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"PREVALENCE OF INTESTINAL PARASITES AND ITS ASSOCIATION WITH SOCIODEMOGRAPHIC, ENVIRONMENTAL AND BEHAVIORAL FACTORS IN CHILDREN IN POKHARA VALLEY, NEPAL"

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ABSTRACT:

Intestinal parasitosis in children is the commonest infection across the globe. Epidemiological research carried out in different countries has shown that prevailing socioeconomic condition is the single most powerful determinant of prevalence of parasitic infection in a society. The objectives of this study were to assess the prevalence of intestinal parasitosis in different pediatric age group (1-14 year) children, to identify the causative socio-demographic determinants and also to assess the controlling factors .5236 stool samples of children of both sexes, aged 1-14 years were processed at Manipal Teaching Hospital, Pokhara, Nepal. Out of 5236 stool samples, male were 3004 (57.4%) and females were 2232 (42.6%). *Giardia lamblia* showed highest prevalence both in male and female children 21.50% and 20.25% respectively. Other parasites in male children were *Entamoeba histolytica (8.05%), Ascaris lumbricoides (2.86%), Enterobius vermicularis (1.66%)* and *Ancylostoma duodenale* (0.73%).The same in female children were as follows: *Ascaris lumbricoides* (1.34%), *Ancylostoma duodenale* (0.94%) and *Hymenolepis nana* (1.03%).Highest prevalence of dual pathogenic protozoa seen in <5 years of age in male was 41.8% whereas in older males >10 years was 35.9%. Older girls of 10-14 years had 22.3% *Entamoeba histolytica* and *Giardia lamblia* parasitosis as opposed to the same age group boys who had 20.84% dual protozoal infestation. Mostly single pathogenic species was detected from all the samples except 10 patients, who had double parasites e.g., Giardia lamblia with *Entamoeba histolytica, Hymenolepis nana, Entamoeba coli* or *Ascaris lumbricoides*.A significantly low ($p<0.05$) prevalence rate of intestinal parasitosis in children using toilet (15.74%) was noted as compared to those who were not using toilets (69.40%). Similarly, significant($p<0.05$) was the lower prevalence rate of intestinal parasitic positivity in urban children (26.33%) as compared to that of those who were residing in rural areas (54.19%).Children from upper caste belonging to higher socio-economic group had significantly low($p<0.05$) intestinal parasitosis(20.27%) as opposed to lower caste children belonging to lower socio-economic group(49.16%) . According to the results, low level of education and consequently poor socio-economic and hygienic condition of families appear to be powerful determinants of intestinal geoparasitosis.

KEY WORDS: Intestinal parasites, children, Pokhara valley, Nepal.

INTRODUCTION:

Intestinal parasitic infection is one of the commonest and major causes of public health and in turn socio-economic problems in the world especially in developing nations like India, Nigeria, Bangladesh and other countries (1,2,3). People from poor sanitation, improper hygienic practices and lower socio-economic groups are reported to have a very high burden of intestinal parasitic infestation with prevalence rate as high as 40 –59% (4, 5). Nearly 200 million people are infected with *Giardia lamblia* while *Entamoeba histolytica* infects about 10% of the world population (5). In 1997, it is estimated that amoebiasis, 45 million people carried *Entamoeba histolytica* in their intestine and $1/10^{th}$ of them suffer from invasive form of amoebiasis which accounts for 70,000 deaths per year (4). Intestinal parasites reportedly affect both on nutritional and immune status of individuals. The reported prevalence of intestinal parasitosis in Nepal vary considerably from one study to another with over 90% prevalence in some areas[6]. Manipal(6). Teaching Hospital, Pokhara valley, Nepal serves as a referral center for pediatric and young adolescent population in and around Western region of Nepal. Most of the patients belong to low socio-economic strata having inadequate safe water supply and lack of proper environmental sanitary facilities. This two-year study reports a prospective analysis of serious enteric parasites and associated epidemiological factors. Similar study in school children has also been done in Bangladesh and Malaysia with comparable results (3, 9).

