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Original paper

Prevalence of intestinal parasites in Deula community, Kirtipur Municipality, Kathmandu, Nepal

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ABSTRACT. Infections with intestinal protozoans, helminths, and other parasites are major, but overlocked problems in developing countries. Accurate surveys of intestinal parasites in Deula community inform empirical treatment regimens and can assess the impact of community-based drug treatment programs. There is limited information on this topic in Nepal. In a prospective study of intestinal parasites in symptomatic people of the Deula community, January–July 2018, samples were examined by microscopy of a direct and concentrated faecal sample. We studied 150 samples. The median (inter-quartile range) age of the people was 34.5 (16–50.5) years, 52% were female and 48% were male. The proportion of people with abdominal pain was 30.39%, diarrhea 42.16%, anemia 14.71% and malnutrition 3.92%. Altogether 102 (68%) parasitic infections were detected. The most common parasites using all methods of detection were *Entamoeba histolytica* (35.30%), *Giardia lamblia* (21.57%), *Trichuris trichiura* (14.71%), hookworm (13.73%), *Ascaris lumbricoides* (7.84%) and *Strongyloides stercoralis* (6.85%). *E. histolytica* was most common, followed by *G. lamblia* in all age groups, *T. trichiura* and *A. lumbricoides*. Hookworm and *S. stercoralis* were more common with increasing age. This study substantiate the significance of intestinal parasitic infections in indicative Deula community and the need for adequate facilities for laboratory diagnosis together with education to improve personal hygiene and sanitation.

Keywords: helminths, protozoans, intestinal parasites, Deula community, Kirtipur

Introduction

Intestinal parasitic infections are among the major public and socioeconomic concerns that have unpleasantly affected the well-being of the underprivileged in developing countries as they can lead to ill health and death [1]. An estimated one billion people in sub-Saharan Africa, Asia, and the Americas are infected with one or more types of helminth [2,3]. This includes 576–740 million people infected with hookworm [4,5] and 30–100 million people infected with *Strongyloides stercoralis* [6]. Although mortality due to soil-transmitted helminth (STH) infections are revealed to be extensively distributed by studies in several rural areas of Nepal where lack of education and public awareness, open defecation and lack of safe drinking water as well as poverty are prevalent [7]. STH infections have detrimental effects on nutrition, growth, and cognitive development, contribute substantially to anemia, increase the burden of poverty, impair mental and educational development and damage economic productivity [6,8]. Climate enhances the transmission of these infections, with sufficient moisture and warm temperature essential for the molting of larva in the soil [9]. Protozoa and helminths are commonly familiar to cause enteric parasitic infections. It has been predicted that *Trichuris trichiura*, hookworm, and *Ascaris lumbricoides* infect, 1,050 million, 1,300 million and 1,450 million people worldwide, respectively, while schistosomosis affects over 200 million people [10].

Furthermore, all over the world there are about two billion individuals were infected with gastrointestinal parasites; out of these majorities were concerned in children due to malnutrition [11,12]. Children are particularly vulnerable to GI parasites and carry higher loads of parasites in them [13]. Nepal has some of the poor health indicators in

Figure 1. Map of Nepal (left) and Kirtipur municipality (right)

the South Asia region, with high rates of malnutrition [14]. Slightly more than a half of the population have access to basic sanitation facilities [15] and still, river water is the main source of water for some households [16]. Infection with intestinal parasites is all over, with infections keep going due to poverty. A limited number of studies have described the more general burden of gastrointestinal parasites in Nepal [17,18] but local data are limited by a lack of diagnostic microbiology facilities.

More than half population of the world reportedly lives in misery and discomfort and suffers vast financial loss attributed to parasitosis alone [19]. Intestinal parasitosis seems to be one of the foremost health problem among Deula community in study area as well. So, the main aim of this research work was to inspect whether the intestinal parasites are more prevalent among the Deula community of Kirtipur Municipality, Kathmandu, Nepal.

Materials and Methods

Study area

Kirtipur is an ancient city located in the southwestern part of Kathmandu valley and is 5 km apart from central Kathmandu. The study was performed in the Deula community of Kirtipur municipality–9 (Fig. 1). The total population of Kirtipur is 68,000 and only Deula community consists of 324 population [20]. Most of the people (family heads) are engaging in toilet cleaning in other locality as their profession and their family is uneducated. Despite of their profession, the sanitary system in their own locality is unmanaged and their children are found playing in the dirt all the times.

