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Prevalence of Cryptosporidiosis Among School Going Children in Kathmandu, Nepal

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Abstract

Background: Intestinal parasitic infection among children poses a critical public health issue in Nepal. This study was conducted to determine cryptosporidiosis among school going children in Kathmandu, Nepal.

Methodology: A total of 187 collected stool samples were subjected to direct microscopy, formal-ether concentration technique, Sheather's sucrose floatation technique and modified acid fast staining technique.

Results: The occurrence of cryptosporidiosis was 29.4%. Cryptosporidiosis was high in female (35.2%) without any significance (p = 0.100). Similarly, cryptosporidiosis was highest in age group 5 - 8 (31.8%) which was not statistically significant (p = 0.619). The cryptosporidiosis was higher in symptomatic case (31.0%) than asymptomatic case, which was insignificant (p = 0.475). The cryptosporidiosis was higher in children not following hygienic practice (35.6%) with significance (p = 0.015).

Conclusion: The outcome of this study revealed that cryptosporidiosis infections remain highly endemic among school children in Kathmandu, Nepal. This suggests proper diagnosis; specific treatment and adequate WaSH (Water, Sanitation and Hygiene) practices are required to lower the parasitic burden in low-resource settings.

Keywords: *Cryptosporidiosis; Children; Enteric Parasites; Nepal*

Introduction

Cryptosporidium spp. is a leading cause of persistent diarrhea in developing countries. This coccidian parasite causes a self-limiting diarrhoeal infection in immunocompetent individuals, and full recovery is expected with proper oral hydration therapy [1]. The organism can cause illnesses lasting longer than 1 or 2 weeks in previously healthy persons or indefinitely in immunocompromised patients;

furthermore, in young children in developing countries, cryptosporidiosis predisposes to substantially increased diarrhoeal illnesses. The first case of human cryptosporidiosis was reported in 1976, and since then, it has been widely studied. Several studies suggest that it spreads in daycare centers and possibly in widely distributed water supplies, public pools, and institutions such as hospitals and extended care facilities for the elderly [2].

There are 27 species of *Cryptosporidium* that are pathogenic to humans [3,4]. The oocyst stage is of primary importance for the dispersal, survival, and infectivity of the parasite and is of major importance for detection and identification [5]. In WHO bulletin, the reported prevalence of *Cryptosporidium parvum* is 1 - 4% in Europe and North America; and 3 - 20% in Africa, Asia, Australia, South and Central America. Peaks in the prevalence in developed countries are observed in spring and in the late summer. Numbers of asymptomatic carriers, as determined by stool surveys, are generally very low (< 1%) in industrialized countries, although higher rates have been reported in day-care centers. Routine bile endoscopy suggests a higher prevalence of asymptomatic carriage: 13% of non-diarrheic patients were shown to carry *Cryptosporidium parvum* oocysts. High rates of asymptomatic carriage (10 - 30%) are common in non-industrialized countries. Seroprevalence rates are generally higher than fecal carriage rates, from 25 - 35% in industrialized countries to 95% in South America increase with age and are relatively high in dairy farmers and day-care centre attendants [6].

Intestinal parasitic infection is still a serious public health in Nepal and there is little data on the prevalence of intestinal parasites among school going children in Nepal [7,8].

Therefore, the present research has been designed to study the prevalence of cryptosporidiosis among school going children in Kathmandu, Nepal and its relation with behavioral pattern and life style of the children relating to health.

Methods

A total of 187 stool samples were collected from school going children (n = 187) of Kathmandu valley in a screw capped plastic container. All the samples were processed in Microbiology Laboratory of National College. This study was approved by the Institutional Review Board, National College and the informed consents were obtained from the participants. A questionnaire on age, sex, hygienic practice (hand-washing) and gastrointestinal symptoms (diarrhea) were filled and used for analysis. Each fresh stool sample was examined macroscopically and microscopically for the detection of *Cryptosporidium* Spp. Microscopic examination of sample was done by standard formol- ether concentration method. Sheather's sucrose floatation method followed by modified acid fast staining was conducted for detecting oocysts of *Cryptosporidium*. All the *Cryptosporidium* positive specimens were stored at ambient temperature in 2.5% potassium dichromate for about 10 days and were examined for sporulation as described by Ghimire., *et al*. [9]. The data obtained were analyzed by statistical software SPSS (version 11.5).

Results

The Cryptosporidiosis was found as high as 29.4%. The gender wise distribution of *Cryptosporidium* spp. in school going children revealed higher prevalence in female school going children (35.2%) than in male school going children (24.2%) with no significant difference (Table 1). Cryptosporidium spp. was present highest in age group 5 - 8 (31.8%). The occurrence of *Cryptosporidium* spp. in different age groups was also found statistically insignificant (Table 2).

