Incidence of Human Protozoan Parasitic Infections in Chattogram City, Bangladesh

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ABSTRACT

Human protozoan infections constitute the largest segment of public health concern across the Indian sub-continent including Bangladesh. An MS research project investigated 6155 pathological reports of human blood/stool/urine screening tests at seven diagnostic centers and /or the Chittagong Medical College Microbiological Laboratory (CMCML). All microscopy confirmed infections were recorded every other day of the week at the selected diagnostic centers along with cross examination of selected samples, especially the thick and thin blood films for malaria-positive slides in CMCML. The accuracy and authenticity of the findings and diagnoses were verified through on-site visits during the days of data collection. The primary data spanned January, 2006 through June, 2006, and revealed a total of 307 positive cases of malaria, leishmaniasis, giardiasis, entamoebiasis, and trichomoniasis in blood, blood serum, stool, and urine samples of the patients suspected of the diseases. The total incidence, TPR accounted 4.99%. *Entamoeba histolytica* was prevalent in February. *Giardia intestinalis* was prevalent in 11–20 year old people while Trichomonas *vaginalis* was prevalent among females in May. Other infections were not linked demographically or temporally. Estimating infection incidence and the use of the chi-squared test for understanding their associations with various host and parasitic factors helped revealed the underlying severity of the infection burden and associated risk factors as well.

Keywords: Human protozoan parasites, incidence, pathological reports, cross sectional survey, Chattogram city

INTRODUCTION

Human protozoan parasites, particularly coccidians, are common in Bangladesh and contribute significantly to the public health burden. Different regions of the country exhibit distinct patterns of parasitic infections. For example, filariasis and leishmaniasis (kala-azar) are more prevalent in the northern regions, whereas malaria remains endemic in the northeastern and southeastern parts of the country. Amoebiasis and trichomoniasis are also periodically reported across Bangladesh (International Centre for Diarrheal Disease Research, Bangladesh [ICDDR,B], 2000).

Understanding the occurrence and epidemiology of these infections is essential for designing effective public health interventions. Ensuring community health requires regular monitoring and reporting of disease prevalence in infection-prone areas (World Health Organization [WHO], 1996). However, an updated database on common protozoan infections in Chittagong is currently lacking.

Geographically, Chittagong is bordered by the hill tracts and the coastline of the Bay of Bengal, making it a hub for populations from diverse socioeconomic and cultural backgrounds, including residents from both local and surrounding districts. Due to the availability of comparatively affordable and reliable healthcare services, many patients seek treatment at Chittagong Medical College and Hospital (CMCH), which is surrounded by numerous diagnostic and clinical service centers. Consequently, data collected from diagnostic laboratories around CMCH are considered representative of a broad cross-section of the population in the city and its adjacent areas.

A review of existing literature indicates that relatively few studies have been conducted on protozoan infections in this region. Earlier research based on primary stool sample screenings and secondary published data

demonstrated that intestinal protozoan parasites are prevalent in Bangladesh (Muttaleb & Islam, 1976). That study also reported that amoebiasis and giardiasis are common in both rural and urban settings. However, district-specific data on protozoan infections, particularly outside the Chittagong Hill Tracts (CHTs) remain limited.

Although several baseline studies on malaria have been conducted intermittently by local and international organizations, an exclusive, comprehensive study on malaria in Chittagong city is still lacking (ICDDR,B, 2003). Moreover, such studies often focus on a single infection rather than addressing the broader spectrum of protozoan diseases.

The present study addresses this gap by investigating the incidence and distribution of major protozoan infections in Chittagong city. It examines species identification and demographic patterns associated with these infections. The findings aim to provide a comprehensive assessment of infection incidence and distribution in alignment with the study objectives outlined below.

General Objective

To develop a baseline descriptive database of human protozoan infections in Chittagong city.

Specific Objectives

1. To estimate the types and incidence of human protozoan infections based on pathological reports and laboratory samples collected from diagnostic centers in Chittagong city.

