Prevalence of Intestinal Worm Infestation and its Associated factors among Children in Rural Village of Eastern Nepal: A community based study

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ABSTRACT

Introduction: Parasitic diseases have been with mankind since time immemorial and even today they are important obstacles to the development of economically less favoured countries. According to the World Health Organization estimates, 870 million children live in the areas highly prevalent to them. The prevalence varies in Nepal from 13%-81% even up to 100% in some rural areas. Periodic community based surveys are important to assess the intensity of infection and foster the preventive strategies.

Method: A community based qualitative and quantitative cross sectional study was carried out in the department of Microbiology, Nobel Medical College from May 2022 to Dec 2022. The data was collected using various questionnaires and then plastic containers were distributed to bring stool sample for examination using standard methodology.

Result: Among 200 samples, 38 (19%) showed parasitic infections in which 17% showed single and 2% showed mixed parasitic infection. The highest prevalence of parasitic infection was seen in age between 5-10 years and males outnumbered females (M:F=1.7:1). The majority of them were helminths and high prevalence of intestinal parasitic infection was seen in participants who had gastrointestinal symptoms, hand-washing without soap; irregular/no nail trimming, water without purifying and those who missed biannual deworming.

Conclusion: The present study reveals high prevalence of intestinal worms in the study population which indicates living conditions and low standards of sanitation in the society and calls for long term control measures to improve their living conditions, including treatment of the infected individuals.

Keywords: *Ascaris lumbricoides*; Microscopy; Parasites; Prevalence; Sanitation

Introduction

Parasitic diseases have been with mankind since time immemorial and they are important obstacles to the developing countries.[1] The current assessments suggest that at least one third of the total population in the world is infected with intestinal parasites.[2] In addition, poverty, malnutrition, high population density, the unavailability of portable water, low health status and a lack of personal hygiene provide optimal conditions for the growth and transmission of intestinal parasites.[3] The most affected regions of the world include Africa, South Asia, and South America.[1, 2, 4] The prevalence of parasitic infections varies with the level of sanitation and is generally higher in the tropics and sub-tropics than in more temperate climates. In addition, poverty, malnutrition, high population density, the unavailability of portable water, lower health status and a lack of personal hygiene provide optimal conditions for the growth and transmission of intestinal parasites.[3] Intestinal parasitic infections have been a common public health problem, particularly in developing nations, where children are more commonly infected resulting in both physical and mental retardation. Intestinal parasites are the leading cause of diarrhoea which is transmitted faeco-orally when we consume contaminated food and water.[5] Most of the intestinal parasitic infections result nutritional stress, abnormal physical growth, anaemia, adverse health, worse school performance and cognitive impairment.[4, 5] The prevalence of the intestinal parasitic infections varied from one region to another and it also depends largely on the diagnostic methods employed and the number of stool examinations.[2] Hence, we aimed to determine the prevalence of intestinal parasitic infection and the factors associated with it among these age groups.

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Methods

A community based qualitative and quantitative (combined) cross sectional study was carried out in the department of microbiology, Nobel medical college from May 2023 to July 2023. This study was started after acquiring approval from Institutional Review Committee of Nobel Medical College and Teaching Hospital. Informed consent was taken from the patient before history taking and sample collection. Children below 18 years of age and willing to participant in the study were included. Age above 18 years and those not willing to participate were excluded.[6] Convenience sampling method was used. The sample size was calculated by using the following formula:

$n= Z^2 \times p \times q/e^2$

$=1.96^2 \times 0.1517x (1-0.1517)/0.05^2$

$=197$

Where,

n= minimum required sample size

Z= 1.96 at 95% Confidence Interval (CI)

p= prevalence taken as 15.17% from published literature.[7]

q= 1-p

e= margin of error, 5%

The calculated sample size was 197 almost equal to 200. The data was collected from the children using various questionnaire and then well labeled, clean, dry, disinfectant free, wide-mouthed plastic containers were distributed to them with instruction requesting them to bring about 20 gm stool sample avoiding contamination of urine, water and other substances in a container. Single specimen was collected from each individual. The slide was prepared by using Normal saline, Lugol's Iodine and the Formal-Ether concentration technique was performed for those cases which were negative by saline and iodine preparation method. Examination of the wet mount was done by compound microscope. Smear was first observed under low power (10X) then under high power (40X) for examination of ova, cysts, trophozoites and larvae.[1, 8] The collected data were entered in Microsoft Excel 2007 and analyzed by manual calculation.

