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A Study of Prevalence of Intestinal Protozoan Infections and Associated Risk Factors among the School Children of Biratnagar Submetropolitan, Eastern Region of Nepal

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ABSTRACT

Introduction: Intestinal Protozoan infections remain a public health problem in low-income and middle-income settings of tropical and subtropical zones however epidemiological evidence is scarce in urban areas. **Objectives:** To measure the prevalence of intestinal protozoan infections and to identify risk factors associated with protozoan infections among the school children of Biratnagar. **Materials and Methods:** The cross-sectional study was conducted in Grade VI, VII and VIII in Government and private schools of Biratnagar. Stratified random sampling method was applied to choose the schools and the study subjects. The Chi-square test was used to measure the association of risk factors and protozoan infections. **Results:** Overall prevalence of intestinal protozoan infections among the school children was 20.0 percent. Giardia lamblia was seen high (12.5%) in comparison to Entamoeba histolytica (7.5%). The prevalence of protozoan infection was seen slightly higher in male (20.7%) than female (19.1%) but the difference was not significant. The protozoan infection was higher among children whose mother was illiterate (26.9%) than below School Leaving Certificate (SLC) (18.5%) and SLC pass and above (11.1%) (P>0.05). The use of soap and water before meal had lower prevalence of protozoan Infections (14.3%) than only use of water (20.2%) (P>0.05). The protozoan infections was also seen lower who wear sandals or shoes (15.1%) than those did not wear (24.3%) (P>0.05). The infection rate was significantly lower among having clean nail (7.5%) than not having clean (28.3%) (P<0.001). The protozoan infection was seen higher among children having the habit of nail biting and thumb sucking but the difference was not significant. **Conclusion:** The prevalence of intestinal protozoan infection was found to be high in school children of Biratnagar and was seen significantly more among populations who have unhygienic skin, nail and clothes cleanliness.

Keywords: Prevalence, Intestinal protozoan infections, Risk factors, School children, Biratnagar

Introduction

Intestinal protozoan infections are fecal-derived diseases known to affect preferably the poorest and deprived communities in low and middle income countries of tropical and subtropical regions[1].The social and environmental conditions in such urbanization type in low income countries can be also ideal for poor hygiene-related protozoan parasitic diseases transmission and persistence in urban areas where overcrowding of neighbourhoods, promiscuity, poor sanitation access and mostly poor hygienic conditions are common[2].Intestinal protozoan infections such as giardiasis and amebiasis are also known to cause considerable morbidity and mortality[3,4].Recent estimates in 2010 indicated that intestinal protozoan infections like amebiasis and giardiasis were found harmful than the most common soil-transmitted helminthiasis [1].The burden of amebiasis was estimated in 2010 at 2.4 DALY greater than the burden of ascariasis alone[1].Amoebic colitis and amoebic liver abscess Entamoeba histolytica is distributed throughout the world, and is a substantial health risk in almost all countries where the barriers between human faeces and food and water are

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inadequate[5].Giardia spp as well as Cryptosporidium spp and Microsporidia infections are known to hinder human health significantly[3,4].Most of the available data on the burden of intestinal parasitic infections worldwide are mostly focused on soil-transmitted helminthes (STH) in rural and urban areas of tropical and subtropical regions while data on intestinal protozoan infections are scarce[6].Therefore the present study was carried out to measure the prevalence of intestinal protozoan infections and to identify risk factors associated with protozoan infections among the school children of Biratnagar Submetropolitan.