2. To assess the distribution, demographic characteristics, and associations of these infections.

MATERIALS AND METHODS

Pathological reports from seven diagnostic centers (annexure-1) where patients generally come from different parts of the Chittagong city upon doctor advice were scrutinized and examined. The labs were selected on the basis of the standard of works and reliability of their reports as suggested by the concerned physicians of Chittagong Medical College Hospital (CMCH). Microscopic study on different sample slide, like blood, stool, and urine at the CMCML was helpful for cross checking of the diagnoses in the centers. Identifying the term-MP (+ve or –ve) up to species level, i.e. whether *Plasmodium falciparum* or *P. vivax* followed the ideas and views achieved in Chittagong Medical College Microbiological Laboratory (CMCML).

The survey continued for six months through January, 2006 to June, 2006.

Grouping of the infections: According to the infection sites three sorts of pathogenic parasites were studied, viz. blood parasites, intestinal parasites, and urinogenital parasites. All of these were further analyzed through two sex groups, eight age groups, and six month groups.

Terminology

Incidence (Test Positivity Rate, TPR)

$$= \frac{\text{Number of positive cases}}{\text{Number of cases examined}} \times 100$$

Chi –squared value

$$\chi^2 = \sum \frac{(O-E)^2}{E}$$

Here, O = Observed value, E = Expected value (Huntsberger, 1965)

RESULTS AND DISCUSSION

A total of six species of protozoan parasites were recorded in the study. They are-

A. Blood Parasites (from blood)

Malarial Parasites (MPs)

1. *Plasmodium falciparum*, 2. *P. vivax* (Cox, 1982)

Identification: The ultra-structure of the two MPs is similar to that of coccidian, except that these organisms lack conoids. Syzygy is absent, and the macro gametocyte and micro gametocyte develop independently. The zygote is motile and is called ookinete; the sporozoites are not enclosed within sporocysts. They are heteroxenous, with merozoites produced in the vertebrate host and sporozoites developing in the invertebrate host.

B. Reticulo-endothelial parasite (Causing Kala azar) (from blood serum)

Leishmania donovani (Cox, 1982)

Identification: The promastigote forms turn into amastigote or leishmanial form in human reticulo-endothelial cells, especially the macrophages. Infected blood harbors the round stages while the latter come out from the ruptured macrophages.

C. Intestinal parasites (from stool)

Entamoeba histolytica (Cox, 1982)

Identification: Several successive stages occur in its life cycle, namely trophozoites, precyst, cyst, metacyst, and metacysic trophozoites. Although the diameter of most trophozoites fall into the range of 20μm to 30 μm, occasional specimens are as small as 10 μm or as large as 60 μm**.**

Giardia intestinalis (Cox, 1982)

Identification: The trophozoites measure 14 μm in length and 7 μm in width. They look like a tennis or badminton racket when viewed flat, and on side-on view, a longitudinally split pear shaped. The dorsal surface is convex while the ventral surface is concave with a sucking disc. On the other hand the fully formed cyst is oval in shape and measures 12 μm long by 7 μm broad. The axostyles lie more or less diagonally, forming a sort of dividing line within the cell wall. There are four nuclei which sometimes remain clustered at one end and sometimes in pairs at opposite poles.

D. Urinogenital parasites (from urine)

Trichomonas vaginalis (Cox, 1982)

Identification

This sole urino-genital parasite is 7 μm to 32 μm long by 5 μm to 12 μm wide. The undulating membrane is shorter than that of *T. tenax*. Some were found with pseudopodia.

N.B. The details of the structure and life history of these parasites were studied in CMCML.

Incidences of the parasitic infections

A total of 6155 diagnostic reports were examined for malaria and leishmaniasis in blood (4216 patients, 223 +ve), giardiasis and entamoebiasis in stool (1776 patients, 80 +ve), and trichomoniasis in urine samples (163 patients, 4 +ve). So, a total of 307 patients were found infected by at least one of the six protozoan parasites-

