**Cyclospora cayetanensis:** An Infestation among Diarrheal Children in Kathmandu Valley, Nepal

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**Abstract**

*Cyclospora cayetanensis*, a coccidian parasite which is responsible for recurring diarrhea and gastroenteritis especially among children living under poor hygienic condition in developing country like Nepal. Aimed of this research is to find out the prevalence of intestinal parasites and *C. cayetanensis* among diarrheal children in a Pediatric Hospital in Kathmandu valley, Nepal. Cross-sectional type of study was undertaken. Altogether 196 stool specimens were collected from June to September 2013 among outpatient diarrheal children in Kanti Children’s Hospital. Modified Ziehl Neelson staining method was applied for detection of oocysts of *Cyclospora* after formal-ether sedimentation. Parasites were detected in 13.7% (27/196) of stool samples from ≤ 15 year old diarrheal patients. *C. cayetanensis* was detected in 4.8% (8/196). In genderwise, infection rate of *C. cayetanensis* 4.5% (5/112), in male were higher than 3.6% (3/84) in female. In agewise, infection rate of *C. cayetanensis* in 5.7% (3/52) 11-15 year old were highest followed by 4.1% (3/78) in 0-5 year old and 3.0% (2/66) in 6-10 year old. In seasonwise, infection rate of Cyclospora was highest in the month of August 7.4% (4/54) followed by 3.9% (2/51) in July, 2.3% (1/44) September and 2.1% (1/47) in June. Altogether five different type of parasites were detected. Infection rate of *Giardia lamblia* were highest 5.1% (10/196) whereas lowest was Cryptosporidium parvum 1.0% (2/196). Prevalence of *C. cayetanensis* is highly probable to infant, neonate, toddler and diarrheal children. Therefore, attention should be made in laboratory investigation of *C. cayetanensis* while suspecting the diarrheal patients infected with other parasites.

**Keywords:** Cyclospora, Parasites, Modified Ziehl Neelson, Children

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**Introduction**

*Cyclospora cayetanensis*, is a coccidian parasite which is responsible for prolonged diarrhea in both immune-competent and immune-compromised patients. The pathogenesis and virulence factors phenomenon of *C. cayetanensis* are yet to be defined, but Inflammation and jejunitis had been found out [1]. *C. cayetanensis* infect human and cause of acute and chronic gastroenteritis [2]. It has been reported from various parts of the world in Southeast Asia [3,4]. The important vehicle for infection is source of water either by ingestion of parasite through contaminated water directly or through contaminated vegetable. Moreover, it has been implicated in outbreaks developing countries (e.g. like Nepal) [5]. In the study of Sherchand and Cross, between 2001-2004 in Nepal showed that contaminated drinking water, raw green vegetables, infected animals were the possible sources of infection with Cyclospora [6].

The Patients suffering from cyclosporiasis show the symptoms of an abdominal cramps, diarrhea, fatigue, nausea, and vomiting, chronic watery, anorexia, and weight loss. However, the cause of disease is still unrevealed. This study was carried out at Kanti Children’s Hospital (KCH), Kathmandu Valley, aiming to find out the prevalence of parasites and *C. cayetanensis* especially diarrheal children.

**Material and Methods**

**Study site:** Cross-sectional type of study was undertaken at KCH in Kathmandu Valley from June to September 2013.

**Collection of data and samples:** Demographic data were collected by using a standard questionnaire and with proper instruction ≤ 15
Table 1. Distribution of age and intestinal parasites among diarrheal children from outpatients in Kanti Children’s Hospital

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Total no. of children</th>
<th>Any parasite detected</th>
<th>p-value</th>
<th>C. cayetanensis</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (year)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-5</td>
<td>78</td>
<td>11 (14.1)</td>
<td>0.902</td>
<td>3 (4.1)</td>
<td>0.768</td>
</tr>
<tr>
<td>6-10</td>
<td>66</td>
<td>8 (12.1)</td>
<td></td>
<td>2 (3.0)</td>
<td></td>
</tr>
<tr>
<td>11-15</td>
<td>52</td>
<td>8 (15.4)</td>
<td></td>
<td>3 (5.7)</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>196</td>
<td>27 (13.8)</td>
<td></td>
<td>8 (4.1)</td>
<td></td>
</tr>
</tbody>
</table>

Any parasite detected counterstain was added on smear formed stain, then rinsed with tap water. Smear was drained, and air dried [8]. oocysts of C. cayetanensis were identified having size (8-10 μm), circle shape and pink color.

Ethics: Written informed consent was taken from all participants and/or their parents before enrolling into the study. Institutional Review Board, Institute of Medicine, Research Department, Kathmandu, Nepal was approved this research. Win-pepi statistical software was used for data calculation where p value of data <0.05 considered as statistically significant.

Results
Parasites were detected in 13.7% (27/196) of stool samples from ≤ 15 year diarrheal patients. C. cayetanensis was detected in 4.8% (8/196). Infection rate of C. cayetanensis in 5.7 % (3/52) 11-15 years old were highest followed by 4.1% (3/78) in 0-5 years old and 3.0% (2/66) in 6-10 years old [Table 1].