Study setting

This was a prospective study of symptomatic people in Kirtipur municipality–9, between 3rd January and 29th July, 2018. Clinical, demographic, and epidemiological records were collected from the people attending physician, clinical and demographic information on a standard form including age, gender, the presence of diarrhea (duration if positive), abdominal pain (together with duration), anemia, and malnutrition, weight, and severe clinical situation. Potential risk factors for infection were also recorded including the number of people living in the household (below 16 years old, those 16–60 years and above 60 years old), the occurrence of domestic pets-animals (specifically: cat, dog, bird or other), the being of livestock (chickens, pigs, cows or other), the presence of water at the house, the type of water regularly used (river, rain, city water, well, pond or bottled water), whether the detergent was used to clean hands (always, sometimes or never), where the family defecates (in a toilet, in the soil, outside the house or in the river), whether the patient is at school and wore shoes.

The systematic random sampling technique was applied in the selection of individuals for the sample and data collection from the Deula community of the selected area. The people were taught in brief about the importance of the examination of the stool to detect the parasite and how to collect stool samples with the aid of their family members. After the proper

Table 1. Sex-wise prevalence of the parasite in Deula community

Sex	No. of samples examined	Positive cases n (%)	Negative cases n (%)	χ^2	*P*-value
Male	72	42 (58.33)	30 (41.67)	0.25986	0.6102
Female	78	60 (76.92)	18 (23.08)		

instruction for the stool sample collection method, labeled collection vials and application sticks were provided to them. Everyone was instructed to collect about 10 gram of fresh stool. Labeling and quantity were checked in every specimen. 2.5% potassium-dichromate solution was used to preserve the portion of stool samples and brought to the laboratory at Central Department of Zoology, then immediately processed to find cysts, trophozoites, eggs, and larva of intestinal parasites by direct smear method [21] and concentration method [22].

The direct smear examination was done for the observation and identification of different helminth eggs or larva and protozoal cysts, oocyts, trophozoites by wet preparation i.e. unstained smear preparation and a stained smear preparation [21]. Unstained smear preparation of sample was prepared by taking a drop of normal saline in a clean glass and 1–2 drops of stool sample was mixed over it making its consistency thin and clear, then observed under the microscope [21]. To prepare stained smear sample, a drop of diluted Lugol's iodine solution was kept in a glass slide and mixed 1–2 drops of stool sample with it. The preparation was then observed under the microscope [21]. Furthermore, in addition to the direct stool smear preparation and examination method, for some confusing samples, an indirect method of examination was also used. The faecal samples were coprological examined by concentration technique (floatation and sedimentation). A beaker was used where nearly 42 ml of water was mixed with about 3 grams of faecal sample and then filtered. For around 5 minutes, the filtrate solution was centrifuged. The NaCl solution was applied to saturate the filtrate and again centrifuged. The mixture from the top was examined by adding methylene blue and the sediment was stained with an iodine solution to detect eggs, trophozoites, and cysts of parasites [22,23].

Calibration of eggs, cysts and larva

Ocular and stage micrometer was used for calibration of length, breadth and diameter of parasites eggs, cysts and larva. They were measured with the calibration factors.

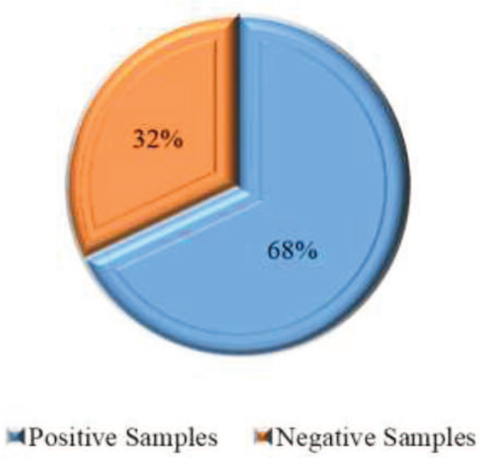

Figure 2. General prevalence of intestinal parasites

Calibration Factor (C.F.) for 10×=10.37 micrometer
Calibration Factor (C.F.) for 40×=2.588 micrometer

Identification of the eggs, cysts and larva

The identification and confirmation of the eggs, cysts, and larva were made by comparing the structure, color, size of eggs, cysts and larva from published books, literature, and journals [24].

Statistical analysis

The collected data from the field survey and laboratory reports were statistically analyzed with the help of Microsoft Excel 2016 and Pearson's Chi-squared test performed by 'R' 4.0.2 version software package [25]. $P<0.05$ was standard for the statistically analysis.

