International Journal of Current Research in Medical Sciences
ISSN: 2454-5716
www.ijcrims.com
Volume 2, Issue 4, April -2016

Original Research Article

http://s-o-i.org/1.15/ijcrms-2016-2-4-2

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

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Abstract

Introduction: Intestinal helminthic infection is a major public health problem in children of developing countries because of poor socio-economic conditions and lack of good hygienic living. **Objectives:** To measure the prevalence of intestinal helminthic Infections and to identify risk factors associated with helminthic 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 helminthic Infections. **Results:** Overall prevalence of intestinal helminthic infections among the school children was 15.5 percent. Hookworm was found high (6.5%) in comparison to other worms i.e. Ascaris lumbricoides (5.5%), Trichuris trichuria (2.5%) and Hymenolepsis nana (1.0%). The use of soap and water after defecation had lower prevalence of helminthic Infections (11.2%) than only use of water (38.7%). The helminthic Infections was also seen lower who wear sandals (3.2%) than those did not wear (26.2%). The Infection rate was significantly lower among having clean nail (6.2%) than not having clean (21.7%). The helminthic Infections was seen higher among children having the habit of nail biting and thumbs sucking (P<0.001). **Conclusions:** Intestinal helminthic infections among the school children are a common health problem. Poor personal hygiene and sanitary condition, and lack of clean drinking water supply are supposed to play an important role in establishing helminthic infections.

Keywords: Prevalence, Helminthic infections, Risk factors, School children, Biratnagar.

Introduction

There are more than a dozen different species of soil-transmitted helminths that infect humans, mainly found in the tropical and subtropical parts of the developing world.[1] The World Health Organization (WHO) estimates that almost 2 billion people are infected with one or more of these soil transmitted helminths, accounting for 40% of the global morbidity from infectious diseases.[2]

It is estimated that approximately one-third of the almost three billion people that live in developing regions of sub-Saharan Africa, Asia and the Americas are infected with one or more

helminths. The most common helminthiasis are those caused by infection with intestinal helminths; Ascariasis, Trichuriasis and hook-worm, followed by Schistosomiasis and Lymphatic Filariasis. This practically illustrates that the inhabitants of thousands of rural, impoverished villages throughout the tropics and subtropics are often chronically infected with several different species of parasitic worm.[3]

Poverty, lack of awareness, failure to practice proper hand washing after defecation, unsafe drinking water and use of improper toilets are some of the reasons that are not totally eradicated from most of the parts of Nepal.[4,5] Because of these reasons most of the school going children are still suffering from helminthic parasitic infections. Socio-economic and cultural factors and lack of adequate basic sanitation have caused the children of Nepal vulnerable to intestinal helminthic infections.[5] Therefore the present study was carried out to measure the prevalence of intestinal helminthic Infections and to identify risk factors associated with helminthic 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).[6] 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 helminthic parasites.

First we used low power lens and afterwards the high power lens. Then we observed ova of different intestinal helminthic parasites.[7] 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 helminthic 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.

Results

Table 1: Distribution of helminthic infections among study population

Characteristics	Frequency	Percent
Helminthes		
Positive	31	15.5
Negative	169	84.5
Total	**200**	**100.0**
Name of helminthes		
Ascaris lumbricoides	11	5.5
Hookworm	13	6.5
Trichuris Trichuria	5	2.5
Hymenolepsis nana	2	1.0
Total	**31**	**15.5**

Table 1 shows the status of helminthic infections among the school children of Biratnagar. A total intestinal helminthic infection was found to be 15.5 percent. Hookworm was seen highest in comparison to other helminthes.

Table 2: Association between sociodemographic characteristics with helminthic infections

Characteristics	Helminthes Positive	Helminthes Negative	Total	P-Value
School				
Private	17 (13.9)	105 (86.1)	122	0.444
Government	14 (17.9)	64 (82.1)	78	
Gender				
Male	12 (10.8)	99 (89.2)	111	0.041
Female	19 (21.3)	70 (78.7)	89	
Religion				
Hindu	25 (15.4)	137 (84.6)	162	0.955
Others (Muslim, Buddhist, Christian)	6 (15.8)	32 (84.2)	38	
Ethnicity				
Brahmin/Chhetri	13 (14.8)	75 (85.2)	88	0.443
Kirati	3 (23.1)	10 (76.9)	13	
Janajati	7 (20.0)	28 (80.0)	35	
Dalit	4 (23.5)	13 (76.5)	17	
Terai Caste	4 (8.5)	43 (91.5)	47	
Fathers Education				
Illiterate	6 (18.8)	26 (81.2)	32	0.238
Below SLC	22 (17.5)	104 (82.5)	126	
SLC & above SLC	3 (7.1)	39 (92.9)	42	
Mothers Education				
Illiterate	8 (15.4)	44 (84.6)	52	0.458
Below SLC	22 (16.9)	108 (83.1)	130	
SLC & above SLC	1 (5.6)	17 (94.4)	18	
Total	**31 (15.5)**	**169 (84.5)**	**200**	

SLC: School leaving certificate

The respondents from Government school were found higher helminthic infections than Private school but the difference was not significant. The prevalence of helminthic infections was seen significantly higher in female than male (P<0.05). The respondents from Dalit were found higher helminthic infections than other ethnic groups but the difference was not significant. The helminthic infection was higher among children whose father was illiterate than below School Leaving Certificate (SLC), and SLC pass and above (Table 2).