monoinfections that caused pathogenic effects in human body. This gave an overall incidence of 3.70% for the protozoan parasites. Besides, incidence for blood parasites stood 3.42%, while 4.51% and 2.45% for stool and urino-genital parasites respectively. Species-wise incidence counting found 3.66% for *P. falciparum*, 2.75% for *P. vivax*, 2.34% for *L. donovani*, 2.87% for *E. histolytica*, 1.63% for *G. intestinalis*, and 2.45% for *T. vaginalis*. Irrespective of the species identity the gross incidence of malarial parasites was 3.47%. Month-wise incidence analysis for malaria revealed highest (3.62%) in May and lowest in February (1.59). *E. histolytica* was most prevalent (5.15%) in February and least (1.30%) in June. *G. intestinalis* incidence was highest (3.25%) in April, and lowest (1.30) in June. *L. donovani* incidence stood highest (2.00%) in April, and lowest (0.99%) in May. *T. vaginalis* incidence was highest (3.02%) in May, and least (1.80%) in February. Difference in age group-wise incidences was apparently notable though accepting the null hypothesis of the chi-squared test. The overall incidence of the infections was highest (6.55%) in 1-10 year age group and least (2.90%) in 51-60 year age group. Sex-wise distribution of the overall incidence of the six infections was found insignificant with a ration of 3: 2 for male and female. Intra host group incidence was also calculated. Males were infected most with *E. histolytica* (incidence, 5.74%) and least with *T. vaginalis* (1.51%). But females were found highly vulnerable to *P. vivax* infection (TPR 4.10%) and least to that of *L. donovani* (TPR 3.02%).

The statistical tool, chi squared (χ^2) test used to distinguish the insignificant difference of incidences from the significant ones was weighed with 95% degree of confidence, i.e. at .05% level of significance. From the calculation overall difference in incidences of the six parasitic infections between male and female patients, inter-species difference in the incidences of the six parasites, difference in distribution of the overall infections among six months (January to June), etc. were found statistically insignificant. But difference in species-wise distribution for *E. histolytica* among the six parasitic infections in the month of February was found to be significantly higher than any other month of the study period. No other species showed significant difference with regard to inter or intra species/host group distribution, presumably due to a common grade of infection vulnerability of the study population and/or a relatively smaller sampling coverage (Table 1-5, Figure 1-3).

Table-1. Diagnostic sample specific overall incidences of the parasitic infections

Samples	No. of tests	No. of positive tests	TPR (%)	χ^2 test
Blood	4216	223	5.29	Insignificant
Stool	1776	80	4.51	
Urine	163	4	2.45	
Total	**6155**	**307**	**4.99**	
Male	4486	201	4.48	Insignificant
Female	1669	106	6.35	

Table-2. Overall incidence of each parasitic infection

Parasites	No. of tests	No. of positive tests	TPR (%)	χ^2 test
P. falciparum	4002	146	3.66	Insignificant
P. vivax	4002	70	1.75	
L. donovani	214	7	2.34	
E. histolytica	1776	51	2.87	
G. intestinalis	1776	29	1.63	
T. vaginalis	163	4	2.45	

Table-3. Month wise distribution of the total parasitic infections

Month	January	February	March	April	May	June	χ^2 test
No. of test	978	812	936	1029	1138	1262	Insignificant
No. of +ve test	40	41	48	46	59	73	
TPR (%)	4.09	5.05	5.13	4.47	5.18	5.78	

Table-4. Month wise distribution of the incidences of the parasitic infections

Parasites	January	February	March	April	May	June	Mean	χ^2 test
P. falciparum	2.56	1.78	2.57	3.39	4.31	4.18	3.13	Insignificant
P. vivax	1.29	0.99	1.43	1.22	2.10	3.05	1.68	Insignificant
L. donovani	1.55	1.47	1.84	2.00	0.99	0.00	1.31	Insignificant
E. histolytica	2.03	**5.18**	2.16	4.88	1.54	1.30	2.85	**Significant**
G. intestinalis	0.09	1.17	1.26	2.15	2.03	1.01	1.29	Insignificant
T. vaginalis	1.85	1.80	0.00	0.00	**3.02**	3.00	1.61	**Significant**

Table-5. Host age wise distribution of the incidences of the parasitic infections

