and Wani *et al.* (2008) 27.92% in Kashmir valley, both were close to present findings.

3.2. Prevalence of parasites in different study areas

In 12 study areas, highest prevalence was found (87.5%) in Kamrangichar, and lowest 30% found in Hajaribag (Figure 6). Kamrangichar is an island Thana surrounded by mainly Buriganga River. The population is very dense in this area they live in unhygienic environment, there is lack of fresh water supply, lack of sanitary latrines, defaecate in open areas, they walk barefooted most of the time and most important this area is surrounded by polluted Buriganga River which facilitates the growth of intestinal parasite. Hajaribag was urban Thana of Dhaka metropolitan city where chemical pollution occurred mostly as many chemical factories found there; as a result survival of parasite's egg and cyst in that environment is very low because of that chemical pollution that's why lower prevalence of infection observed there.

In different study areas, the prevalence of protozoan parasites was comparatively higher in Shahidullah hall (43.33%). In case of cestodes, highest prevalence was found in Kamrangichar (71.25), in case of trematodes, highest observed in Hajaribag (15%) and among nematodes, highest recorded in Moghbazar (70%) (Figure 7).

3.3. Parasitic prevalence in age groups

Considering all of the four age groups, the highest prevalence (75.65%) was found in children group (1 to 15 years) (Figure 8). Relationship between age and prevalence of parasitic infection ($r = -0.284$, $p = 0.716$) was not significantly correlated. Inverse correlation implies that as age increase prevalence tend to decrease due to better immune response in upper ages. Similar high prevalence (73.3%) was found in children by Ara *et al.* (1997). According to Steketee (2003) and Garzon (2003), children are the worst affected. This could be due to the fact that child are exposed to environmental hazard favoring parasitic infections. In another study by Uddin *et al.* (2005), highest (87.50%) was also noted among aged 12-14 years, Singh *et al.* (1984) recorded a maximum of 92.5% from 5 to 9 years of age but Khanum *et al.* (2010) found lowest prevalence in 08-10 years age group. The infestation of nematodes found highest in all age groups, among children (28.49%) and adult age group (10.40%), protozoa were the 2nd highest infestation group. Highest infestation (13.98%) of cestodes was observed in children group (Figure 9).

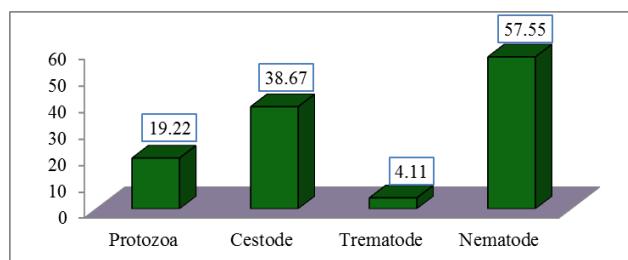


Figure 1. Overall prevalence of different parasitic groups.

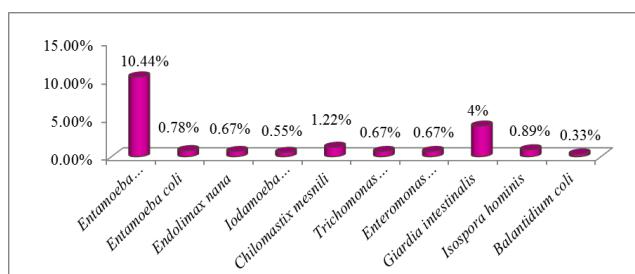


Figure 2. Prevalence of protozoan parasites found in female inhabitants.