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

Characteristics	Helminthes Positive	Helminthes Negative	Total	P-Value
Source of drinking water at home				
Tap	13 (9.6)	123 (90.4)	136	0.001
Tube well	18 (28.1%)	46 (71.9%)	64	
Water treatment at home				
Yes	3 (4.5)	64 (95.5)	67	0.002
No	28 (21.1)	105 (78.9)	133	
Hand wash before meal				
No wash	9 (10.8)	74 (89.2)	83	0.046
Water only	20 (22.5)	69 (77.5)	89	
Soap	2 (7.1)	26 (92.9)	28	
Bath				
Regular	5 (6.0)	79 (94.0)	84	0.001
Irregular	26 (22.4)	90 (77.6)	116	
Hand wash after defecation				
Soap	19 (11.2)	150 (88.8)	169	<0.001
Water	12 (38.7)	19 (61.3)	31	
Sandal wear				
Yes	3 (3.2)	90 (96.8)	93	<0.001
No	28 (26.2)	79 (73.8)	107	
Skin				
Clean	5 (6.5)	72 (93.5)	77	0.005
Not clean	26 (21.1)	97 (78.9)	123	
Nail				
Cut clean	5 (6.2)	75 (93.8)	80	0.003
Uncut & Unclean	26 (21.7)	94 (78.3)	120	
Clothes				
Clean	5 (6.2)	76 (93.8)	81	0.003
Not clean	26 (21.8)	93 (78.2)	119	
Nail Biting				
Yes	25 (32.5)	52 (67.5)	77	<0.001
No	6 (4.9)	117 (95.1)	123	
Thumb Sucking				
Yes	25 (30.9)	56 (69.1)	81	<0.001
No	6 (5.0)	113 (95.0)	119	
Food Habit				
Vegetarian	5 (13.5)	32 (86.5)	37	0.712
Non-Vegetarian	26 (16.0)	137 (84.0%)	163	
Total	**31 (15.5%)**	**169 (84.5%)**	**200**	

Table 3 shows the children using soap and water after defecation had significantly lower prevalence of helminthic infections than those using only water (P<0.001). The study population who did not wear sandal and shoes showed significantly higher prevalence of helminthic infections than those wear sandal (P<0.001). The association was also seen among the unhygienic skin, nail and clothes cleanliness and helminthic infections (P<0.05). The helminthic infections was seen higher among children having the habit of nail biting and thumbs sucking (P<0.001).

Discussion

Infections with helminth parasites present a major public health problem in developing countries and have constituted global health as well as economic threat, which does not only depend on regional or ecological conditions, but also on the development of the people.[8] Worm infections generally infect people who live in poverty with lack of adequate safe and clean water and poor sanitary conditions. Socioeconomic status and socio-cultural factors of people are significantly responsible for helminthic infection. Worm infestations are responsible for various morbidities in children.[9]

Prevalence of worm infestation in this study was found to be 15.5 percent which is less as compared to the study conducted by Avhad et al in Aurangabad district, Maharashtra state, India (32.05%)[10], Kaliappan et al in southern India (34.72%)[11], Kumar et al in 2014 (49.38%)[12], Lone et al in Kashmir, India (58.1%)[13], Shrestha et al in Baglung District of Western Nepal (21%)[14] respectively. Biratnagar is the town where educational level of majority of the population is high, surroundings and environmental condition is better than other parts of the country. Because of these factors, the prevalence of worm infestation may be low as compared to the study conducted in different parts of different country.

The prevalence rate of Hookworm was found to be 6.5% followed by Ascaris lumbricoides (5.5%), Trichuris trichiura (2.5%) and Hymenolepsis nana (1.0%). Globally, hookworms, Ascaris lumbricoides and Trichuris trichiura are the most prevalent parasites, with hookworm being more common.[15] But some previous reports recorded higher prevalence of Ascaris lumbricoides than other helminthes.[16,17] This distribution of soil-transmitted helminthic infections being consistent with various studies.[18] The high prevalence of soil transmitted helminthes is directly related to the unhygienic living conditions or practices associated with lack of knowledge about the communicable disease and many other factors, which need to be studied.

