Intestinal Parasitic Infections among School Going Children in Kathmandu Valley, Nepal

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ABSTRACT

Objectives: In order to assess the Intestinal Parasitic infections from the School Going Children of Kathmandu Valley, this study analyzed the proportion of parasitic infection from the stool samples.

Methods: Stool samples were collected from two schools of Kathmandu and analyzed for the assessment of intestinal parasites from May to June, 2018. The assessment of intestinal parasites was performed by Direct Microscopy and Formol ether Sedimentation technique and Modified Ziehl-Neelsen Staining was performed for the confirmation of Coccidian parasites.

Results: The result is that out of 165 stool samples, intestinal parasites were detected in 28 (16.9%) samples and among them, 13 (46.4%) were protozoa and 15 (53.6%) were helminthes. A total of nine different parasites were recorded in the study. Among them, *Taenia* spp 5 (17.85%) for helminthes and *G. lamblia* 5 (17.85%) for protozoans was dominant and the least dominant organism for helminthes was *H. diminuta* (3.58%), for protozoans *C. parvum* (3.58%). Among the participants, more females were infected with intestinal parasite than male with majority from age group 13-15 years (23.1%). The distribution of parasites was higher among the students who drank water without treatment. Out of 28 intestinal parasites, 14/69 (20.3%) students showed the positive cases i.e. who drank water without treating followed by 13/70 (17.1%) students who filtered before drinking. The students who drank water after boiling 1/26 (3.8%) showed less distribution of parasites. The distribution of parasites was higher in the students who washed hands only with water on the basis of hand washing habits before eating i.e. 15/80 (18.7%). The distribution of parasites was higher among the students who bite their nail sometimes i.e. 15/76 (19.7%) as compared to the student who never bite their nail 13/89 (14.6%).

Conclusion: Intestinal parasite is still a major health problem among the school going children in Nepal. Therefore, the infection preventive measures and school health awareness activities should continue.

Key words: Intestinal parasites, school, children, hygiene, Nepal

INTRODUCTION

Parasites are the organisms which dwell in other body or require host to complete the life cycle. Parasitic infections that are caused by intestinal helminthes including Trematodes, Nematodes and Cestodes and protozoa are among the most prevalent infections in humans in developing countries (Haque 2007).

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Some of the common protozoa found in the world are *Giardia lamblia* which causes Giardiasis, *Entamoeba histolytica* which causes Amoebiasis while commonly found helminthes are *Ascaris lumbricoides* causing Ascariasis, *Trichuris trichuira* causing Trichuriasis (Kucik et al 2004). Intestinal parasitic infections generally occur due to food and water borne transmission and constitute a worldwide health burden causing morbidity in 450 million people, many of which are women of child bearing ages and children in developing countries (Derso et al 2016; Haque 2007).

Infections with intestinal parasites cause a considerable public health burden with protozoa being the more common cause of gastrointestinal infections while the helminthes play the equal role in the developing regions (Fuhrimann et al 2016; Haque 2007). The intestinal protozoa are now being prevalent in both developed and developing countries among patients with Acquired Immune Deficiency Syndrome (AIDS), immunocompromised hosts and among children aged less than five years (Haque 2007; Sharma et al 2007).

Clinical features of helminthic infection differ a lot on the basis of the helminthes species, intensity of infection, and host age. *Taenia solium* can cause neurocysticercosis. Chronic infection with *Schistosoma* spp causes granulomas, fibrosis, and inflammation of the spleen and liver. Hookworm infection and Schistosomiasis can affect pregnant women, cause neonatal prematurity and increased maternal morbidity and mortality (Wang et al 2008). Amoebiasis is one of the leading cause of death worldwide. At least 750 million episodes of diarrhea occurs per year causing five million deaths (Yadav and Prakash 2016).

Parasitic infections have a high prevalence and it is estimated that over than three billion populations is infected by Intestinal Parasitic Infections in the world today (Fallahi et al 2015). Intestinal parasitic infections are amongst the most common infections worldwide (Emile et al 2013).