Methodology

A cross-sectional study was conducted from 15th March 2015 to 25th August 2015 in Grade VI, VII and VIII in Government and Private Schools of Biratnagar. To represent children for at least 66.2% intestinal parasitic infection, the sample size was calculated as 200 based on prevalence of 66.2%, 95% confidence level and 10% allowable error. The required sample size was 200 children aged 12-16 years (Agbolade OM *et al* in 2007) [7].This research was based on random selection of the study area Biratnagar. Stratified random sampling method was applied to choose the schools and the study subjects. The strata were Government and private schools of Biratnagar. The schools from its strata were chosen randomly on the basis of Government and private ratio. Out of total 167 schools in Biratnagar Submetropolitan, 65 were government (38.9%) and 102 were private schools (61.1%). Children of Grade VI, VII, and VIII were listed first and required sample was chosen randomly from Grade VI, VII and VIII from selected schools. Out of 200, 38.9 percent (78) were taken from Government schools and 61.1 percent (122) were taken from private schools on the basis of probability proportionate to sample size. Study subjects were enrolled till the required sample size was full filled .Ethical clearance was taken by Institutional Ethical Review Board of B P Koirala Institute of Health Sciences, Dharan, Nepal. Written permission was taken from each schools head and parents of each student. Written consent was sent through students for approval of parents and then students were brought that written consent after signature of parents. Students of Grade VI, VII and VIII of both sexes and available after three visits was included in the study. Available after three visits means the students was selected randomly on the basis of Roll No. provided by school. Selected students were followed up to three visits and in the case of unavailability next student was taken.Semi-structured questionnaire was administered to the study subjects and Microscopic examination of stool was done. In each visit more than 20 students was enrolled & same number of plastic bottles was given for stool collection and collected next day morning. Microscopic examination of stool was done by preparing slide using Normal Saline and Lugol's Iodine to observe the ova of different intestinal protozoan parasites. First we used low power lens and afterwards the high power lens. Then we observed ova of different intestinal protozoan parasites [8]. The confidentiality and privacy of the study was maintained; name of the individuals or participating group was not disclose after the study. The prevalence was calculated, Chi-square test was used to measure the association of risk factors and intestinal protozoan parasites. The confidence level was set at 5% in which probability of occurrence by chance is significant if P< 0.05 with 95% Confidence Interval.

Result

Table 1: Distribution of protozoan infection among study population

Characteristics	Frequency	Percent
Protozoa		
Positive	40	20.0
Negative	160	80.0
Total	**200**	**100.0**
Name of protozoa		
Entamoeba histolytica	15	7.5
Giardia Lamblia	25	12.5
Total	**40**	**20.0**

Table 1 shows the status of protozoan infections among the school children of Biratnagar. A total intestinal protozoan infection was found to be 20.0 percent. Giardia lamblia was seen high (12.5%) in comparison to Entamoeba histolytica (7.5%).

Table 2: Association between socio-demographic characteristics with protozoan infections

Characteristics	Protozoa Positive	Protozoa Negative	Total	P-Value
School				
Private	22 (18.0)	100 (82.0)	122	0.384
Government	18 (23.1)	60 (76.9)	78	
Gender				
Male	23 (20.7)	88 (79.3)	111	0.776
Female	17 (19.1)	72 (80.9)	89	
Religion				
Hindu	33 (20.4)	129 (79.6)	162	0.787
Others (Muslim, Buddhist, Christian)	7 (18.4)	31 (81.6)	38	
Ethnicity				
Brahmin/Chhetri	18 (20.5)	70 (79.5)	88	0.801
Kirati	1 (7.7)	12 (92.3)	13	
Janajati	7 (20.0)	28 (80.0)	35	
Dalit	3 (17.6)	14 (82.4)	17	
Terai Caste	11 (23.4)	36 (76.6)	47	
Fathers Education				
Illiterate	5 (15.6)	27 (84.4)	32	0.588
Below SLC	28 (22.2)	98 (77.8)	126	
SLC & above SLC	7 (16.7)	35 (83.3)	42	
Mothers Education				
Illiterate	14 (26.9)	38 (73.1)	52	0.267
Below SLC	24 (18.5)	106 (81.5)	130	
SLC & above SLC	2 (11.1)	16 (88.9)	18	
Total	**40 (20.0)**	**160 (80.0)**	**200**	

SLC: School leaving certificate

The respondents from Government school were found higher protozoan infection than Private school. The prevalence of protozoan infection was seen slightly higher in male than female. The protozoan infection was higher among children whose mother was illiterate than below School Leaving Certificate (SLC), and SLC pass and above. All the variables mentioned in Table 2 were not significant with protozoan infection (P>0.05).