MATERIALS & METHOD:

Study area: This was a cross sectional prospective study done in Manipal Teaching Hospital from Jan, 2000 to Dec, 2002.Children attending to out-patient as well as in-patient pediatrics department of Manipal Teaching Hospital ,which caters a specialized tertiary patient care services to around 4.5 lakhs of population in and around Pokhara valley, situated in the Western region of Nepal. Patients of *both rural and urban* population from neighboring 40 VDC's (village development committee) in Pokhara and Lekhnath municipality of Kaski district under Gandaki zone were seeking medical services from this hospital.Chidren belonging to upper caste Brahamin-Chettri were mainly coming from urban area and lower caste Gurung, Thapa, Tamang, Magar, Limbu, Sarki and Sunar children were mainly from villages under those above mentioned districts. In those villages, there is no direct road links. Water supply from natural sources of dhara (flowing water), dugwell, stream, brooklets and community piped water supply from hill-top fountains. Excreta disposal in villages are primitive type e.g., open field defecation, self-made pit-latrines or rarely seen sanitary latrines, made by non governmental organizations.Study subjects and sample collection: A total of 5236 stool samples over 2 year period were examined. Stool samples obtained from children of both sexes aged 1-14 years were found to contain one or other type of intestinal parasites. In this study, children were coming from the above mentioned neighbouring urban and rural areas. The samples were collected from individual patients who were attending the out-patient or in patient department of hospital with complaints of anaemia, failure to thrive, nausea, vomiting, loose motion and abdominal pain. The samples were sent to the laboratory for immediate processing without any delay. A proforma was made regarding age, sex, presenting complaints, duration of illness, number of siblings, dietary habits, housing, types of latrine used, personal hygiene and any medication used prior to presentation. A written informed consent was taken from each patient.

Parasitic examination: 4 - 5 grams of stool samples were collected in a Universal plastic container [10 ml capacity] without any preservative and necessary precaution was taken to avoid contamination. For suspected pinworm cases, Scotch tape similar to NIH (National Institute of Health) swabs were improvised as well as perianal examination was done. All samples were examined on the same day of collection. The samples were then observed making a saline and an iodine preparation by formal-ether concentration method (7). The method of estimation of parasitic burden in the intestine was adopted as mentioned by Cheesebrough (8). Nearly 9-10 stool samples were examined per clinic day in addition to routine urine, full blood count including absolute eosinophil count and serum electrolytes were done according to requirement of individual patient.

Drug Distribution: All stool positive children were given anti-parasitic medications according to the specific types of parasite detected in each case namely albendazole, mebendazole, metronidazole, praziquantel and piperazine citrate.

Statistical analysis: The results obtained were analyzed with Epi-info version 6 programmes of WHO/CDC.Chi-square test and simple distribution of the variables were used to quantify the "p" value of the relationship of the variables.

RESULTS:

During the 2-year period, 5236 stool specimens were examined at Manipal Teaching Hospital Pathology department. Out of 5236 samples examined, 3004 (57.4 %) were from male and 2232 (42.6%) were from female children. Out of 5236 stool specimens, 2036 (38.8%) stool specimens were positive for various types of intestinal parasites.

Table 1.Prevallence of G. lamblia and E histolytica by age-sex distribution

	Age (in years)	Total Tested	G.lamblia(%)	E.histolytica(%)	Both parasites(%)
MALE	Less than 5	1272	330(25.95)	118(9.2)	448(41.8)
	5 to9	1070	210(18.7)	92(8.85)	302(41.1)
	10 to 14	662	106(16.01)	32(4.83)	138(20.84)
	Total	**3004**	**616(21.50)**	**242(8.05)**	**888(29.56)**
FEMALE	Less than 5	892	174(19.50)	46(5.15)	220(24.66)
	5 to9	854	194(22.7)	52(6.07)	246(28.7)
	10 to14	484	84(17.3)	24(4.9)	108(22.3)
	Total	**2232**	**452(20.25)**	**122(5.46)**	**574(25.71)**

Table2.Prevalence of individual parasite among male and female children

	MALE		FEMALE		TOTAL
	(3004)		(2232)		(5236)
Parasites	Positive	Percentage	Positive	Percentage	
G. lamblia	646	21.5	452	20.25	1098 (20.97)
E.histolytica	242	8.05	122	5.46	364(6.95)
E. coli	136	4.52	119	5.33	255(4.87)
A.lumbricoides	86	2.86	30	1.34	116(2.2)
Taenia spp.	20	0.66	18	0.80	38(0.72)
H.nana	28	0.93	26	1.18	54(1.03)
A.duodenale	50	1.66	18	0.80	68(1.29)
E vermicularis	22	0.73	21	0.94	43(0.82)
Total	1230	40.94	806	36.11	2036(38.88)

Table 3.Prevalence of intestinal parasitosis among children having toilets and no toilets at their houses.