In gender, ratio between male and female were 1.3:1, infection rate of C. cayetanensis 4.5 % (5/112) in male were higher than C. cayetanensis 3.6% (3/84) in female [Table 2].

Table 3: Monthwise distribution of Cyclospora cayetanensis and total parasites in proportion in stool samples

<table>
<thead>
<tr>
<th>Month</th>
<th>Cyclospora cayetanensis (%)</th>
<th>Total parasites (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>June</td>
<td>2.1</td>
<td>12.9</td>
</tr>
<tr>
<td>July</td>
<td>3.9</td>
<td>9.8</td>
</tr>
<tr>
<td>August</td>
<td>7.4</td>
<td>18.8</td>
</tr>
<tr>
<td>September</td>
<td>2.3</td>
<td>15</td>
</tr>
</tbody>
</table>

Table 4: Number of positive and percentage rate of intestinal parasites among diarrheal children were shown in Table 4.

<table>
<thead>
<tr>
<th>Name of parasites</th>
<th>Number (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Giardia lamblia</td>
<td>10 (5.1)</td>
</tr>
<tr>
<td>Cyclospora cayetanensis</td>
<td>8 (4.8)</td>
</tr>
<tr>
<td>Entamoeba histolytica</td>
<td>4(2.5)</td>
</tr>
<tr>
<td>Entamoeba coli</td>
<td>3(1.5)</td>
</tr>
<tr>
<td>Cryptosporidium parvum</td>
<td>2(1.0)</td>
</tr>
</tbody>
</table>

*None of multiparasites was detected.
In seasonwiser, infection rate of C. cayetanensis was highest in the month of August 7.4% (4/54) followed by 3.9% (2/51) in July, 2.3% (1/44) September and 2.1% (1/47) in June [Figure 1]. Altogether 6 different types of parasites were detected. Infection rate of Giardia lamblia were highest 5.1% (10/196) whereas lowest was Cryptosporidium parvum 1.0% (2/196) [Figure 2].

Photograph 1: Oocyst of Cyclospora cayetanensis (Ziehl-Neelsen, 100X)

Discussion

Prevalence of C. cayetanensis infections among ≤15 year outpatient diarrheal children in KCH, Kathmandu, Nepal was conducted in this study. Intestinal parasitosis is detected to be highly prevalent in Nepal, small developing country located in south Asia [9]. Infection rate of C. cayetanensis and other parasites was higher between 11-15 years old in diarrheal children. Altogether five species of parasites were detected in 13.7% of stool samples from ≤ 15 year old diarrheal patients. Among them, most of prevalence in G. lamblia was detected. In Nepal, C. cayetanensis was detected in 4.8% of patients. In previous study, 7.9% were found to be positive for C. cayetanensis in diarrheal Children in Nepal [10].

In this study, we could not detect significant differences in prevalence of C. cayetanensis among < 15 year age groups and in gender. In gender, prevalence of C. cayetanensis 4.5% in male was higher than in female 3.6%. In previous study, prevalence of C. cayetanensis in female (53.4%) was higher than male (46.6%) in Nepal [10]. Total of the 60 patients infected with Cyclospora identified in this study, 63.4% were male and 36.6% were female in Mexico [11].

In age, prevalence of C. cayetanensis in 5.7% 11-15 years were highest. In previous study, the most of the infection rate of C. cayetanensis infection (50.7%) was found between 2-5 year old of age group whereas the lowest prevalence (4.1%) were above 28 years of age in Nepal [10]. Cyclospora was most frequently identified in boys of school age (36.7%) in Mexico [11].

The highest attack rates occur among children older than 18 months where as in our study, however, all age groups may acquire the disease, the highest attack rates was detected among children age between 2 to 5 years [12, 13]. There is no apparent immunity to infection, and reinfection can occur at all ages [14, 15].

Prevalence of C. cayetanensis was most in the month of August. The higher distribution of Cyclospora infection in Nepal occurs during summer and rainy season [10]. Their infections were relevantly identified in the rainy season (June-August) in children of Mexico [11].

Cyclosporiasis occurs with high incidence during the rainy seasons from April to June in Peru and May to September in Nepal [1, 2].

In Kanti Children’s Hospital, C. cayetanensis infection with diarrheal illness patients is not routinely diagnosed. Thus, adequate diagnosis and treatment are not always conducted promptly. In addition, Cyclospora makes it difficult to include its differential diagnosis due to lack of epidemiologic information. Therefore, our study suggests that there is need of highly specific assays to diagnose Cyclospora infections.

Conclusions

Prevalence of C. cayetanensis is highly probable in infant, neonate, toddler, and children and is one of the important etiologic agents of diarrheal illness among children. It is also equally probable infection in male and female as well as in rainy season. Therefore, attention should be made for laboratory investigation of C. cayetanensis while suspecting the diarrheal patients infected with other parasites.
Author Contributions
BB and GR design the proposal and format of research. BB collects the stool sample from hospital and proceeding in Lab of TUTH. JBS and BB and NNM write the article. All authors revised and finalized the draft.

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Conflict of interest:
None declared

References