Results

General prevalence of intestinal parasites

A total of 150 stool samples were collected from the Deula community of Kirtipur Municipality and examined from January to July, 2018. Out of them, 102 samples were positive and 48 samples were negative (Fig. 2). Of the total of 102 positive samples, the distribution of protozoan infection 58 (56.86%) was higher than the helminth infection 44 (43.14%) (Fig. 3).

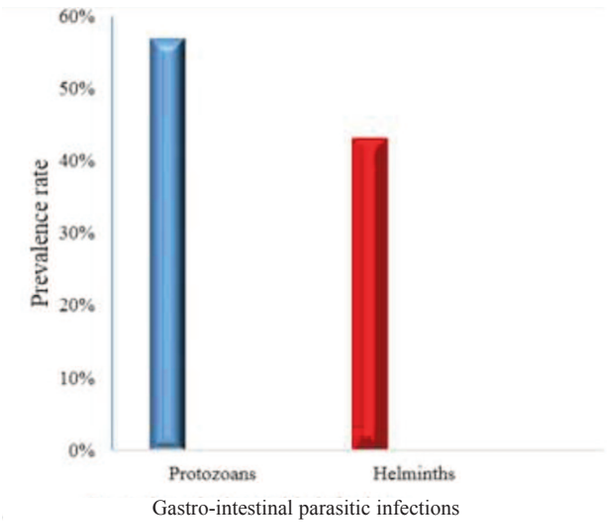

Figure 3. Distribution of protozoan and helminthic infection in Deula community

Sex-wise prevalence of parasites

All samples were categorized into male and female gender groups (Tab. 1). The overall sex-wise prevalence of intestinal parasites was found the highest among females and lowest among males. There were no significant differences in sex between different age groups (P>0.05).

Parasite infections

A total of 102 (68%) parasitic infections were detected in the Deula community (Tab. 2). Parasitic infections were detected in 23.53% of children below 16 years, 59.8% of adults 16–60 years, and 16.67% of old aged above 60 years. *E. histolytica* (35.29%) were the most common and *S. stercoralis* (6.86%) least common parasites detected in all age groups. The proportion of people positive for all gastro-intestinal parasites increased with increasing age (except old age) (P<0.005).

Multiple parasites (polyparasitism)

Out of 102 positive samples for any parasite type: a single parasite type was present in 71 samples (69.61%); two parasite types in 24 samples (23.53%); three types in 6 samples (5.88%); and four types in a single sample (0.98%) (Tab. 3). The most common multiple infections were combinations of *E. histolytica*, *G. lamblia*, *T. trichiura* and hookworm.

Demographic, clinical and epidemiological data

The median (interquartile range (IQR)) age of people was 34.5 (16–50.5) years. Diarrhea was present in about half of symptomatic people and was not common among people (P>0.05). Two-thirds of people reported having abdominal pain and this was significantly common in older children (P>0.05). Malnutrition and wasting were common in children (P<0.0001). Kwashiorkor was only present in the below 16 year age group (one patient, 5% of patients aged below 16 years). Dogs and cats were recorded as present in 9.33% and 2.67% of households, respectively. Eighty-four percent of patients had livestock (buffalo, chickens, cattle, chicken, and ducks) living in their household with chicken ownership most common at 72%. Water jar was the main source of water for 86.67% of people, although this was often supplemented by tap water for drinking. Families with younger children were unlikely to wear slippers and least used soap for hand wash (Tab. 4).

Table 2. Gastrointestinal parasites identified in faecal samples

Parasites	All ages	Below 16 year	16–69 year	Above 60 year	*P*-value
Protozoa					
Entamoeba histolytica	36	8 (22.22%)	21 (58.33%)	7 (19.45%)	0.004012
Giardia lamblia	22	6 (27.27%)	14 (63.64%)	2 (9.09%)	0.04505
Helminths					
Trichuris trichura	15	4 (26.67%)	9 (60.00%)	2 (13.33%)	0.182
Hookworm	14	3 (21.43%)	8 (57.14%)	3 (21.43%)	0.103
Ascaris lumbricoides	8	2 (25.00%)	5 (62.50%)	1 (12.50%)	0.3189
Strongyloides stercoralis	7	1 (14.29%)	4 (57.14%)	2 (28.57%)	0.5488
Total	102	24	61	17	