Helminthic infections are most prevalent in tropical and subtropical regions of the developing world where adequate water and sanitation facilities are inadequate (Haque 2007). The 3 major intestinal helminthic infections include Ascariasis, Trichuriasis, and Hookworm infection which account for about 1.75 billion of those cases that comprise more than three-quarters of the total prevalent Neglected Tropical Diseases (NTD) infections (Herricks et al 2017).

The parasitic infection rate in Nepal is detected in the range of 16.7% to 62.84% (Tandukar et al 2013; Yadav and Prakash 2016). The variation in infection is attributed to the geographic, demographic, hygienic, socioeconomic and cultural differences (Furhimann et al 2016).

A pilot project in Nepali schools, providing deworming tablets, a hot meal for the children and food gifts for girls to takeback to their parents created such a virtuous circle of success that the World Food Programme said they would like to expand the programme worldwide, if donors would support them. In June 1996, a WHO survey in Parsa, Surkhet and Dailekh districts in Central Development Region and Mid-Western Development Region indicated that 65% of children were infected with hookworm, followed by 21% with roundworm and 19% with whipworm. But a mid-term review of the Primary School Nutritious Food Project (PSNFP) in November 2000 indicated that the proportion of children with any worm infection at all had fallen from 74% to 48% and anaemia had vanished and since the programme was successful, it was decided to extend it worldwide.

In the study conducted among public school children in a rural village of Kathmandu Valley, among the 194 participating children, prevalence of intestinal parasitic infection was found as 23.7%. Among protozoan parasites, *Giardia lamblia* was the most common (58.6%) whereas *H. nana* was the most common (21.7%) among the helminthes (Pradhan et al 2014).

Intestinal parasitic infections are major public health issues in developing countries, mostly affecting children, contributing to high mortality. Parasitological study helps to know about the condition of student of different schools. This work enables government planning and helps them to make policies regarding this issue. It helps to launch different awareness programme about their health hygiene. Therefore, this study aimed to determine the prevalence of intestinal parasites and correlates with different hygienic practices.

MATERIALS AND METHODS

Sampling sites and period

Stool samples were collected from two public schools of Kathmandu district from May to June, 2018.

Laboratory analysis

The experiments were conducted in Microbiology laboratory of GoldenGate International College. A total of 165 stool sampes collected from two schools of Kathmandu were assessed for intestinal parasites. The samples were immediately transported to Microbiology laboratory of GoldenGate International College and Macroscopic examination was performed for obsrving colour, consistency, presence of blood, mucus, worms, segments in stool sample. However, the observation was not included in the result. The collected samples were preserved using 10% formalin solution and stored in cold and humid condition. Following this, Direct Microscopy was performed using Iodine mounting and observed under 10X and then 40X. Samples were subjected to Concentration method by Formol ether Sedimentation technique and pellet was observed microscopically under 10X and 40X after iodine mounting. Modified Ziehl-Neelsen Staining was performed for confirmation of Coccidian parasites.

Data analysis

Demographic and laboratory data were entered into an excel sheet and analysed using SPSS.

RESULTS

General distribution of intestinal parasites

This study included a total of 200 students of two schools. Among them, only 165 (82.5%) participants followed up with the stool sample. Of them 89 (53.9%) were males and 76 (46.1%) were females.

The study was conducted among the students of two schools. The age of the students ranged from 7-15 years. The intestinal parasites were detected in 28 (16.9%) samples and among them, 13 (46.4%) were protozoa and 15 (53.6%) were helminthes.

Distribution of individual intestinal parasites

A total of nine different parasites were recorded in the study. Among them, *Taenia* spp 5 (17.85%) for helminthes and *G. lamblia* 5 (17.85%) for protozoans was dominant which was followed by *A. lumbricoides*, *Blastocystis* spp, *Entamoeba coli*, *E. vermicularis*, *Strongoloides* spp, *H. diminuta*, *C. parvum*. The least dominant organism for helminthes was *H. diminuta* (3.58%), for protozoans *C. parvum* (3.58%).