Toilet	Total no	Positive no	percentage
Yes	2945	446	15.14
No	2291	1590	69.40
Total	5236	2036	38.88

Table 4.Prevalence of intestinal parasitosis among children of rural and urba dwellings

Dwellings	Total no	Positive no	Percentage
Urban	2878	758	26.33
Rural	2358	1278	54.19
Total	5236	2036	38.88

Table 5.Prevalence of intestinal parasitosis among children of higher and lower social status.

Social status	Total no	Positive no	Percentage
Higher	1864	378	20.27
Lower	3372	1658	49.16
Total	5236	2036	38.88

intestinal parasites is shown in Table1. The distribution was not uniform for all ages. The prevalence rate of common intestinal protozoa *E histolytica* and *G lamblia* in 10-14 year old male children (20.84%) was lower as compared to female children (22.3%)of same age, which was statistically significant ($p< 0.05$). In male children, prevalence rate of *Ascaris lumbricoides* (2.86%), *Anchylostoma duodenale* (1.66%) and *Enterobius vermicularis* (0.73%) were noted. A prevalence of *E. histolytica* (8.05%) and non-pathogenic *E. coli* (4.52%) were recorded in male children. The least common intestinal parasite *Enterobius vermicularis* was found in 0.73% in male and 0.94 % in female children, conspicuous by their relatively low occurrence. *H nana* and *Taenia* spp. were detected in 1.03% and 0.72 % respectively. We could not differentiate the various species of Taeniasis. *Ancylostoma duodenale* was detected in male and female children 1.66% and 0.80% respectively. Mostly single pathogenic species was detected from all the samples except 10 patients, who had double parasites e.g., *Giardia lamblia* with *E histolytica, Hymenolepis nana, E coli* or *Ascaris lumbricoides*. A significantly low ($p<0.05$) prevalence rate of intestinal parasitosis in children using toilet (15.14%) was noted as compared to those who were not using toilets (69.40%). The urban dwellers were having 26.33% as opposed to rural dwellers of 54.19% of intestinal parasitosis. In Table 5, it is clearly shown ($p<0.05$) that those belonging to higher socio-economic group of children, residing in urban settlement, were having intestinal parasitosis (20.27%) as opposed to those who belonged to lower socio-economic status. According to the results, low level of education and consequently poor socio-economic and hygienic condition of families appear to be powerful determinants of intestinal geoparasitosis.

DISCUSSION

In Manipal Teaching Hospital, Pokhara valley, Nepal from Jan 2000 - Dec 2002, 5236 stool samples were processed from children who presented with abdominal pain, diarrhea, vomiting, anemia and failure to thrive. Out of the total 5236 stool specimens, 2036(38.88%) samples were positive for all parasites. Of the 5236 samples examined, 3004(57.37%) were from male and 2232(42.62%) were from female children. Present study reveals that (1230/3004; 40.9%) of boys and (806/2232; 36.11%) of girls of Pokhara valley suffered from one or other type of intestinal parasitosis. This study also showed that the parasitic prevalence was uniformly distributed in both sex groups which are in conformity with other similar studies done else where in Nepal, India, Bhutan, Thailand and other South Asian countries (6,9a,9b,9c).