Table 3. Presence of polyparasitism

S.N.	Two parasites	No. of samples	% of + ve cases (n=24)
1.	*E. histolytica* + *G. lamblia*	9	37.50
2.	*E. histolytica* + *T. trichura*	5	20.83
3.	*G. lamblia* + *T. trichura*	5	20.83
4.	*T. trichura* + hookworm	4	16.67
5.	*T. trichura* + *S. stercoralis*	1	4.17
S.N.	Three parasites	No. of samples	% of + ve cases (n=6)
1.	*E. histolytica* + *G. lamblia* + *T. trichura*	5	83.33
2.	*T. trichura* + hookworm + *S. stercoralis*	1	16.67
S.N.	Four parasites	No. of samples	% of + ve cases (n=1)
1	*E. histolytica* + *G. lamblia* + *T. trichura* + *S. stercoralis*	1	100.00

Discussion

The present finding estimated a 68% prevalence rate of GI parasites. This may be due to gastrointestinal parasites as major public and socioeconomic problems in most of the underprivileged and developing countries [1]. This finding can be supported by the findings in rural areas of Southern Nepal with a 58% prevalence rate [26], in suburban public school children in Kathmandu, Nepal with a 40.6% prevalence rate [27], in school children in the northeastern part of Kathmandu valley, Nepal with 66.6% prevalence rate [28], in school children in a public and private school with a 40% prevalence rate [16]. This finding contradicts with prevalence rate reported among school going children in Pokhara, Nepal with a 15% prevalence rate [29], higher than the studies reported in Kathmandu, Nepal with a prevalence rate of 28.5% [7] and in a rural village of Kathmandu valley with prevalence rate 23.7% [30]. The prevalence of infections was higher for protozoans (56.86%) compared to helminths (43.14%). *E. histolytica* noted as the higher rank (35.29%) among all listed parasites. Similar result was also shown by the previous studies [16,31–35]. It is probably due to over distribution of *E. histolytica* and *G. lamblia* cysts in the surroundings and as well as poor hygiene habits facilitating in its chances [16]. Whereas this study depicts helminths infection as less prevalent as only a few numbers of *T. trichiura*, hookworm, *A. lumbricoides* and *S. stercoralis* were recorded. It is supported by some studies [28,36,37] had reported *E. histolytica* as one of the most common protozoan parasites. It is probably due to the consumption of contaminated water, due to close running of the water pipe and sewage line in Kathmandu [37].

Among the identified parasites in the stool samples, gastrointestinal parasites in the Deula community such as protozoans (*E. histolytica* and *G. lamblia*) and helminths (*T. trichiura*, hookworm, *A. lumbricoides* and *S. stercoralis*) were leading, probably due to drinking untreated water, lack of education, poor hygienic environment and underprivileged socio-economic situation of the family. This assumption can be supported by the occurrence of gastrointestinal parasites among the public and private school pupil in a rural area of southern Nepal [26], in suburban public school pupil in Kathmandu, Nepal [27] in the northeastern most part of Kathmandu valley [28], in a countryside of Kathmandu valley [18] and in the pupil in public and private school [16]. Therefore, it seems to be attributed to poor sanitary environment, lack of education, drinking contaminated water, and low socio-economic status of the family [38].

No significant difference was documented in the prevalence of GI parasitic infection among males and females of the Deula community. This finding resembles the parasitic infection in school children in Haiti by [39], in the pupil in Thimi area Kathmandu valley [40]. This finding resembles many studies in Nepal [29–31,41,42]. This enlightens that, both males and females are vulnerable to parasitic infection because the

Table 4. Demographic, clinical and epidemiological details of all of the people studied