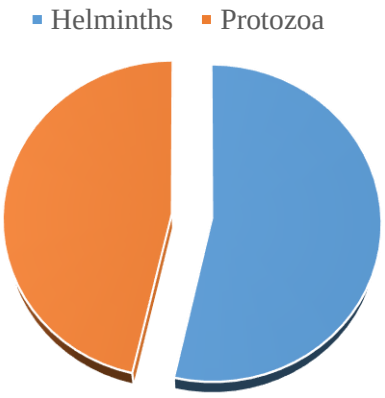

Figure 1: Distribution of parasites

Table 1: Distribution of individual intestinal parasites

Parasites	Number (%)
Helminthes	
Hymenolepis diminuta	1(3.58)
Ascaris lumbricoides	4(14.29)
Enterobius vermicularis	3(10.71)
Strongoloides spp	2(7.14)
Taenia spp	5(17.85)
Subtotal	15(53.57)
Protozoan	
Blastocystis spp	4(14.29)
Giardia lamblia	5(17.85)
Cryptosporodium parvum	1(3.58)
Entamoeba coli	3(10.71)
Subtotal	13(46.43)
Total	28(100)

Sex-wise distribution of students with parasites

Among the participants, more females were infected with intestinal parasite than male. Out of 76 female samples studied, 15 samples (19.73%) yielded parasites. On the contrary, only 13 samples from 89 male participants (14.6%) were found to be positive.

Table 2: Sex-wise distribution of students with parasites

Sex	Total number	Positive (%)
Male	89	13 (14.6)
Female	76	15 (19.7)
Total	165	28 (16.97)

Age-wise distribution of infected students

The distribution of intestinal parasites was higher in the students of age group 13-15 years. Out of 13 students in the age group of 13-15 years, 3 (23.1%) students showed positive results of intestinal parasites where as in the age group 7-9 years, 9 (21.96%) students showed positive results. However, the age group of 10-12 years, 16/ (14.54%) students showed the positive result and least among all the age group.

Table 3: Age wise distribution of infected students

Age group (years)	Total number	Positive (%)
7-9	41	9 (21.9)
10-12	111	16 (14.5)
13-15	13	3 (23.1)
Total	165	28 (16.97)

Distribution of individual parasites according to age group of students

Out of the 28 positive samples of the parasites, age group 10-12 years students showed 16 number of parasites. On the other hand, the age group 7-9 years students showed 9 parasites, whereas age group 13-15 showed 3 parasites and this age group had least number of parasites among all age group. *A. lumbricoides* 4/16(25%) was found to be the most dominant parasite followed by *Taenia* spp 3/16 (18.7%) and *G. lamblia* 3 /16 (18.7%) in the age group 10-12 years. Similarly, single isolates of all the eight species except *A. lumbricoides* 0/9 (0%) were detected in the stool samples of age group 7-9 years. Single isolates of *Strongoloides* spp, *Tenia* spp, *Blastocystis* spp only were detected from the stool samples in the age group 13-15 years.

Distribution of intestinal parasite according to types of drinking water

The distribution of parasites was higher among the students who drank water without treatment. Of the 165 students studied, 69 (41.81%) drank water without any treatment, 26 (15.75%) drank water after boiling and 70 (42.42%) drank water after filtering. Out of 28 intestinal parasites, 14/69 (20.3%) students showed the positive cases i.e. who drank water without treating followed by 13/70 (17.1%) students who filtered before drinking. The students who drank water after boiling 1/26 (3.8%) showed less distribution of parasites.

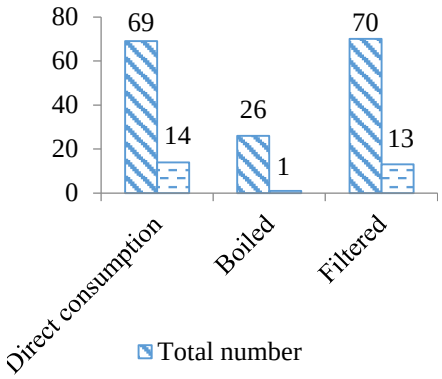

Figure 2: Distribution of intestinal parasites according to types of drinking water