Sex	Frequency (n)	Positive (n)	%	p-value
Male	99	24	24.2	p = 0.100
Female	88	31	35.2	
Total	187	55	29.4	

Table 1: *Occurrence of Cryptosporidium spp. with gender of school going children.*

Age	Frequency (n)	Positive (n)	%	p-value
3-5 years	46	11	23.9	p = 0.619
5-8 years	107	34	31.8	
8-12 years	34	10	29.4	
Total	187	55	29.4	

Table 2: *Distribution of Cryptosporidium spp. with age.*

The occurrence of *Cryptosporidium* spp. in symptomatic case (31.0%) was higher than asymptomatic case (25.9%) with no statistically significance (Table 3). The occurrence of *Cryptosporidium* spp. in school going children not following hygienic practice (35.6%) was higher than with following good hygiene practice (18.8%) and the result was found statistically significant (Table 4).

Symptoms	Frequency (n)	Positive (n)	%	p-value
Symptomatic	129	40	31.0	P = 0.475
Asymptomatic	58	15	25.9	
Total	187	55	29.4	

Table 3: *Symptom wise distribution of Cryptosporidium spp.*

Hygienic Practice	Frequency (n)	Positive (n)	%	p-value
Following	69	13	18.8	p = 0.015
Not Following	118	42	35.6	
Total	187	55	29.4	

Table 4: *Distribution of Cryptosporidium spp. with hygiene practice.*

Discussion

In this present study, prevalence of *Cryptosporidium* spp. was detected as 29.4%. This high prevalence rate may be due to various factors such as geographical factors, age of the school going children, lack of proper sanitation, lack of proper awareness among school going children, lack of personal hygiene, lack of properly treated water, inadequately washed hand, lack of specific treatment, consumption of undercooked food, consumption of contaminated fruits and overall diminished socioeconomic condition of pupils of different schools of Kathmandu Valley who were included in this study. The current prevalence figure was higher than figures revealed by different studies in Nepal [9-13]. Similarly, the present finding was higher than the findings of Filipe., *et al*. [14], Bern., *et al*. [15], Nimri [16], Easow., *et al*. [17] and Latif and Rossle [21] where they found the infection rates to be 9.3%, 1.2%, 8%, 1%, 8.6% and 4.62% respectively. However, the current finding was more or less similar to the findings of Laubach., *et al*. [18], Mahgoub., *et al*. [20] and Munoz-Antoli., *et al*. [22], where they found the prevalence of cryptosporidiosis as high as 32%, 37.3% and 35.7% in Gautemala, Jordan and Nicaragua respectively.

This endemic, zoonotic coccidian parasitosis is highly prevalent in third-world countries that have waterborne fecal contamination of food and water with oocysts and where there is direct infection by person-to-person contact as the common method of transmission of this enteric protozoan [19]. These results suggest that there is heavy contamination of water, food, animal and soil with the oocysts of *Cryptosporidium* which could be the potential source of infection.

The gender wise distribution of Cryptosporidiosis in school going children revealed higher prevalence in female school going children (35.2%) than in male school going children (24.2%), which was statistically insignificant (p = 0.100). Although there is no sexual predi-

lection in the cryptosporidiosis, but the current finding clearly suggests higher prevalence among female school going children. The exact reason behind the high prevalence among female school going children is unknown and it may be associated with cooking and household work such as handling livestock and storing water [20]. Cryptosporidiosis was present highest in age group 5 - 8 (31.8%) but it was found statistically insignificant (p = 0.619). The finding of higher prevalence of cryptosporidiosis in children with age less than 8 is similar to the findings of Bern., *et al*. [15], Easow., *et al*. [17] and Sherchand and Shrestha [9]. The high prevalence of infection in children under 8 years old could be attributed to the extensive use of untreated water, unsafe sanitation and contaminated food in Nepal [21]. Recent studies have shown that the gut microbiome plays a vital role in children's health [23-27] including protection against pathogens and contributing to metabolic functions. In this context, the occurrence of Cryptosporidiosis in symptomatic case (31.0%) was higher than asymptomatic case (25.9%) but it was found statistically insignificant (p = 0.475). This insignificant result may be due to the limitation in conventional microscopy diagnostics. PCR-based methods would probably increase this figure considerably.

The occurrence of *Cryptosporidium* spp. in school going children not following hygienic practice (35.6%) was higher than with following hygienic practice (18.8%) and the result was found statistically significant (p = 0.015). *Cryptosporidium* oocysts can be directly transmitted by fecal oral route as a result of which good hygiene practice (handwashing practice) is the best way to prevent cryptosporidiosis.

Conclusion

Cryptosporidiosis is one of the most prevalent intestinal protozoal parasites, which is endemic in Nepal. The present research reveals that cryptosporidiosis is abundant among school going children in Kathmandu, Nepal. Effective control strategies, proper hygienic education, improved sanitation and safe water supply are necessary to prevent Cryptosporidium infections in low-resource settings.

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Disclosures

The authors declare no potential/perceived conflicts of interest in the study.

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