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Research Article

# Prevalence of intestinal parasites among children attending outpatient department of Kanti Children's Hospital, Kathmandu, Nepal

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## Abstract

Intestinal parasitic infection is one of the main causes of morbidity and mortality in developing countries, especially among children. Even minimum infection of parasites in children may have negative effects on growth, iron deficiency anemia, perceiving function, and impaired cognition. The main objective of this study was to determine the prevalence of intestinal parasites and associated factors among the children attending Outpatient Department of Kanti Children's Hospital, Kathmandu for various illnesses. The research was carried out from March to May 2018. A total of 300 fresh stool samples were collected in clean, dry and screw capped plastic vials and were studied for the presence of intestinal parasites using the direct smear and concentration methods. Children or their parents were interviewed using standard questionnaires. Overall prevalence of intestinal parasites was 25.67%. Protozoan infestation was found in 22.67% cases, while helminthic infestation was found only in 3% cases. No double infestation was detected. The predominant parasite was *Entamoeba histolytica* (14%) followed by *Giardia lamblia* (8. 67%). The prevalence among female (32.11%) was greater than male (21.99%). The infection was found higher in low age of children, using underground water as a source of drinking water and hardly cut their nail in regular fashion, whereas those children followed regular hand washing habit, defecation in toilet, parent's occupation, use of antihelminthic drugs and treatment method had low infection of intestinal parasitic infection. All these evidences have shown that there should be an effective implementation of intervention activities to control and cure the spread of parasites associated infections among children.

**Keywords:** Children; *Entamoeba*; Hygiene; Intestinal parasites; Nematodes

## 1 | Introduction

Intestinal Parasitic Infections (IPIs) are main causes of health deterioration in developing countries, and are among the most common infections all over the world (Nyarango et al. 2008). It is assumed that around 3.5 billion people are affected by different diseases, and that 450 million feeling uncomfortable as a result of intestinal parasitic infections, the majority of them being children (WHO 2013). Worldwide, around 1.5 billion people are suffered from soil-transmitted helminths, above 267 million preschool children, and over 568 million school-age children reside in intestinal helminths prevailing area (WHO 2019). The public health effects of parasitic infection were given less priority in the past, but there is now a moderate consensus that diseases caused by intestinal parasites among children cover an important public health problem.

Gastro-intestinal parasites commonly infect the gastro-intestinal tract but can survive throughout the body parts. Protozoans and helminths are the main types of gastro-intestinal parasites residing different parts of intestine. Intestinal helminths and protozoan infections are the important sources of sickness and death all over the world (Haque 2007). Protozoan and Soil Transmitted Helminths (STHs) are the primary causative agents of IPIs (Dahal et al. 2018). Gastro-intestinal protozoan and helminthic infection occurrence was found higher in Nepal (Agrawal et al. 2012). Majority of children are at the risk of parasitic infections, which have negative effects on their nutritional status and physical development. Majority of gastro-intestinal parasites including *Entamoeba histolytica*, *Giardia lamblia, Ascaris lumbricoides*, *Hymenolepis nana*, Hookworm, and *Trichuris trichiura* were commonly found in school children in Nepal (Pandey et al. 2015). Various symptoms including nutritional disorder, iron deficiency anemia, intestinal blockage, and restriction of mental, and physical growth was noticed in the infected people (Gyawali et al. 2009). The mode of parasitic infections and transmission is varying from place to place, individual and communities' health condition and environmental factors. Children are particularly susceptible to parasitic infection and re-infection because they are potentially more exposed to pathogens, having under developed immunity system, immature personal hygiene efforts, and dependent on the care of others (Krause et al. 2015). Social marginalization has increased the susceptibility of the population to other pathogenicity and morbidities associated with parasitic infection (Keiser & Utzinger 2008).

In a developing country like Nepal, load of parasitic infection appears in all ages mainly due to different factors like lack of

educational opportunities, poor socio-economic status, poor sanitation, consumption of unhealthy food and water. The burden and impact are even higher in school going children of rural community (Sherchand 1997). The reported prevalence of intestinal parasites varies considerably from one study to another and from place to place particularly in children due to insufficient drinking water, over-crowded population and poor personal hygiene with poor nutritional status (Blethony et al. 2006; Alum et al. 2010). The intestinal parasitosis seems to be one of the health concerns among children in Nepal. Therefore, this study aimed to investigate prevalence of gastro-intestinal parasites among children attending Kanti Children's Hospital, Kathmandu and explore the associated risk factors of the parasitosis.