The caste system and class distinction of Nepali society has made great impact on the health and education in Nepal. Children from upper caste belonging to higher socio-economic group had significantly low ($p< 0.05$) intestinal parasitosis (20.27%) as opposed to lower caste children belonging to lower socio-economic group (49.16%). According to the results of this study, low level of education and consequently poor socio-economic and hygienic conditions of families appear to be powerful determinants of intestinal geoparasitosis. Significantly higher prevalence rate ($p< 0.05$) among the lower socio-economic group (Sunar, Sarki, Nepali, Magar, Gurung, Thapa, Pun, Tamang and other backward classes) appeared to be associated with their relatively low literacy rate, unhygienic habits and low socio-economic status compared with upper caste Nepalese (Brahamin and Chettri). The prevalence of intestinal parasitosis found to be associated with socio-economic status, dwelling condition, family size, sanitary disposal and toilet use, type of water supply for cooking and drinking and practice of personal hygiene and habits. A significantly lower prevalence rate ($p< 0.05$) in upper caste Nepalese

was associated with their relatively higher literacy rate and health awareness as compared with the lower caste Nepalese as was evident from our study results .A significantly high prevalence among young children (aged 10years) appeared to be associated with their unhygienic habit and age. A significantly low ($p < 0.05$) prevalence rate of intestinal parasitosis in children using toilet (15.74%) was noted as compared to those who were not using toilets (69.40%) There was a significant difference ($p < 0.05$) in parasite prevalence among children having toilets (pit latrines) and without toilets indicated that the parasitic burden was directly related to excreta disposal in the environment. This is in conformity with similar type of study done in Cuba (10) and Iran (11). This was attributed mainly due to the open air defecating habits of lower caste children. Though not investigated but the significantly higher prevalence of parasitosis in children drinking piped water could be due to the fecal contamination of drinking water supply system as has been seen else in other parts of the country. A very high percentage of fecal contamination of drinking water has been reported even in the capital Kathmandu (12). All stool positive children were treated with anthelmintic and anti-protozoal medications. They had no facility of adequat safe water supply and sanitary latrines. Other factors responsible were lacwere inadequate environmental sanitation, poor personal hygiene, low litera and hilly inaccessible part on the mountain top where health care facility i facilities were unreachable. Poor living condition with lack of portable water, and last but not the least low socio-economic status of status of this underprivileged group of people.

In all the district areas, there was both inbuilt sewage system as well as open drains in many places even in the heart of the city. Similarly, significant ($p < 0.05$) was the lower prevalence rate of intestinal parasitic positivity in urban children (26.33%) as compared to that of those who were residing in rural areas (54.19%). In the rural areas, people living under no brick-built dwellings where sanitary latrine system was almost non-existent. The inhabitants used open fields for defecation and urination, which was more a habit than a real necessity. The children playing in the rural areas in the dirt and soil, children used to get the ova stick to their nails. Ascaris lumbricoides, Giardia intestinalis, E histolytica, Hymenolepis nana and E coli are common intestinal parasites constituting a public health problem in the communities of poor hygienic standard, lack of sanitation and low socioeconomic status.

Older female children of 10-14 years were found to harbor intestinal protozoa more (108/484; 22.3%) than the same age group male children (138/662; 20.84%) and overall the older children above 10 years were harboring less number of parasites than the younger group of children as evident from Table1. The higher rate of prevalence of parasites (22.3%) in 10 to 14 years age group female children may be due to their close physical proximity to their sick siblings in the family as a helping hand to the mother in accordance with the local tradition and custom. Mahendra Raj S et al in 1997 reported similar findings from Malaysian peninsula (13).

Male children have higher education facility as compared to their peer female children in the Nepali society.G.lamblia was found to be the most common protozoa harboured (646/3004; 21.50%) in male and (452/2232; 20.25%) in female children. In this study no AIDS, cystic fibrosis or hypogammaglobulinemic cases documented which were closely associated with G lamblia

infestation (**14**). A study done by Zaka ul A in Saudi Arabia had also shown the inexplicably high prevalence of G lamblia infestation among the school going children in Saudi Arabia (**15**) The next common parasite was E histolytica (242/3004; 8.05%) in male and (122/2232 5.46%) in female children whilst the third most common parasite (a non-pathogenic one) was Entamoeba coli (255/5236; 4.87%) was documented in our study Ancylostoma spp. ova were infrequent though the bare foot walking and drinking contaminated water were common habits among the rural children Similar findings have been reported in the work of Steiner et al in 199[16] Our results showed that < 5 years age group male have the highest (448/1272; 41.8%) rate of infestation. There seems to have an influence of age on the prevalence of infestation of parasites ($p<0.05$). Other investigators have also mentioned the age related variation of prevalence of parasites[17]. The reduction of parasitic infestation with increasing age may be explained by the fact that older children have more awareness of personal hygiene than the younger ones.