Results

In our study the total number of stool sample collected were 200, out of which 38 (19%) showed parasitic infections. Among the positive samples, 34 (17%) showed single parasite and 4 (2%) showed mixed parasitic infection.

Of the total single parasite positive samples 7 (3.5%) were protozoa and 27 (13.5%) were helminths and a total of eight helminths were observed in 4 (2%) mixed positive samples (Table 1).

Table 1. Prevalence of intestinal parasite (n = 200).

Types of infections		Positive case
Single	Protozoa	7 (3.5%)
	Helminths	27 (13.5%)
Mixed	Helminths +Helminths	4 (2%)
Total		38 (19%)

Among the samples collected, males outnumbered females (M:F=1.7:1) and out of 128 (64%) male participants and 72 (36%) female participants, 26 (20.31%) and 12 (16.66%) had parasitic infections respectively (Table 2).

Table 2. Distribution of parasites according to sex.

Gender	Total samples	Positive case
Male	128 (64%)	26 (20.31%)
Female	72 (36%)	12 (16.66%)
Total	200 (100%)	38 (19%)

The highest numbers of participant were in age group between 5-10 years that accounts for 60 (30%) with 17 (28.33%) positive samples followed by age group above 15 years that accounts for 58 (29%) with 5 (8.6%) (Table 3).

Table 3. Prevalence of parasitic infection in different age groups.

Age in years	Total samples	Positive case
< 5	52 (26%)	9 (17.3%)
5-10	60 (30%)	17 (28.33%)
11-15	30 (15%)	7 (23.33%)
> 15	58 (29%)	5 (8.6%)
Total	200 (100%)	38 (19%)

The majority of our isolates were helminths which accounts for 35 (17.5%) isolates and among them the most common was *Ascaris lumbricoides* 15 (7.5%) followed by *Trichuris trichiura* 8 (4%) (Table 4).

Table 4. Frequency of parasite detected.

Types of parasite	Total (n=200)	Percentage
Ascaris lumbricoides	15	7.5%
Trichuris trichiura	8 (4%)	4%
Ancylostoma duodenale	8 (4%)	4%
Enterobius vermicularis	4 (2%)	2%
Total Helminths	35 (17.5%)	17.5%
Giardia lamblia	6 (3%)	3%
Entamoeba histolytica	1 (0.5%)	0.5%
Total protozoa	7 (3.5%)	3.5%

Out of total cases, 85 (42.5%) had gastrointestinal symptoms in which 17 (20%) had parasitic infections and 115 (57.5%) were asymptomatic which showed 21(18.26%) positive cases. Among 200 cases interviewed, participants with hand-washing habits before meal with soap and water were less likely to have intestinal parasitic infection (12.5%) as compared to those without soap and water (30.5%). Out of 98 (49%) participants with nail trimming, 10 (10.2%) samples showed intestinal parasitic infection and among 102 cases with irregular/no nail trimming, 22 (27.45%) samples showed intestinal parasitic infection. Children having habit of thumb suckling/nail biting had prevalence of the infections associated with intestinal parasites was 23.8% and those who did not have habit had 18.43% cases of intestinal parasitic infections. Children who used water without purifying for drinking purposes have more cases of intestinal parasites (30.35%) than children who used purified water for drinking (14.58%). Among 56 (28%) barefoot walking children, 19 (24.35%) had parasitic infection and those 122 (61%) children walking with shoes/slippers, 19 (15.57%) had parasitic infection. Out of 142 (71%) children who participated in bimanual deworming, 12 (8.45%) had intestinal parasitic infection and those who missed bimanual deworming (58; 29%), 26 (44.82%) had intestinal parasitic infection (Table 5).