## 2 | Materials and methods

### 2.1 | Study area

Kanti Children's Hospital (KCH) is a pediatric hospital situated in Kathmandu Metropolitan City. The KCH is a 320 bedded children's tertiary care general hospital which gets referred patients below 14 years of age from all over the country and also caters to patients arriving directly without referral. It has a free ward with 50 beds dedicated to poor patients. It is the only government hospital for children in the Kathmandu valley. Daily 250–400 children visit the KCH for checkup, among them about 40–50 children are related to intestinal parasitic diseases.

### 2.2 | Symptomatic, demographic and epidemiological data collection

The attending parents of the children visiting KCH were interviewed for symptomatic and demographic information on a structured form including varieties of criteria such as age, gender, the presence of diarrhea (duration, if positive), abdominal pain (together with duration), anemia and malnutrition, weight and severe medical conditions. Effective risk factors for infection were also recorded including the number of people living in the household, presence of domestic pet animals (cat, dog, bird or other), presence of livestock (chickens, pigs, cows, buffaloes, goats or other), availability of water resources at the house, type of water routinely used (city water, tap, river, rain, well, pond or bottled water), whether soap was used to hand wash (always, sometimes, once a day or never), where the family disposed their stools (in a toilet, in the forest, farm, outside the house or in river), and whether the patient attended school and whether they wore shoes.

### 2.3 | Stool collection and processing

A total of 300 stool samples were collected purposively among the children below 14 years attending Outpatient Department (OPD) of the KCH for various illnesses from March to May 2018. The total number of children associated with intestinal parasites at hospital were around 2800 in a month (around 40 individuals in a day, according to hospital admin), and 10% admitted children's stool samples (300) were collected for analysis. Written permission was taken from KCH prior to data collection. Verbal consent was also obtained from parents or legal guardian of children and confidentiality of information was assured. Those children who provided stool sample and whose parents gave consent were included in the study. Children with serious symptomatic health problem and those who have used antihelminthic drugs within a month before screening were excluded from the study. Data of socio-demographic and possible risk factors were collected using the structured questionnaire from the children or their parents/guardians. Stool sample was collected in a labeled vial. Before sample collection, instruction was provided to the children on how to collect and bring the stool samples. The collected stool samples were preserved at 2.5% Potassium-dichromate solution, and transferred to the laboratory of Central Department of Zoology, Tribhuvan University, Kathmandu, and then processed to examine cysts, trophozoites, eggs and larvae of intestinal parasites by direct smear method (Chatterji 2011) and concentration method (Arora & Arora 2015).

### 2.4 | Methods of observation

Both direct and indirect smear preparations were first examined under the low power 10× of binocular microscope. Observation was started from one end of the slide to another. When the parasite eggs were seen then the objects were centered and focused under 40×. Observation on each slide lasted for at least 25 minutes for the clear vision and a detailed diagnosis. Micrometry was done for the confirmation of egg, cyst and larva of protozoan and helminth parasites.

### 2.5 | Identification of the eggs, cysts and larvae

The identification and confirmation of eggs, cysts and larvae of protozoan and helminth parasites were made by comparing the structure, color, size of eggs, cysts and larvae from published literature (WHO 1984; Arora & Arora 2015).

### 2.6 | Data management and analysis

The descriptive statistics was used to identify the frequency of gastro-intestinal parasites among different groups such as age, sex, hand washing habit, sources of drinking water, nail cutting habit, defecated area (open and toilet), parent's occupation, use of antihelminthic drugs and treatment method. The prevalence rate of gastro-intestinal parasites was expressed in percentage. Children were divided into five age-groups (<3, 4-6, 7-9, 10-12 and 13-14 years) to analyze the age-wise prevalence of intestinal parasites. The chi-square test was used to compare the difference in frequency of gastrointestinal parasites among different groups according to age and gender of the children.

## 3 | Results

### 3.1 | General prevalence of intestinal parasites

Out of 300 examined stool samples, 25.67% were found positive either for protozoan, or helminthic infections. None of the children were found infected with double infection. Maximum number of children were found infected with protozoan parasites, *Entamoeba histolytica* (14%) and *Giardia lamblia* (8.67%) while helminth parasitic infection were found almost less than one percent, *Ascaris lumbricoides* (1%), *Hymenolepis nana* (0.67%), *Trichuris trichiura* (0.67%), *Enterobius vermicularis* (0.33%) and Hookworm (0.33%) (Table 1).