Distribution of intestinal parasites according to hand washing before eating

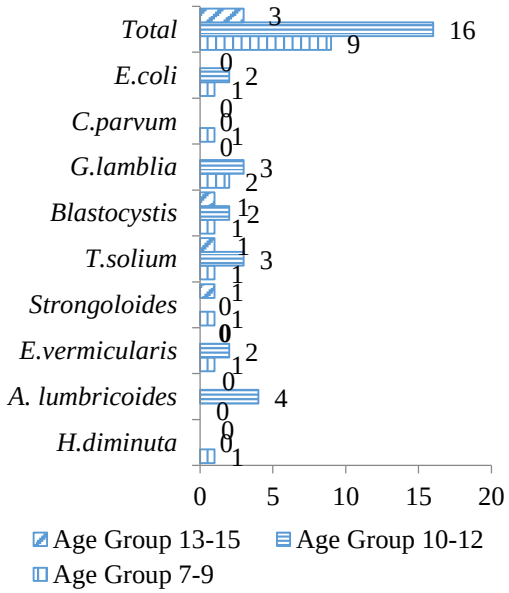

Figure 1: Distribution of intestinal parasites according to the age-group of students

The distribution of parasites was higher in the students who washed hands only with water on the basis of hand washing habits before eating. Out of 165 students, 80 (48.48%) washed hands only with water before eating, 30 (18.18%) washed hands with soap only sometimes before eating and 55 (33.34%) washed hands with soap and water every time before eating. The distribution of intestinal parasite was higher in the student who washed their hands only with water i.e. 15/80 (18.7%), which was followed by the students who washed their hands sometimes with soap i.e. 5/30 (16.6%) and the distribution was lowest in the student who washed their hand always with soap i.e. 8/55 (14.5%).

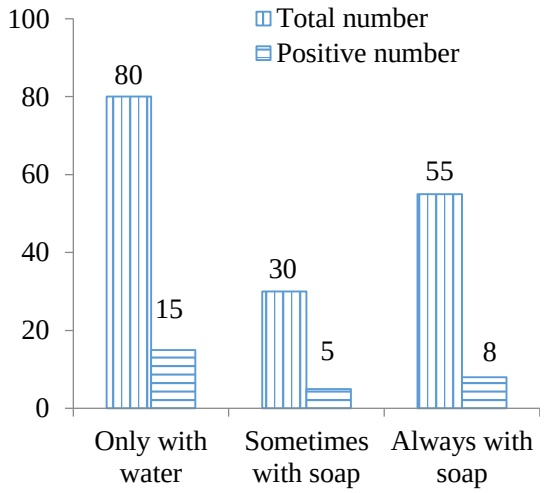

Figure 2: Distribution of intestinal parasites according to hand washing before eating

Distribution of intestinal parasites according to nail hygiene

Of the 165 students studied, 89 (53.93%) students never bite their nail and 76 (46.06%) students bite their nail sometimes. The distribution of parasites was higher among the students who bite their nail sometimes 15/76 (19.7%) as compared to the student who never bite their nail 13/89 (14.6%).

Distribution of intestinal parasites according to education of mother

Out of 165 students studied, the mothers of 86 (52.12%) students could not read and write, the mothers of 64 (38.78%) students had school level education and mothers of 15 (9.09%) had higher secondary level education.

The distribution of intestinal parasite was higher in the students whose mothers could not read and write 16/86 (18.6%), followed by the students whose mothers had school level education 10/64 (15.6%). However, the students whose mothers were educated till higher secondary level were the least infected 2/15 (13.3%).