The prevalence of helminthic infections was seen significantly higher in female (21.3%) than male (10.8%) (P<0.05). Study conducted by Shakya SR in Dhankuta and Sunsari, Nepal showed slightly higher prevalence of helminthic Infections among females (66%) than males (65%) respectively.[19] In Nepal, reported that, the prevalence of parasitic infection was predominantly higher among girls than boys in rural school children.[20] The reasons mentioned for the increased prevalence of parasitic infection in females than males was due to difference in the family preferences for their bringing up. Almost all the opportunities are preferentially given to male children (learning, playing, and other facilities). 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, help cooking and to look and support their mothers in house hold works.[20]

The infection rate of helminthic parasites was higher in children whose mothers had below School Leaving Certificate (16.9%) than School Leaving Certificate (SLC) pass and above (5.6%) but difference was not significant. But in the previous studies, statistical significant association was observed amongst the children with the increasing educational status of their mother and decreased rate of worm infestation.[21] The finding showed that, there was an inverse relationship between mother's educational level and prevalence of helminth infections. This result agreed with report in a western city sample-Turkey that the prevalence of intestinal helminthic parasites was higher in groups where the mother had less than a primary school education.[22]

The prevalence of worm infestation was significantly higher among the children drinking untreated water (21.1%) as compared to those drinking treated water (4.5%). Similar study conducted by Sah et al in Dharan, Nepal also showed higher prevalence of worm infestation among the children drinking untreated water (12%) as compared to those drinking treated water (11.2%).[23] Another study conducted by Shakya et al in Nepal also showed the infection rate was higher among the children drinking untreated water (15%) as compared to those drinking treated water (5.5%).[24]

The infection rate of worm infestation among hand washing with soap and water after defecation was significantly lower (11.2%) than only use water (38.7%). Self-reported measures of hand washing tend to overestimate soap use, so it is possible that hand washing with soap actually takes place to reduce risk in highly contaminated environments.[25] But another study conducted by Tadesse G which showed positive parasites among hand washing with soap and water was also lower but not significant.[26]

Regular wearing of sandal or shoes had a significantly lower prevalence of parasitic infections (3.2%) than those did not wear sandal or shoes (26.2%). A similar study conducted by Sah et al in Itahari, Nepal showed significantly lower prevalence of parasitic infections among the children those wearing of sandal or shoes (2%) than those did not wear sandal or shoes (23.8%).[27] A similar study conducted in Ethiopia also showed that regular wearing of sandals or shoes had a significant contribution to the low prevalence rate of parasitic infections ($P < 0.05$).[26]

Worm infestation among school children having clean nail was significantly lower (6.2%) than children with not clean nail (21.7%). A similar study conducted by Wani et al in Gurez Valley of Jammu and Kashmir State, India also showed significantly lower positive rates of parasites among clean nail (58.03%) than not clean nail (83.33%).[28] But studies conducted by Tadesse G in Babile town, eastern Ethiopia and Sah et al in Dharan, Nepal showed positive parasites among clean nail was not significantly different as compared to not clean nail.[23,26]

Prevalence of parasitic infestation among having the habit of nail biting was significantly higher (32.5%) than not having the habit of nail biting (4.9%). Similar study conducted by Sah et al in Itahari, Nepal also showed significantly higher Prevalence of helminthic infestation among having the habit of nail biting (56.5%) than not having the habit of nail biting (18.3%).[29] Another similar study conducted by Sah in Dharan, Nepal showed similar trend where prevalence of parasitic infestation among having the habit of nail biting was higher (13.6%) than not having the habit of nail biting (10.7%).[30]

Our study has some limitations. First, only one stool sample was collected from each participant. Previous research has shown that multiple stool sampling enhances the sensitivity of intestinal helminthes diagnosis.[31] Second, 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 helminthic parasites.

Conclusion

The overall prevalence of intestinal helminthic Infections was moderately high among school children of Biratnagar. Hookworm was seen highest in comparison to other helminthes. Risk factors like not treat water before drinking, irregular bath, not using soap before meal and after defecation, not wearing sandals, unhygienic skin, nail and cloths cleanliness, habit of nail biting and thumb sucking were found to be significant relationship in the causation of intestinal helminthic infections. Interventions with repeated albendazole mass treatment, health education and improvement of environmental hygiene and supply of clean water can protect from the helminthic infections.

Acknowledgements

We are grateful to B.P. Koirala Institute of Health Sciences for providing grant for the research in 2015. Our gratitude and sincerely thanks to all the

participants of study from Schools of Biratnagar and teachers for their kind co-operation.

Conflict of Interest: No conflict of interest

Funding: B.P. Koirala Institute of Health Sciences, Dharan, Nepal

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How to cite this article: Ram Bilakshan Sah, Ratna Baral, Usha Shah, Nilambar Jha. (2016). A Study of Prevalence of Intestinal Helminthic Infections and Associated Risk Factors among the School Children of Biratnagar Submetropolitan, Eastern Region of Nepal. Int. J. Curr. Res. Med. Sci. 2(4): 8-15.