Parasites	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	χ^2 test
P. falciparum	1.12	2.00	1.33	3.15	2.99	1.07	1.42	0.84	Insignificant
P. vivax	0.22	.65	1.10	1.44	1.49	0.09	0.05	0.11	Insignificant
L. donovani	0.00	0.94	1.07	0.53	2.12	0.00	0.19	0.00	Insignificant
E. histolytica	1.76	2.09	1.35	0.99	1.86	0.87	3.00	0.45	Insignificant
G. intestinalis	1.44	**3.01**	2.76	1.31	0.93	1.00	1.67	0.00	Significant
T. vaginalis	0.00	0.00	2.12	**2.38**	0.37	0.00	0.00	0.00	Significant

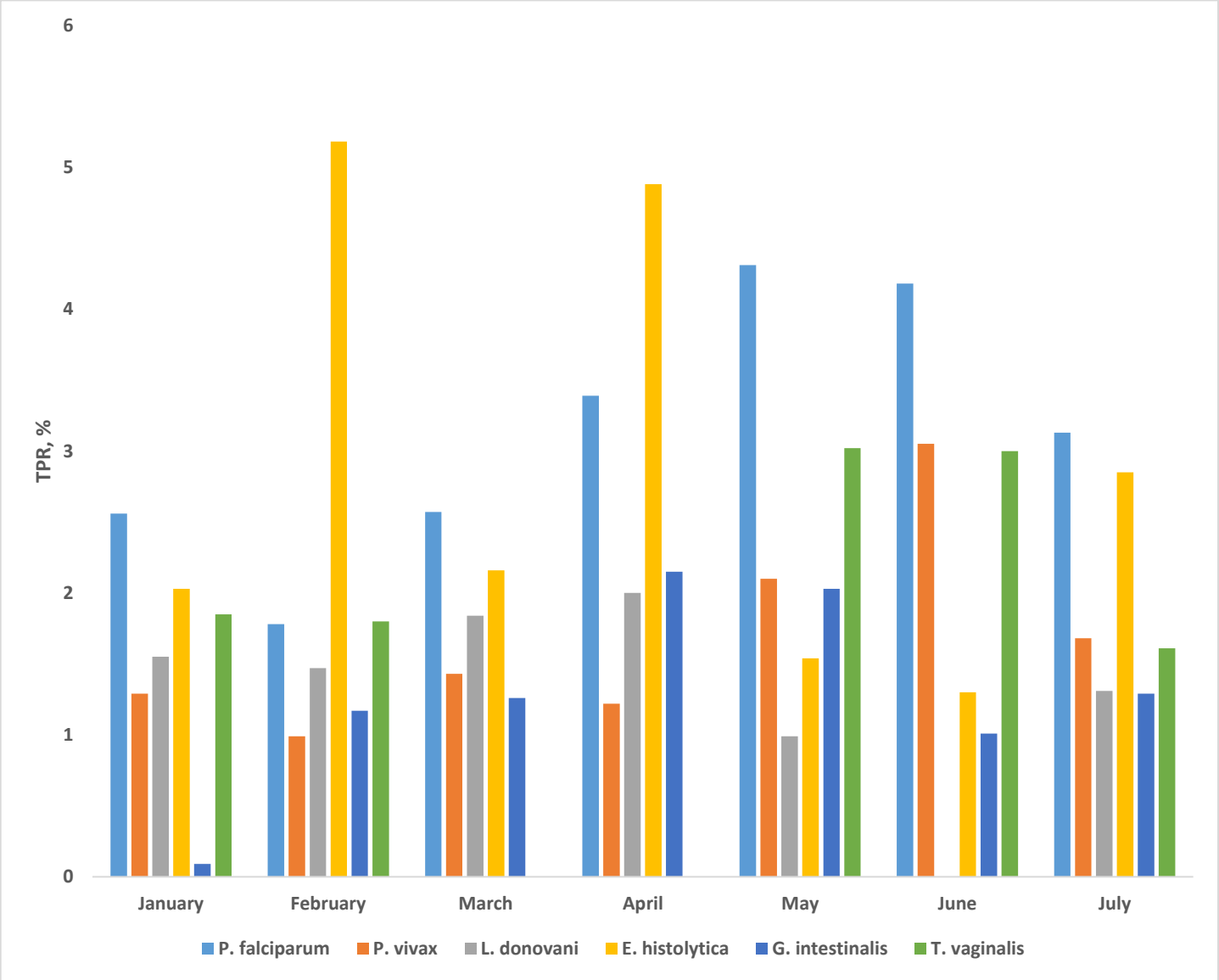

Figure 1 Month specific distribution of the incidences of the infections

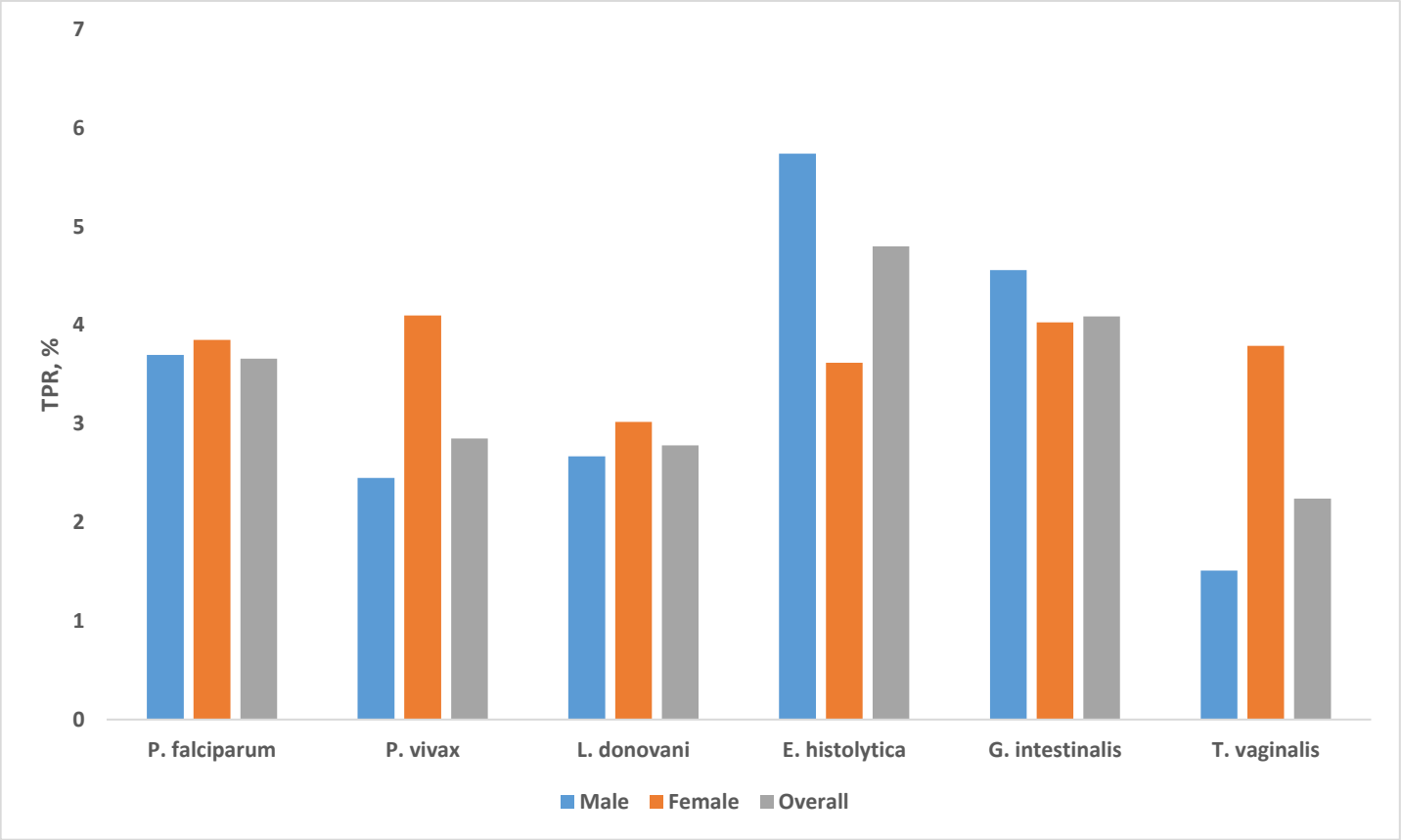

Figure 2 Sex specific and overall distribution of the incidences of the infections