Table 3: Association between personal hygiene and food habit with protozoan infections

Characteristics	Protozoa Positive	Protozoa Negative	Total	P-Value
Source of drinking water at home				
Tap	24 (17.6)	112 (82.4)	136	0.225
Tube well	16 (25.0)	48 (75)	64	
Water treatment at home				
Yes	9 (13.4)	58 (86.6)	67	0.099
No	31 (23.3)	102 (76.7)	133	
Hand wash before meal				
No wash	18 (21.7)	65 (78.3)	83	0.697
Water only	18 (20.2)	71 (79.8)	89	
Soap	4 (14.3)	24 (85.7)	28	
Bath				

Regular	15 (17.9)	69 (82.1)	84	0.519
Irregular	25 (21.6)	91 (78.4)	116	
Hand wash after defecation				
Soap	36 (21.3)	133 (78.7)	169	0.283
Water	4 (12.9)	27 (87.1)	31	
Sandal wear				
Yes	14 (15.1)	79 (84.9)	93	0.103
No	26 (24.3)	81 (75.7)	107	
Skin				
Clean	4 (5.2)	73 (94.8)	77	<0.001
Not clean	36 (29.3)	87 (70.7)	123	
Nail				
Cut clean	6 (7.5)	74 (92.5)	80	<0.001
Uncut & Unclean	34 (28.3)	86 (71.7)	120	
Clothes				
Clean	7 (8.6)	74 (91.4)	81	0.001
Not clean	33 (27.7)	86 (72.3)	119	
Nail Biting				
Yes	19 (24.7)	58 (75.3)	77	0.191
No	21 (17.1)	102 (82.9)	123	
Thumb Sucking				
Yes	20 (24.7)	61 (75.3)	81	0.171
No	20 (16.8)	99 (83.2)	119	
Food Habit				
Vegetarian	9 (24.3)	28 (75.7)	37	0.466
Non-Vegetarian	31 (19.0)	132 (81.0)	163	
Total	**40 (20.0)**	**160 (80.0)**	**200**	

Table 3 shows the infection rate of protozoa was higher in children who did not treat water before drinking than those treat but the difference was not significant. The study population who did not wear sandal or shoes showed higher prevalence of protozoan infections than those wear sandal or shoes (P>0.05). The association was seen among the unhygienic skin, nail and clothes cleanliness and protozoan infection (P<0.05).

Discussion

Intestinal parasite infections are among the most prevalent and persistent of all childhood infections worldwide, and many individuals living in endemic areas are infected continuously from soon after birth to childhood[9]. Infections with intestinal protozoan parasites may have important health consequences, but morbidity-especially for school-aged children is often underestimated[10].The current findings indicated that the prevalence of intestinal protozoan infection was found to be 20.0 percent which was slightly higher than study conducted by Sah *et al* in Itahari, Nepal (18.5%)[11] but lower in comparison to studies carried out by Farag *et al* in Yemen (53%)[12]., Mehraj et al in Pakistan (52%)[13] and Akhter *et al* in Saudi Arabia (27.8%)[14].respectively. Various studies reported prevalence of protozoa infections from 0.3% to 55% in different places of different countries[15,16].This study showed Giardia lamblia was seen high (12.5%) in comparison to Entamoeba histolytica (7.5%). A study conducted by Ngosso *et al* Tanzania in which the most common protozoa isolated were Giardia lamblia (35.6%) followed by Entamoeba histolytica (12.2%)[17]. Another study conducted by Schmidlin et al in Taabo, Cote d'Ivoire in Ivorian area reported prevalence of 15.0% and 14.4% of Giardia lamblia and Entamoeba histolytica, respectively[18].But other studies (Liang *et al* in 2010) found that Entamoeba histolytica was more prevalent than Giardia Lamblia. The discrepancies between the present and other previous studies may be due to differences between studied population characteristics and/ or geographical and socioeconomic factors.The prevalence of protozoan infection was seen slightly higher in male (20.7%) than female (19.1%) but the difference was not significant. A similar study conducted by Sah *et al* in Dharan, Nepal which also showed higher infection