Hookworm infestation is seen mainly in moist and warm climate in tropic and subtropics between 45° N and 30° S of the equator (e.g., Asia, Africa, Central and South America). The paucity of hookworm, Ancylostoma duodenale (68/5236; 1.29%) in this study was interesting. Probably environmental factors did not play a significant role in its transmission [18] or were detrimental for the survival of the hookworm ova and larvae in the hilly regions of Nepal. The Scotch tape and perianal examination when required revealed the overall prevalence of Enterobius vermicularis was only (43/5236; 0.82%) which is in conformity with other reports from other endemic zones as studied by Sung, J. F.et al, in Taiwanese school children(**19**).

The low prevalence of A. lumbricoides (116/5236, 2.2%) was remarkable Lack of surface water of plane land and presence of relatively less humid dry weather of hilly regions of Nepal might be detrimental for the survival of these parasites.

Children presented with vague abdominal, anaemia, failure to thrive and diarrhoea were always suggested to undergo stool examination. The higher or lower percentage of stool testing did not coincide with the higher or lower percentage of stool positivity. Therefore to find out all agents associated with intestinal symptoms further investigations in the form of routine stool microscopy as well as stool concentration methods were performed. During this study 16 samples, which were negative by direct microscopy, were found to be positive by Formol-ether concentration technique. This indicates that concentration method should be compulsory for the microscopy of the negative stool specimen which might give a higher yield of positivity.Giardia lamblia was more often found in faecally contaminated water. In Pokhara valley, both rural and urban people used natural sources e.g. dhara (flowing water), dug well, streams, brooklets and community-made piped water or DWSC (Drinking Water Supply Corporation; non governmental organization funded) water for drinking or cooking purposes although transmission through dug well water or ova and cyst contaminated unwashed fruits or vegetables could not be ruled out. Similarly, person-to-person contact among family members, especially among siblings, may also be another factor for transmission of G lamblia. The importance of animal reservoirs like beavers, cats, dogs and other mammals as a source of

human infection was unclear because the parasites in the intestine of man and other mammals are indistinguishable. Zoonotic transmission has also been suggested for Giardia lamblia(20) but its possibility in Pokhara region was very remote because of the absence of beavers and other reservoir rodents in this region. The isolation rate of G lamblia was a little higher as compared to other study done by Ram R *et al* in Indian born Nepali children in Darjeeling district (21). It may be inferred that *G lamblia* is primarily associated with abdominal symptoms among these children although there may be inapparent infection with other intestinal pathogens as well. Based on the two techniques used, the results from the Scotch tape provided a higher sensitivity for the detection of *Taenia* spp. and *Enterobius vermicularis* eggs as had also been done in Saudi Arabia (22). Intestinal helminthic polyparasitism was seen only in 10 cases. A programme to fight against geohelminths in school children should be initiated as a public health priority. Albendazole, among other antiprotozoal and anthelmintic medications was the drug of choice. Frequency of drug distribution should be based on the prevalence of geohelminths in specific endemic areas. Prevalence and intensity of infection was low probably due to periodic antihelminthic treatment (funded by non governmental organizations) offered by the local health authorities. Improvement in mother's level of education brought about decrease in prevalence of intestinal helminthiasis among the children belonging to upper caste society residing in the urban settlement. Similar observation had also been noted in Haitian children in Latin America (23). Therefore, improvement in female education in lower caste Nepalese residing in the rural areas should be encouraged to reduce the incidence of communicable disease in the family.

CONCLUSION:

The study has shown that protozoan cysts have been the main cause of gastrointestinal manifestations among children in Pokhara valley, Nepal. This study must create awareness among the local community and health authority, which should actuate them to take necessary steps to minimize the transmission of parasite in children. This study also represents not only intestinal parasitosis in children of Pokhara valley, Nepal but also depicts real picture of parasitic infestation in other 3rd world countries of Asia, Africa and Latin America. Therefore, suitable prophylactic measures, early detection and anti-protozoal and anthelmintic treatment will go a long way in containment and lessen the burden of parasitic infestations among children in this part of the globe as well as socio-economically deprived section of people in developing nations of the world. School-based health education should be implemented in order to prevent and control intestinal parasitosis.

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