**Table 1.** Prevalence of intestinal parasites among children of KCH

| Parasites | Percentage |
|---|---|
| *Entamoeba histolytica* | 14.00 |
| *Giardia lamblia* | 8.67 |
| *Ascaris lumbricoides* | 1.00 |
| *Hymenolepis nana* | 0.67 |
| *Trichuris trichiura* | 0.67 |
| *Enteriobius vermicularis* | 0.33 |
| Hook worm | 0.33 |

### 3.2 | Sex and age wise prevalence

Among the stool sample collected people, 63.67% were male. Parasitic prevalence in female and male were found 32.11% and 21.99%, respectively, however there was no differences in the parasitic infection between the gender ($\chi^2$ = -3.124, df = 1, P = 0.073). The age-wise intestinal parasitic infection indicated that maximum parasitic prevalence was found in children <3 years age group (17%) and minimum parasitic prevalence in 13–14 years age-group (0.67%). There was no significant difference in the prevalence of intestinal parasites in children between the age group ($\chi^2$ = -8.501, df = 4, P = 0.074). Similarly, age and sex-wise study for prevalence of intestinal parasites revealed that both females (23.85%) and male (13.08%) at the age of < 3 years were infected (Fig. 1).

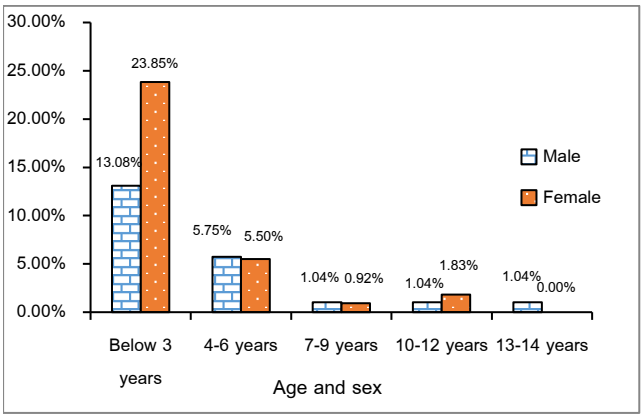


**Figure 1.** Age and sex wise prevalence of intestinal parasites in children

### 3.3 | Associated risk factors of intestinal parasites

Among 300 children who provided fecal samples, 8% children used open field for defecation followed by diaper/cloth (7%), pot toilet (6%) and toilet (4%). Fifteen percent of infected children used water only for hand wash and children who used water and soap were nine percent, and <2% infection was found for those who used mud and ash (Table 2). Children using drinking water directly without any treatments (12%) was found higher infection than children drinking filtered water (7%), boiled water (5%), boiled and filtered water (2%) and chemically treated water (<1%).

Higher parasitic prevalence (14%) was found among children using underground water for cleaning fruits and vegetables, where as 11% infected children used tap water for vegetable and fruits cleaning. High prevalence (16.67%) was found among the children who cut their nail hardly in regular fashion (Table 2).

The higher parasitic prevalence was found for non-vegetarian children (26.61%) than vegetarian (13%). Farmers' children had more parasitic prevalence (7%) than the parents having job holders (5%), working for foreign countries (4%), and business

**Table 2.** Probable risk factors of intestinal parasitic infection among children of KCH.

| Variables | Practices | Infection (%) |
|---|---|---|
| **Defaecation** | Toilet | 4.00 |
| | Pot toilet | 6.00 |
| | Open field | 8.33 |
| | Diaper/ cloth | 7.33 |
| **Hand wash** | Water only | 15.0 |
| | Water and soap | 9.00 |
| | Others (ash and mud) | 1.67 |
| **Drinking water source** | Underground | 10.67 |
| | Tap water | 8.33 |
| | Jar | 6.67 |
| **Drinking water consumption** | Direct | 12.00 |
| | Boiled | 4.67 |
| | Filtered | 6.66 |
| | Boiled and filtered | 1.67 |
| | Chemically treated | 0.67 |
| **Cleaning vegetables** | Tap water | 11.34 |
| | Underground water | 14.0 |
| | Jar | 0.33 |
| **Nail cutting habit** | Once a week | 9.00 |
| | Once in 2 weeks | 0.00 |
| | Sometimes | 16.67 |
| **Food habit** | Vegetarian | 12.56 |
| | Non vegetarian | 26.61 |
| **Parents occupation** | Farmer | 7.67 |
| | Businessmen | 3.33 |
| | Job holder | 5.33 |
| | Abroad | 3.67 |
| | Others | 5.67 |
| **Use of antihelminthetic** | User | 8.33 |
| | Non user | 17.34 |
| **Treatment Method** | Direct taking medicine | 16.0 |
| | Traditional method | 5.34% |
| | Consulting doctor | 4.33% |