rate of protozoa in males (14.3%) than female (11.4%) but the difference was not significant[19].On the contrary a study conducted by Alyousefi *et al* in Sana'a city, Yemen showed that the infection rate of protozoa was lower in males (29.4%) than female (32.2%)[20].The infection rate of protozoa was similar between male (18.4%) and female (18.6%) but the difference was not significant[11].A study conducted by Ngui *et al* in Malaysia also showed similar infection rate of protozoa between male (73%) and female (73.3%)[21].This indicated that the gender may or may not play role in parasitosis depending on the region and other environmental or behavioral factors. Generally, the increased mobility of the male increases the risk of infection among them, while female have more soil contact during growing vegetables and eat raw vegetable with prepared food more often than males.The protozoan infection was higher among children whose mother was illiterate (26.9%) than below School Leaving Certificate (SLC) (18.5%) and SLC pass and above (11.1%) but the difference was not significant. A similar study conducted by Sah et al in Itahari, Nepal which showed the protozoan infection was insignificantly higher in children whose mothers had below SLC (22%) than SLC pass and above (13.4%)[11].But a study conducted by Hussein et al in Iraq showed the infection rate was significantly associated with level of mother's education[22]. We found no significance influence of mothers education level on protozoan infection, contrary to some literature report [23,24] despite the fact that protozoan parasites were more common in children from mother with no education level.Children using source of drinking water as tube well had higher prevalence of protozoan infection (25.0%) than using tap water (17.6%) but the difference was not significant. But a similar study conducted by Sah et al in Itahari, Nepal showed that the children using source of drinking water as tube well had significantly higher prevalence of parasitic infestation (48.6%) than using tap water (21.4%)[25]. A study conducted by Awasthi et al in India also showed a strong association between intake of tube well water and occurrence of infection ($P<0.001$)[26].This study showed the infection rate of protozoa was higher in children who did not treat water before drinking (23.3%) than those treat (13.4%) but the difference was not significant. Similar studies conducted by Hussein et al in Iraq[22] and Ngui et al in Malaysia [21] also showed the higher rate of infection among children drink untreated water than those drink treated water. This high prevalence may be due to contamination of municipal water supplies with human waste, poor quality of water, faulty of sewage line and insufficient level of chlorine.This study shows the children using soap and water before meal had lower prevalence of protozoan infections than those using only water but the difference was not significant. Another similar study conducted by Sah *et al* in Itahari, Nepal also showed that the infection rate of protozoan parasites among hand washing with soap and water before meal was lower than only use water but the difference was not significant [11].But hand washing practices showed a significant intestinal parasite infection reduction compared to those who did not wash. The difference was more significant when it occurred before eating than after defecating[6].This study did not show the association of protozoan infection with sandal wearing habit but higher among children not wearing sandal (24.3%) in comparison to sandal wear (15.1%). A similar study conducted by Sah *et al* in Itahari, Nepal also showed the higher protozoan infection among children not wearing sandal (22.8%) in comparison to sandal wear (14.1%) but the difference was not significant.[11].But a study conducted by Tadesse G showed positive parasites significantly lower among sandal wear (3.9%) as compared to not sandal wear (9.6%)[27].The positive protozoan infection among school children was significantly lower among having clean nail (7.5%) in comparison to not clean (28.3%) respectively. A similar study conducted by Sah et al in Itahari, Nepal also showed significantly lower positive protozoan infection in school children among having clean nail (6%) in comparison to not clean (24.8%) respectively[11].The studies conducted by Wani et al in Gurez Valley of Jammu and Kashmir State, India [28] and Tadesse G in Ethiopia [27] also showed lower prevalence of intestinal protozoan parasites among the children those having clean nail in comparison to having not clean nail. Literature reported that the prevalence of intestinal protozoan infections is one of the most accurate indicators of socioeconomic and environmental conditions of a population [29] and may be associated with several determinant factors, such as personal hygiene, adequate sanitation, water treatment, fecal pollution of water and foods[30]. Limitations of this study: Firstly, we conducted single stool examination for detection of intestinal protozoan infections, which could have underestimated the prevalence, as optimal laboratory diagnosis of intestinal parasitic infections requires the examination of at least three stool specimens collected over several days[31]. Secondly, it was planned to conduct stool sample testing within 2 hour of collection; however, due to logistic constraints, it was delayed at times from 3 to 6 hour as a result of which we could not detect the invasive intestinal protozoan parasites.

Conclusion

The overall prevalence of intestinal protozoan infection was found to be high among school children of Biratnagar. Risk factors like unhygienic skin, nail and clothes cleanliness was found to be significant relationship in the causation of intestinal protozoan infections. Health education regarding hygienic practices in the school at primary levels and supply of clean water can have substantial effect in prevention of intestinal protozoan parasites among the children.

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