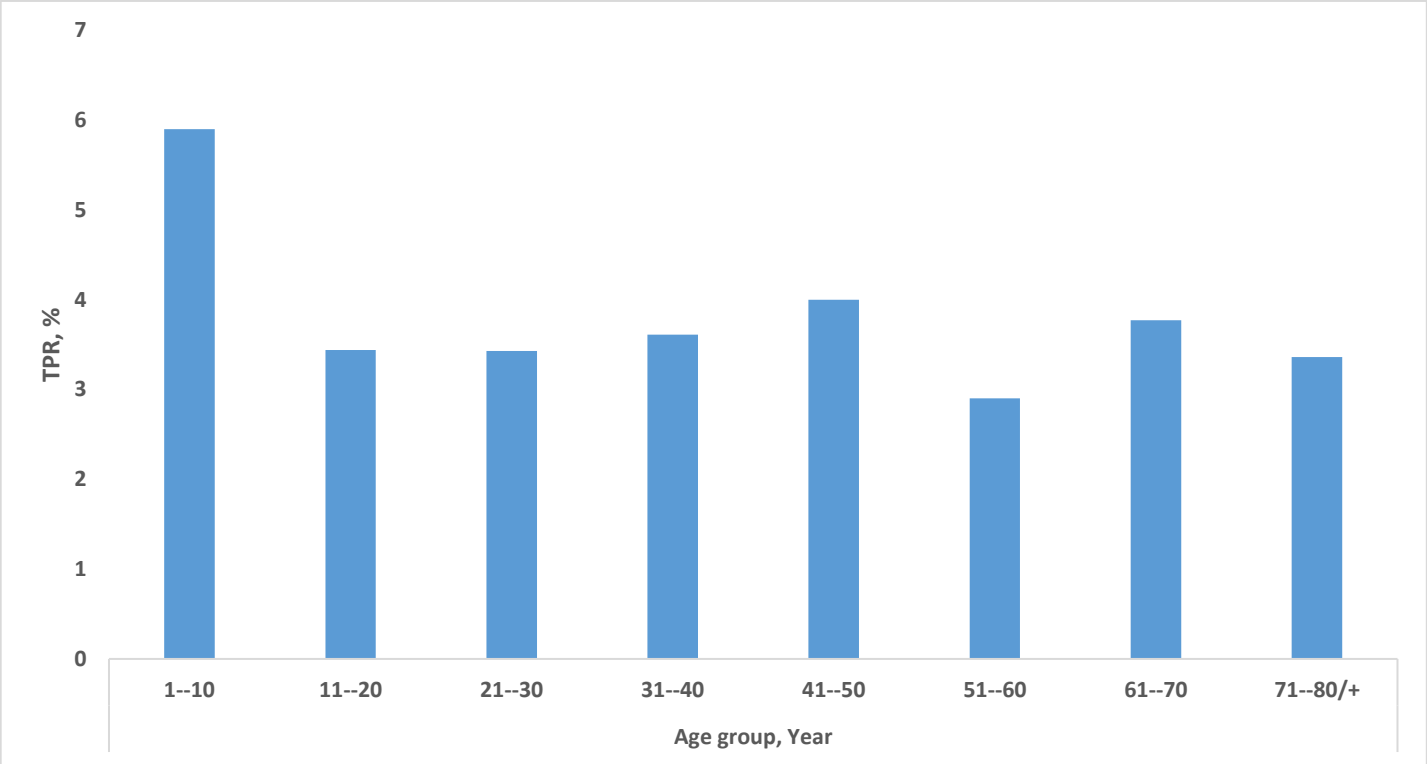

Figure 3 Age group specific overall distribution of the incidences of the infections