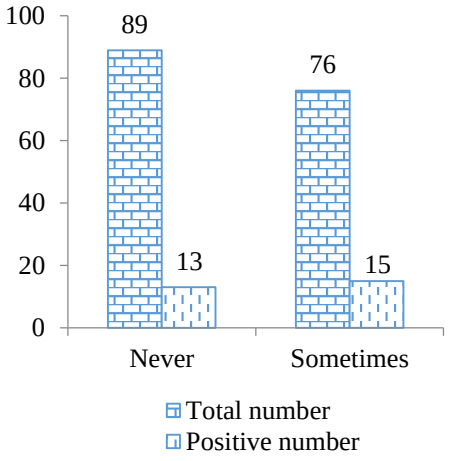

Figure 5: Distribution of intestinal parasites according to nail hygiene

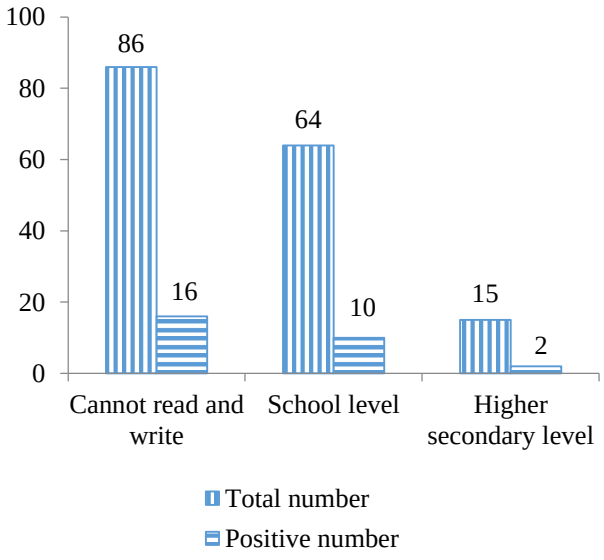

Figure 6: Distribution of intestinal parasites according to education of mother

DISCUSSION

The study presented that 16.96% of the students were detected in two schools of Kathmandu. This result was comparable to a study done by Sah et al (2016) in Biratnagar in which worm infection was found to be 15.5%. Another study conducted among the school going

children of Pokhara also had similar result i.e. 15% (Khadka et al 2013) distribution of parasites. However, the rate was lower in comparison to the study conducted by Avhad et al (2012) in Aurangabad district, Maharashtra state, India (49.38%),

A total of 46.42% parasites were protozoan and 53.57% were helminthic. Sharma et al (2004) found the prevalence of helminthes infection was 76.9% and that of protozoa was 23.1%. However, the results of Easow et al (2005) reveal that protozoa was dominant which is in contrast to the current study. The high prevalence of helminthic parasites is directly associated with unhealthy lifestyles or practices which can be linked to lack of awareness, socioeconomic conditions, awareness, and supply of drinking water (Khadka et al 2013; Sah et al 2016).

Out of the nine different parasites detected in the stool samples, *G. lamblia* (17.85%) and *T. solium* (17.8%) were dominant among protozoa and helminthes respectively. The result is in coherence with the findings of Easow et al (2005) which also revealed *G.* lamblia (73.4%) as the main intestinal parasite which is the most common causative agent of diarrhea in Nepal (Hashmey et al 1996). However, *C. parvum* (32.16%) was found to be predominant as per the study by Sherchand et al (2010) which was the lowest in this study. The detection of *C. parvum* is significant as it affects immune-competent individuals (Sharma et al 2007). Though not predominant, the rate of detection of *E. coli* (10.71%) was comparable to the finding of Sharma et al (2004).

The distribution of intestinal parasites was found to be higher among females (19.73%). This result is similar to the study conducted in Chitwan where 24.8% (34/149) females and 21.8% (32/147) males showed the distribution of parasite (Bhattachan et al 2015). The reason for greater distribution of parasites among females may be because of our conservative society where females working with household and soil related work is a general trend (Rai et al 2017). Nonetheless, there wasn't significant difference between the distribution of intestinal parasites in male and female. However, the study conducted in Dharan showed higher distribution of infection in male (12.4%) than in female (10.1%) (Sah et al 2013). A study by Wani et al (2010) also showed that 78.1% males were likely to be affected by worms as compared to 70.2% females which suggests that gender may not be significantly associated with the parasitosis. The increased prevalence parasitic infection in females than males may be due to difference in the family preferences for their bringing up. Almost all the opportunities are preferentially given to male children. On the other hand, in many rural areas, girls are not enrolled in school and their job at home is to look after their younger siblings and help in house hold works. (Sah et al 2016).

The detection of parasites was higher among the students below 12 years which is in agreement with the study conducted by Sherchand et al (2010) in which occurrence of parasitic infection was highest in age group 8-12 years (58.8%) followed by 5-8 years (53.3%). The distribution of parasitic infection was found higher in age group less than 10 years in the study done by Poudyal et al (2006). The students in the younger age often spend their time outdoors playing in sand or eating with unwashed, dirty hands. However, the students above 15 years are usually more conscious about their hygiene, cleanliness, and sanitation. Likewise, literacy of parents as well as socio-economic condition of the family can also impact on the distribution of parasite (Javaid et al 2016).