(3%). Those children who used antihelminthic treatment within the six-month time period before sample collection were less infected (8%) than did not use antihelminthic treatment (17%). The intestinal parasitic infection was found maximum (16%) among those children who took medicines directly without consulting doctor compared to those children who consult doctor for the treatment.

## 4 | Discussion

The present study assessed the prevalence of intestinal parasitic infections among the children attending the outpatient department of Kanti Children's Hospital, Kathmandu. The results from analysis of stool samples indicated that 25.67% of children in the study was found infected with at least one type of pathogenic intestinal parasite. The prevalence of IPIs in present study was almost in agreement with the findings of, and who reported prevalence of 21.3%, 22.0%, 23.2% and 25.6% among children in Kaski (Chandrasekhar et al. 2005) and Kathmandu districts of Nepal (Bhandari et al. 2015); Bihar of India (Akhtar & Kumar 2018) and Nairobi of Kenya (Mbae et al. 2013). The finding is lower than reported by Nyantekyi et al. (2010) in Wondo Genet, Southern Ethiopia (85.1%), Wani et al. (2007) in Srinagar City, Kashmir, India (46.7%) and Bhandari et al. (2011) in Kavrepalanchowk District of Nepal (40%). The difference in prevalence could be attributed to timing of the study, sampling of study participants, seasonal differences in conducting the study, environmental conditions (climate, humidity, pollution), geographical factors (migrations, religions, lifestyles), and implementation of different prevention, and control measures (Abera & Nibert 2014).

The predominantly prevailing parasite was *Entamoeba histolytica* (14%) followed by *Giardia lamblia* (8.67%). The study results showed that protozoan parasites were more dominant parasitic infections among the children. This finding corresponds to the results of similar studies conducted in Birgunj, Nepal (Shakya et al. 2012), in Baglung District, Nepal (Shrestha et al. 2012) and in Bihar, India (Akhtar & Kumar 2018). The higher rate of protozoan infection may be due to the presence of farming land in rural areas contaminated with fecal matter resulted due to open defecation, lack of public awareness and use of contaminated drinking water and resistant to chlorine by the cyst form of the protozoan parasites (Dahal et al. 2018). Furthermore, the periodic uses of anti-helminthic drug administration to the children could possibly define the lower prevalence of helminthic infections observed in this study.

The prevalence of parasitic infestation was more common in females (32.11%) as compared to that in males (21.99%) but this difference was not statistically significant. Marothi and Singh (2011), Patel et al. (2014) and Zemene and Shiferaw (2018) reported similar results in their study with predominance in females. In addition, the prevalence of parasitic infections was statistically insignificant with the age of children. All age groups were affected by intestinal parasites but age groups of children below three years were highly affected one. The high susceptibility of parasitic infection among small aged (<3 years) children reported in this study is in agreement with previous reports (Shakya et al. 2012; Esiet & Edet 2017; Shrestha et al. 2019). This might be attributed to the strengthening of immune status and rise in the consciousness on hygienic behavior and environmental sanitation among children with the increase in age (Shakya et al. 2012). Moreover, under-5 years of age children are more prone to intestinal parasites because of the low immunity they have in this stage that needs special care and follow-up (Valiathan et al. 2016). On contrary to our report, higher infection rate among children aged 10–15 years have been reported by different studies done in Nepal (Khanal et al. 2011; Rai et al. 2005) attributing it to lack of parental control regarding dietary habits and increased outdoor activities (Pradhan et al. 2014).