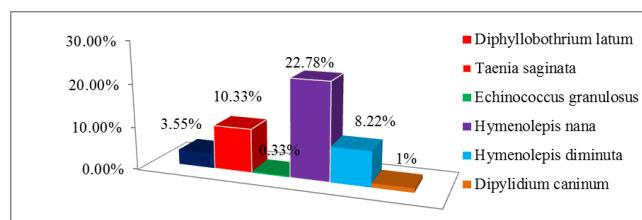
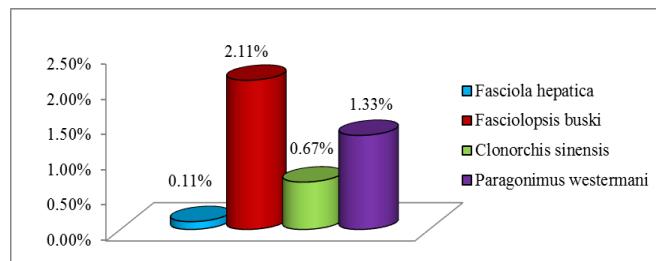
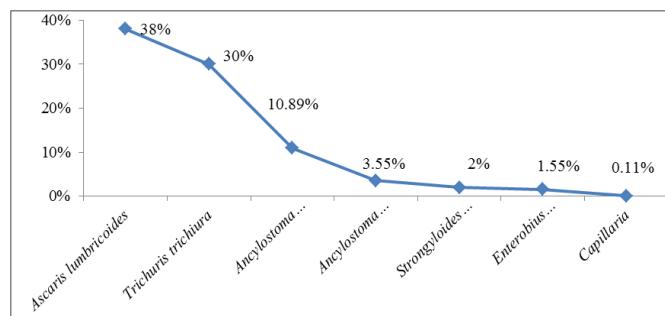
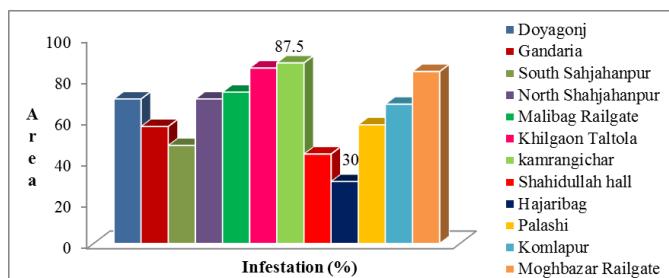
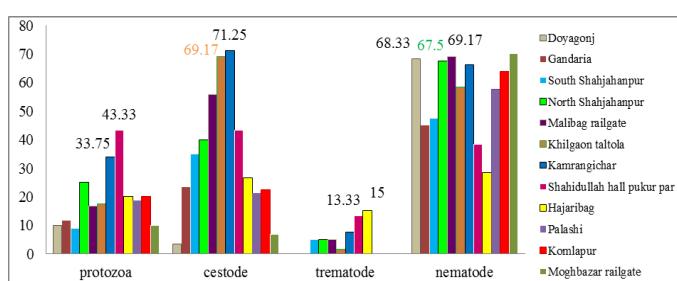
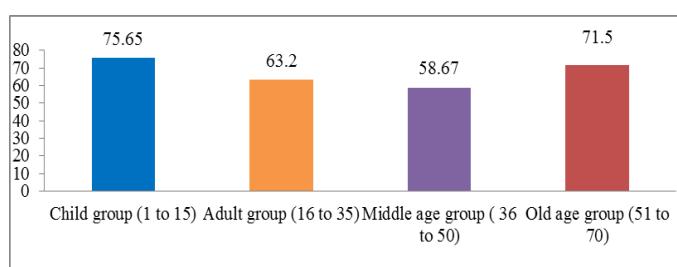


Figure 3. Prevalence of cestode parasites found in female inhabitants.

**Figure 4.** Prevalence of trematode parasites found in female inhabitants.**Figure 5.** Prevalence of nematode parasites found in female inhabitants.**Figure 6.** Prevalence of intestinal parasites among the female inhabitants in different study areas.**Figure 7.** Prevalence of different parasitic groups among female inhabitants in different study areas.**Figure 8.** Overall prevalence of parasitic infection in different age groups among the female inhabitants.

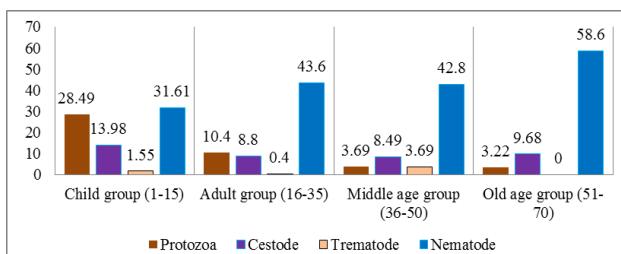


Figure 9. Overall prevalence of parasitic group in different age among female inhabitants.

4. Conclusions

The prevalence of helminthiasis and protozoan infection is widespread in Bangladesh. The female inhabitants of the slum areas were more vulnerable to parasitic infestation due to the differences in hygienic conditions, rate of literacy, malnutrition, status of anaemia, and prevailing socioeconomic condition. Under above circumstances incidence of intestinal parasites is likely to be common. Information on the prevalence and intensity of human intestinal parasites of the people of Dhaka city is very meager. Such information is necessary in planning the control of parasitic infection.

Conflict of interest

None to declare.

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