DISCUSSION

The climatic, environmental, and demographic conditions of Bangladesh are highly conducive to the long-term persistence of human protozoan parasites. This observation is supported by the present study as well as a limited number of prior investigations (ICDDR,B, 2004). Malarial infections caused by *Plasmodium falciparum* and *P.*

vivax are well recognized as endemic in Chittagong. However, the epidemiological status of other infections—namely giardiasis, entamoebiasis, leishmaniasis, and trichomoniasis remains inadequately characterized due to the absence of comprehensive nationwide studies. Existing sporadic reports documenting mortality and morbidity associated with dysentery and diarrhea (caused by *Entamoeba* and *Giardia*), kala-azar (caused by *Leishmania*), and cerebral malaria (caused by *P. falciparum*) provided important motivation for conducting this research. The primary data indicate that the six protozoan infections are commonly experienced by populations across nearly all regions of the country.

Ensuring public health and hygiene requires systematic investigation of these infections to better understand their epidemiological significance and to inform effective intervention strategies. The present study contributes baseline data on common protozoan infections in one of the most densely populated urban areas of Bangladesh. The lack of comprehensive, area-specific studies on parasitic infections represents a major limitation in the country's infectious disease control and prevention programs.

Although Dhaka has been the focus of several studies on infectious diseases including kala-azar, giardiasis, cholera, and dysentery, the investigations do not adequately represent all geographic regions, particularly the southeastern and northeastern parts of the country. In contrast, certain regions have been repeatedly studied for specific infections, such as malaria, often under national and international collaborative programs with notable success.

The Chittagong Hill Tracts comprising Rangamati, Khagrachari, and Bandarban are widely recognized as major reservoirs of malaria in Bangladesh, particularly for *P. falciparum* and *P. vivax*. Species diversity and richness of the *Plasmodium* genus are believed to be highest in this region (ICDDR,B, 2006). Among mosquito-borne diseases, malaria, filariasis, kala-azar, dengue fever, and certain forms of viral encephalitis are prevalent in Bangladesh (Chowdhury, 1978).

Given their clinical and epidemiological significance, protozoan infections in this work have increasingly attracted attention from healthcare professionals and researchers. For instance, Begum & Rahman (1975) reported four pathogenic intestinal protozoa—*Dientamoeba histolytica*, *Endolimax nana*, *Iodamoeba butschlii*, and *Giardia intestinalis*—among patients in Dhaka Medical College and surrounding clinics. Similarly, Chowdhury (1978) confirmed that *E. histolytica* and *G. intestinalis* were among the most common intestinal parasites affecting middle- and lower-income populations in Dhaka at that time. Interestingly, the overall prevalence of the six protozoan infections in the present study was 3.70%. Blood and reticuloendothelial protozoa (*P. falciparum*, *P. vivax*, and *Leishmania donovani*) showed a prevalence of 3.42%, intestinal protozoa (*E. histolytica* and *G. intestinalis*) 4.50%, and the urogenital protozoan (*Trichomonas vaginalis*) 2.45%. Monthly prevalence rates were as follows: January, 3.99% (male 3.25%, female 4.73%); February, 4.02% (male 4.00%, female 4.04%); March, 3.95% (male 3.44%, female 4.46%); April, 4.14% (male 4.25%, female 4.03%); May, 3.88% (male 4.00%, female 3.76%); and June, 3.54% (male 3.23%, female 3.85%). Anyway, intestinal protozoan infections were the most prevalent, followed by blood and urogenital infections. Females were affected approximately twice as often as males (male: female ratio = 1:2). Similarly, malaria infections were more frequent among females (male: female ratio = 3:4).

Despite its relatively short duration (six months), the present study successfully compiled baseline data on protozoan infections across different host groups categorized by age, sex, and month. To the best of our knowledge, this represents one of the first comprehensive efforts of its kind in an urban setting of Bangladesh.