In the present study, 43.67% children used toilet, 22% children used pot toilet, 17.67% children used diaper/cloth and only 16.67% people used open fields as defecation place. The prevalence of intestinal parasites was found to be higher (8.33%) in the persons who used open field as defecation place which is in agreement with Karunaithas et al. (2011). This study demonstrated significant association between hand washing after using toilet, and rate of intestinal parasites infestations. The prevalence of intestinal infection was found higher (15%) among those children who used only water as cleaning agent and it seems similar to the findings of Sah et al. (2016). Minimum prevalence of intestinal infection (1.67%) was found in those people who used other agents like to hand wash gel, soap, ash, etc. as cleaning agent. A recent cluster randomized control trial study showed that hand washing with soap significantly reduces intestinal parasite infection in children (Mahmud et al. 2015).

Based on the sources of drinking water in the study area, parasitic infection was found to be the highest among children using underground water like stone spout, well, and Tube-well than tap or jar water. The rate of infection was higher (10.67%) in children using underground water whereas lower rate (6.67%) was found in children using water from jar. This pattern of infection has also been reported in children of squatter community in Dharan (Chongbang et al. 2016) and Kanti Children Hospital, Kathmandu (Pokharel et al. 2009). Due to the practice of open defecation near water sources, in rainy season the feces may be washed away into the sources of drinking water (Mbae et al. 2013).

In the present study, the prevalence of intestinal parasite was found to be higher (26.61%) in those children who were non-vegetarians in comparison to vegetarians. Several studies (Dhakal 2018; Yadav 2017) showed higher prevalence of intestinal parasites among non-vegetarians and the current findings is similar with result shown by Pandey et al. (2015). This might be due to consuming infected raw meat and improperly cooked meat which is the possible risk factors of transmission.

The nail cutting habit was not significantly associated with the prevalence of parasitic infection ($\chi^2$ = 0.848, P = 0.654). Higher prevalence was found among the children who cut their nail when he/she feels necessary or randomly (16.67%). This is due to poor hygienic practice, socioeconomic status, and also playing habit of children with soil. A study by Mahmud et al. (2015) in Ethiopia showed that weekly nail clipping of children significantly reduced intestinal parasites infection.

Among the children attending OPD of Kanti Children Hospital, 55.33% children used anti-helminthic drug and 44.67% were non user. The findings revealed that prevalence of intestinal infection was found a minimum (8.33%) in children who used anti-helminthic drug and maximum (17.34%) in those children who did not use anti-helminthic drug. This pattern of infection was also reported in squatter community in Dharan, Sunsari (Chongbang et al. 2016). Helminthic infections were less prevalent as compared to the protozoan infections, and this result was similar to other studies done in Kathamandu (Pradhan et al. 2014) and Dharan (Gyawali et al. 2009). The periodic campaign of anti-helminthic drug administration to the children and nationwide bi-annual integrated de-worming as well as vitamin A supplementation could possibly explain the lower prevalence of helminthic infections seen in this study.

Although these findings are limited to one hospital, it may represent the population of the area because of the wide range of health service provision for children in the hospital. All these evidences have shown that there should be effective implementation of intervention activities to control the spread of intestinal parasitic infections. Furthermore, this study indicates the requirement of targeted health education, health awareness, practice of hygiene, regular screening and specific treatment among children and their parents for effective control of intestinal parasitic infections.

## 5 | Conclusions

The overall prevalence of intestinal parasites among the children attending hospital was 25.67%. The higher prevalence of protozoan parasites in this study correlates with behavioral, social, and economic factors of the study participants that mediate potential exposure. The predominantly prevailing parasite was *Entamoeba histolytica* followed by *Giardia lamblia*. No double infestation was detected. The hand washing habit, defecation, parent's occupation, use of antihelminthic drugs and treatment method were significantly associated with parasitic infections. Associated risk factors leading to intestinal parasitosis is one of the common causes in children generally accompanied by symptoms such as diarrhea, stunting, physical and mental weakness.

## 6 | Research implication

The present study assessed the prevalence of intestinal parasitic (both helminthes and protozoan) infections and associated risk factors among the children attending OPD of Kanti Children's Hospital. These findings could be beneficial to overcome the existing limitations and to implement possible preventive measures to control and cure the parasite associated infections among the children.

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## Authors' contributions

Acharya, A. and Subedi, J. R. designed the research, collected data and performed laboratory work for coprological examination and identification of parasites; Acharya, A. and Devkota, R. P. analyzed the data and wrote the manuscript; Subedi, J. R. supervised research work. All authors reviewed and approved the final manuscript for publication.

## Conflicts of interest

Authors declare no conflict of interest.

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