The distribution of intestinal parasite was significantly higher among the students drinking untreated water (20.3%) as compared to those drinking treated water (18.6%). It is comparable to the study conducted in Dharan by Sah et al (2013 a) which also showed higher distribution of parasite among the students drinking untreated water (12%) as compared to those drinking treated water (11.2%). In addition to this, the results of a study conducted by Shakya et al (2012) in Nepal also showed the rate of parasitic infection was higher among the children drinking untreated water (15%) than those drinking treated water (5.5%). Another study showed that the distribution of parasite among the children drinking untreated water was higher (21.1%) in comparison to those drinking treated water (4.5%) (Sah et al 2016). The increasing pollution in water resources might lead to the presence of different types of parasites in untreated water that directly goes inside a person's body. This might be the reason for higher occurrence of intestinal parasites in students drinking untreated water (20.28%).

The results of this study recorded higher distribution of

parasites among the students who washed their hands only with water (18.75%). A similar result was obtained in a study conducted by Tadesse (2005) in which higher rate of parasitic infection was observed among children who didn't wash their hands regularly before meals. The high distribution of intestinal parasite among those students may be because of faeco-oral route associated with contaminated hands as water may not flush the parasites effectively (Tiwari et al 2013). Lower prevalence of parasitic infection (6.3%) was observed in children using soap and water before meal (Sah et al 2013 b) which is similar to our result which showed 14.54% of the students who washed hands with soap and water before eating were affected with parasitic infection.

The distribution of intestinal parasite was higher in students who bit their nail sometimes (19.73%) than the students who never bite their nail. Finger sucking habit and unwashed hands may transfer the parasites to the mouth and ultimately result in the infection (Sah et al 2016). This result is similar to the study by Sah et al (2016) in which prevalence of parasitic infection was significantly higher (56.5%) among students having nail biting habits than those who didn't bite their nails (18.3%). This is also in harmony to other studies conducted by Sah et al (2013 a) in Dharan where the parasite infection rate among the nail biting students were found to be 13.6% and 32.5% respectively. Similarly, the distribution of intestinal parasites was higher among the student whose nail was not clean and doesn't cut their nail regularly (21.7%) than those who cut their nail regularly (6.2%) (Sah et al 2016). Another result also showed that children who did not trim their nail had higher distribution of intestinal parasites (33.3%) than the children who trimmed their nail (16.7%) (Shrestha et al 2012).

Higher infection rate was recorded among the students whose mother couldn't read and write (18.6%) than the students whose mother were educated. A similar result was seen in a study by Sah et al (2016) where parasitic infection was higher in children whose mothers had education below School Leaving Certificate (16.9%) than School Leaving Certificate (SLC) pass and above (5.6%). Likewise, in another study, the results showed that children of illiterate parents (16.7%) were more infected than those of literate ones (Shakya et al 2012).

Chakraborty et al (2004) suggested that there was decreased rate of worm infection among the children with the increasing educational status of their mother. Therefore, maternal education has been found to be the most important risk factor for parasitism in other studies as well (Toma et al 1999; Phiri et al 2000; Quihui et al 2006) because higher amount of time spent by a mother in household activities is directly related to better health of children.

CONCLUSION

Parasites have widespread effect on mental and behavioral functions of children. In this study, distribution of intestinal parasites is relatively low. Out of 165 total students, 28 (16.96%) samples were positive and nine different intestinal parasites were detected out of which helminthes were found to be higher. *Taenia* spp *and* *Giardia lamblia* were the most common helminthes and protozoa respectively. Females showed higher infestation than male. Intestinal parasite is still a major health problem among the school going children. Parasites disturb healthy life and development in hundreds of millions of individuals throughout the world. Various human populations are at serious risk of illness and even death from parasites. It should be taken into account that medically important parasites infect human hosts and cause debilitating effects. So the concerned authority should take responsibility to cope with this infestation.

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CONFLICT OF INTEREST

Authors declared no conflict f interest.

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