Table 5. Potential risk factors associated with parasitic infection among study population.

Variables	Total samples (n=200)	Positive case
GI symptoms		
Present	85 (42.5%)	17 (20%)
Absent	115 (57.5%)	21 (18.26%)
Nail trimming		
Yes	98 (49%)	10 (10.2%)
No	102 (51%)	28 (27.45%)
Thumb suckling/ nail biting		
Yes	21 (10.5%)	5 (23.8%)
No	179 (89.5%)	33 (18.43%)
Use of purified water		
Yes	144 (72%)	21 (14.58%)
No	56 (28%)	17 (30.35%)
Bare foot walking		
Yes	78 (39%)	19 (24.35%)
No	122 (61%)	19 (15.57%)
Biannual deworming		
Yes	142 (71%)	12 (8.45%)
No	58 (29%)	26 (44.82%)

Discussion

The prevalence of intestinal parasite in this study was 19% which was similar to previous studies.[6,9,10] However, in some studies prevalence was found to be higher than in our study.[3, 5, 11] Similarly, the prevalence of intestinal parasitic infection in some studies was lower than our studies.[7, 12, 13] These differences in prevalence might be related to multiple factors of our living society like geographic areas, seasonal variation, economic status, occupation, hygiene condition, the facility of toilets at home, washing hands after defecating/before eating, living in mud house, walking barefoot , living in overcrowded house, practicing open defecation, personal habits and drinking water.[5,14,15]

There was more number of positive samples with single parasitic infection (17%) than the mixed one (2%) which was in agreement with most studies.[7,12,16] Low prevalence of mixed parasitic infection might be due to increasing awareness about health and hygiene among the people[17].

This study reported a higher prevalence rate of parasitic infection in male (20.31%) than in female (16.66%). Similar findings were reported by other studies.[9, 11, 16, 18, 19] However, KC et al. in 2019 reported that the prevalence was almost equal in both males and females.[17] But some of the studies showed higher prevalence of parasitic infection in females than males which were not in agreement to this present study.[6, 13] Although intestinal worm infestation is gender independent, difference in prevalence among boys and girls found in the study might be related to personal hygiene or may be affected by different socioeconomic aspects of places.[12, 18]

Concerning the relation of age group and parasite infection, our study revealed the highest numbers of participant were in the group between 5-10 years (28.33%) which is in accordance with study done by Rai et al.[8] The lowest prevalence was in the age group below 5 years (17.3%) and above 15 years (8.6%). Although study done by Dahal et al. found that the lowest prevalence of intestinal parasitic infection was in age group above 15 years which was in agreement with our study but highest in age group below 5 years.[6] In our study, it may be due to the fact that very young children are usually under the direct observation of their parents that resulted into low prevalence of parasitic infection where as primary school children are seldom under the control of their parents, play much outdoor games and also they do not have knowledge regarding parasitic infection, unhygienic behavior, lack of sanitation and contaminated food and water. Relatively low parasitic infection was found among elder children in our study might be due to their hygienic behavior, knowledge of sanitation and use of clean food and water.[6, 16]

A total of 6 species of intestinal parasites were identified. Among them, 35 (17.5%) were helminths and 7 (3.5%) were protozoan parasites. The prevalence of helminthic parasites infection was higher than that of protozoan and Ascaris lumbricoides (7.5%) was the commonest intestinal parasite isolated which is comparable to other studies. [6, 12, 19] Similarly, the second most common intestinal parasite isolated in our study was *Trichuris trichiura* (4%) followed by Hook worm (4%), *Giardia lamblia* (3%), *Enterobius vermicularis* (2%) and *Entamoeba histolytica* (0.5%). But in some studies, the cyst of E. histolytica was predominant followed by cyst of G. lamblia.[7, 16, 20] It may be associated with the poor sanitation, low socio-economic status in the community, ingesting of eggs through faeco-oral route, poor personal hygiene and poor environmental hygiene that contribute to high prevalence of helminths among the children.[11]