CONCLUSION AND RECOMMENDATION

This study reported the occurrence, burden, distribution, and associations of six human protozoan parasitic infections. These infections were confirmed through laboratory assays on blood, urine, and stool samples collected in an urban area of Bangladesh from January to June 2006. The overall test positivity rate was 4.99%, and most statistical analyses supported the null hypotheses, with only a few instances showing significant differences in infection rates among host groups. However, infections caused by *Entamoeba histolytica*, *Giardia intestinalis*, and *Trichomonas vaginalis* were found to be significantly associated with demographic or temporal factors. The database generated in this study can help identify at-risk populations and inform targeted

intervention strategies. The findings require validation through larger field-based studies with increased sample sizes to develop effective healthcare intervention programme. Promoting public health and hygiene in infection-prone regions of Bangladesh should then be based on a multifaceted approach, including enhanced surveillance, expanded field investigations, and longitudinal research on these six protozoan infections in the country.

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REFERENCES

1. Ahmed, S. U., Nahar, N., Khan, M. R., Hoque, M. M., Afroza, A., & Baby, K. B. (1997). Clinical presentation of kala-azar in children: A study of fifty cases. Mymensingh Medical Journal, 6(1), 30–35.
2. Anonymous. (2003). Health and health sciences. In Banglapedia: National encyclopedia of Bangladesh (Vol. 5, pp. 54–57). Asiatic Society of Bangladesh.
3. Begum, N. N., & Rahman, K. M. (1975). Comparative finding of helminths and protozoa by various techniques. Bangladesh Medical Journal, 4, 8.
4. Chowdhury, M. R. (1978). Intestinal parasitic infections in privileged class of Dhaka population, Bangladesh. Armed Forces Medical Journal, 4, 5–12.
5. Chatterjee, K. D. (1980). Parasitology (protozoology and helminthology) in relation to clinical medicine (12th ed., pp. 183–186). Kolkata: Chatterjee Medical Publishers.
6. Cox, F. E. G. (1982). Modern parasitology. Oxford: Blackwell Scientific.
7. Huntsberger, D. V. (1961). Elements of statistical inference (p. 291). Boston: Allyn and Bacon.
8. Higgins, A. D., Jankins, J. O., Kurmia, L. W., Harun, S., & Juwono, S. S. (1984). Human intestinal parasitism in three areas of Indonesia. Tropical Medicine and Parasitology, 78(6), 637–648.
9. International Centre for Diarrhoeal Disease Research, Bangladesh. (2001). Health and science bulletin (Vol. 3, No. 2, pp. 1–2). Centre for Health and Population Research.
10. International Centre for Diarrhoeal Disease Research, Bangladesh. (2003). Health and science bulletin (Vol. 1, No. 2, pp. 1–5). Centre for Health and Population Research.
11. International Centre for Diarrhoeal Disease Research, Bangladesh. (2004). Health and science bulletin (Vol. 1, No. 4, pp. 1–3). Centre for Health and Population Research.
12. International Centre for Diarrhoeal Disease Research, Bangladesh. (2006). Health and science bulletin (Vol. 1, No. 2, pp. 1–7). Centre for Health and Population Research.
13. Khaled, G. A. (1983). Incidence of intestinal parasitic infections in Bangladesh Rifles. Bangladesh Armed Forces Medical Journal, 7(1), 29–31.
14. Muttalib, A. M., & Islam, N. M. (1976). Incidence of intestinal parasites in rural children. Bangladesh Medical Journal, 4(1), 11–27.
15. World Health Organization. (1996). The world health report 1996: Fighting disease, fostering development. Retrieved May 30, 2006, from http://www.who.int/whr/1996/en/

Annexure- 1 (List of the Diagnostic Laboratory/clinic/center)

1. Chittagong Medical College Microbiology Laboratory, Panchlaish, Chittagong
2. Chevron Clinical Laboratory (ptv) Ltd, Panchlaish, Chittagong
3. Chittagong Metropolitan Diagnostic Centre, Panchlaish, Chittagong
4. Chittagong Leb. Limited, Panchlaish, Chittagong
5. Doctor’s Lab. Panchlaish, Chittagong
6. Dr. Mahfuzur Rahman’s Lab, Chawkbazar, Chittagong
7. Medi Aid Complex (pvt) Ltd., Panchlaish, Chittagong
8. Meghna Diagnostic Centre, Panchlaish, Chittagong