Parameters	Age			*P*-value
	Below 16 year	16–60 year	Above 60 year	
Age at sampling (median, IQR), years	6.5 (4–10.5)	26 (19–45)	5 (63–68)	N/A
Clinical syndromes				
Diarrhoea negative	11 (55.00%)	42 (58.33%)	6 (60.00%)	0.738
Diarrhoea positive	9 (45.00%)	30 (41.67%)	4 (40.00%)	
No abdominal pain	13 (65.00%)	50 (69.44%)	8 (80.00%)	0.431
Abdominal pain	7 (35.00%)	22 (30.56%)	2 (20.00%)	
No anemia present	18 (90.00%)	60 (83.31%)	9 (90.00%)	0.5972
Anemia present	2 (10.00%)	12 (16.67%)	1 (10.00%)	
No malnutrition	16 (80.00%)	72 (100%)	15 (100.00%)	1.22×10^{-5}
Malnutrition present	4 (20.00%)	–	–	
No kwashiorkor	19 (95.00%)	–	–	0.0002419
Kwashiorkor present	1 (5.00%)	–	–	
Risk factors				
Two or less adults in household	6 (23.08%)	49 (44.95%)	5 (33.33%)	6.052×10^{-5}
Three or more adults in household	20 (76.92%)	60 (55.05%)	10 (66.67%)	
Domestic animals				
Domestic animals	21 (80.77%)	101 (92.67%)	10 (66.67%)	0.0003571
No domestic animals	5 (19.23%)	8 (7.33%)	5 (33.33%)	
Dog	3 (60.00%)	6 (75.00%)	5 (100.00%)	0.1225
Cat	2 (40.00%)	2 (25.00%)	–	
Main source of water				
Tap water	3 (11.54%)	10 (9.17%)	2 (13.33%)	0.8067
Water jars	23 (88.46%)	99 (90.83%)	13 (86.67%)	
Use of soap for hand wash				
Don’t use	5 (19.23%)	1 (0.92%)	–	4.206×10^{-13}
Always use	15 (57.69%)	105 (96.33%)	13 (86.67%)	
Use sometimes	6 (23.08%)	3 (2.75%)	2 (13.33%)	
Wearing slippers				
Doesn’t wear	12 (46.15%)	2 (1.83%)	4 (26.67%)	2.2×10^{-16}
Wear slippers	14 (53.85%)	107 (98.17%)	11 (73.33%)	
Livestock rearing				
Livestock present	20 (76.92%)	95 (87.16%)	11 (73.33%)	0.08893
No livestock	6 (23.08%)	14 (12.84%)	4 (26.67%)	

infection in an individual is determined by family income, sewage disposal quality, nutritional status, and behavioral characteristics [43–45].

The present finding was maximum for single parasitic infection (69.61%) followed by double parasite types (23.53%), triple parasite types (5.88%); and four parasitic types (0.98%). The given result was in agreement with the studies in Nepal and elsewhere in the world [7,16,46–49]. In contrast, some studies had reported a higher prevalence of multiple infections [28,50]. In this study, *E. histolytica* + *G. lamblia* (37.50%) was documented as prevalent in total double parasitic infections. A study among school children [46] had stated a higher rate of infection due to *A. lumbricoides* + hookworm, which is the opposite to the present finding.

The study was limited as only a single stool sample was examined from most of the people [51]. In addition, due to lack of adequate methods which could have increased the numbers of faecal parasites availability, improved detection of mixed infections, and allowed for parasite species [52]. Our findings do not imply causation of disease in this population, as we did not perform a case-control study comparing the prevalence of parasites in symptomatic and asymptomatic people from similar demographic settings. Case-control research might also clarify the significance of risk and protective factors. However, other studies support a pathogenic role for most of these parasites among children in South Asia [53–57].

Entamoeba, *Giardia*, *Trichuris*, *Ascaris*, hookworm, and *Strongyloides* infections were all more common in children with abdominal pain and in children regularly defecating anywhere apart from a toilet (such as the open latrine). All types of infections occurred in all aged people, who drank tap water, in households with domestic animals (cats or dogs), and with cattle/goats, and those who defecated in the open latrine. An association between hookworm infection and living with cattle has been described in Thailand [58]. Specific additional risk factors associated with *S. stercoralis* infection included living with chickens or more significantly cattle and for giardiosis using water from a tap and not washing hands with soap.

In conclusion, almost 68% were recorded as positive cases where protozoan parasitic infection was more prevalent than helminth parasitic infection. Altogether six species of parasites were encountered with *E. histolytica* as the most prevalent GI parasite. The intensity of single infections was more than double infections. The prevalence rate of infection was found higher among the female than in the male. This shows that GI parasitic infections are still prevalent as a major health problem among Deula communities. Transmissions of infections were generally due to poor sanitary habits, use contaminated water, somewhat lack of knowledge related to infections, etc.

Based on the results, discussions, and conclusions derived from the present study, following recommendations have been suggested for the effective control of intestinal parasites among the Deula community of Kirtipur Municipality, Kathmandu.

There is higher prevalence of intestinal parasites due to lack of personal hygiene, open defecation, use of contaminated food, water and soil, etc. Thus proper personal hygiene, education, awareness programs should be conducted.

Molecular study should be done for the identification of parasites in species level.

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