In the present study, higher prevalence of intestinal parasitic infection were observed in the participants who reported the gastrointestinal symptoms like abdominal pain, abdominal discomfort, nausea, vomiting and diarrhoea than the participants who did not have gastrointestinal symptoms. This is in accordance to other studies carried out in Nepal.[13, 16]

Participants with hand-washing habits before meal with soap and water were less likely to have intestinal parasitic infection (12.5%) as compared to those without soap and water (30.5%). Similar findings were also reported from different places where children with no hand washing habits were at higher risk of intestinal parasites infection.[12, 17] Children who play outdoors and do not wash hands before meals and after using toilets have very high chances to come in contact with parasites.[5,12] Therefore, appropriate hand-washing habit especially in school aged children, with an adequate frequency, is considered as an essential preventive measure to protect from many infectious diseases including intestinal parasitic infections.[5]

The study also found higher prevalence of intestinal parasites infection in the participants who had not trimmed their nails during our examination (27.45%) in comparison to children who had trimmed their nails

(10.2%). Similar findings were also reported elsewhere.[15, 16] This is due to the playing habits of children with soil, poor socioeconomic status and poor hygienic practice results accumulated dirt containing eggs of parasites under fingernails. It results in significant source and transmission of parasitic infections.[10] The outcome was in accordance with the studies conducted before by Shrestha et al. which reported that the prevalence rate of parasitosis was significantly more in participants who had habit of nail biting and thumb suckling. The nail-biting habit accounts for autoinfection and induces long-term parasitosis in children.[12]

The highest number of intestinal parasitic infections was seen in children drinking unpurified water (30.35%) and less among those drinking filtered or boiled water (14.58%). The outcome was in accordance with the study conducted before which reported that the prevalence rate of parasitosis was significantly more in children drinking unpurified water.[16, 17] Most of the parasites are soil transmitted and mainly transmitted by faeco-oral route. The quality of drinking water used for drinking and other domestic purpose is an important source of intestinal parasitic infection. The contamination of drinking water sources due to open defecation, flood during rainy season, and disposal of human and animal wastes directly into rivers can be possible causes for higher cases of parasitic infections among untreated water consumers.[12]

Our study revealed that walking barefoot is a risk factor for having increased soil transmitted helminthes infection. Similar results have been reported from other studies.[12, 15] Walking barefoot is especially a risk factor for hookworms, as their larvae in the soil can penetrate into unbroken skin. Although walking barefoot is not directly related to infections of other helminths, but it indirectly leads to the infection when child touches the contaminated feet and eat with unwashed hands afterwards.[15] Prevalence of Intestinal parasitic infection among children who did not consume albendazole was found to be five times higher than children who had taken albendazole. Other study also reported that the rate of parasitic infection was more among children who were not received antiparasitic drugs.[1, 12] These children would act as a carrier for parasitic infection and tend to spread the infection in the community.[20] Indeed, study concluded by Nanthavong et al. found that the rate of prevalence of parasitosis among children was significantly decreased after the implementation of a biannual deworming program.[22] The mass deworming program in eradicating parasitosis in children with improvement in sanitary conditions, sanitary habits, and good environments decrease high infection and reinfection rates of parasitic infections in children.[12]

Conclusion

The present study reveals high prevalence of intestinal worms in the participants which is an indicator of poor living conditions and low standards of sanitation in a society and calls for long term control measures to improve their living conditions, including treatment of infected individuals. Effort to reduce transmission by improving sanitation, and health education should be considered. Regular surveys regarding the prevalence of intestinal parasites in hospitals and communities should be encouraged as these surveys not only give an estimate of prevalence of particular parasite, but also serve as an index of the communities' progress towards effective sanitation.

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