Pattern of Intestinal Parasites at Open Air Defecation Sites in Kathmandu Valley, Nepal.

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Abstract

The poor socio-economic status of street children leads to dangerous and unhealthy living environments. Also open defecation and regular contact with dogs, flies and contaminated soil, water, faeces, foods and fomites; increase their chance of infestation by intestinal protozoa and helminths. This study intends to found out the intestinal parasites among the stools collected from openly-defecating street children in Kathmandu Valley, Nepal.

A total of 93 stool samples were collected in plastic vial with spoon and tight-fitting lid from 93 of street children who were defecating in the roadside and air-bridge in different locations of Kathmandu Valley from May 2008 to July 2008. Stool microscopy included examination by direct wet mount in 2.5% potassium dichromate solution and confirmation techniques used for oocysts of *Cyclospora* was Z-N (acid-fast) staining, oculo-stage micrometer and bisporulation assays.

Analysis of the results show that majority of stool specimens were brown or pale yellow (63.4%), soft-formed (78.5%), without blood (96.8%), with mucus (62.4%) and without adult forms of helminths (96.8%). The entire stool specimen was positive for intestinal parasite, (prevalence of 100.0%). The intestinal parasites seen included: *Entamoeba histolytica, Entamoeba coli, Giardia lamblia, Cryptosporidium* spp, *Cyclospora* spp, *Ascaris lumbricoides, Trichuris trichiura,* Hookworm, *Taenia solium*, *Hymenolepis nana, Strongyloides, Hymenolepis diminuta, Enterobius vermicularis* and *Dipylidium caninum.* The intensity of the intestinal parasitic infection was recorded in percentage such as 1.0% for single, 7.1% for double, 51.2% for triple, 30.2% for quadruple and 10.5% for quintuple.

It is therefore concluded that a program should be conducted to treat intestinal parasites in street children living in this environment. Government should implement strict laws and orders against indiscriminate defecation and support this by provision of public toilet.

Keywords: Intestinal parasites; stool; street children; Kathmandu.

Introduction

The total population of Nepal is 23.4 million in which about 52% falls under 18 years. It is one of the poorest countries in the world where 49% of the population are living in absolute poverty. The children have been trafficked for commercial sexual exploitation and forced labour as well as victims of violence, suppression and atrocity, and, therefore, compelled to abandon their families and live on the streets. Estimated 30,000 street children in Nepal, of whom 3,700 are homeless[1-3]. There are about 4,000 children (88% are boys and 12% girls) working in rag-picking, which is considered one of the worst forms of child labour. Most of these children abandon their homes due to problems caused by stepmothers, family conflicts, poverty, lack of awareness, and orphanages. They concentrate in junkyards, temples, market centres, cinema halls, airports, bus terminals, hardware shops, tourist centres while they do their work. While on the street they face problems of hunger, shelter, clothes and face the problems from police, bullies, gang etc. These children have poor socio-economic status because of dangerous and unhealthy living environments and the resulting untreated illnesses and frequent injuries, lack of adequate emotional support, safe food, shelter and safe places to sleep and store belongings, leading to inability of street children to save money and involvement in drug addiction, alcoholism and smoking and in criminal activities[4].

Acute respiratory illness, HIV/AIDS, gastro-enteritis are predominant infections in street children in most cities. Diarrhoeal diseases caused by virus, bacteria, protozoa and helminths are prevalent in the rapidly populated cities like Kathmandu[4, 5]. This has primarily been attributed

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to the absence of potable drinking water, proper sanitary habits, good faecal disposal system and poor socio-economic status[5, 6]. The environmental, parasitic and host factors contribute to the prevalence of intestinal parasites among a given population[6]. The open defecation practice beside the street side is prevalent in cities because of the absence of private and public toilets for safe disposal of faeces. This may increase the contamination of the diarrhoeal agents in the environment which finally lead to transmission in different humans through rainwater, food, flies, soil etc.

This study was conducted to find out the distribution of human intestinal parasites in the street faeces which were defecated by street children in Kathmandu valley, Nepal from May 2008 to July 2008.

Materials and Methods

Study design: The study was cross-sectional descriptive type.

Study area

The study was conducted in Kathmandu Valley from May 2008 to July 2008. Kathmandu is the most densely populated city in Nepal. This is the area where people have come from out of the valley and out of country for study, business, employment and going to abroad. So, it has been a multicultural, multiethnic and multireligious centre. The areas were selected on the basis of significant numbers of street children and homeless people having open defecation such as Jamal Air Bridge, Bir Hospital Air Bridge, Sundhara Air Bridge, New Road Mahabauddha, Ratnapark, Naxal, Gaushala, Koteshwor, Saatdobato, Balkhu and Kalanki.

Human Stool sampling

The nature of the study was explained to the street children and other homeless persons, who were openly defecating in the study areas. In the early morning at about 4 a.m.-5:30 a.m.(+4:45 GMT), a plastic vial with a spoon and tight-fitting lid was given to them to collect fresh stool samples so that contamination with urine and soil could be avoided. The person who used to run away from there seeing the researcher, the researcher himself collected the stool. A total of 93 stool samples were collected from 93 persons. About 2.5% potassium dichromate was added to the stool samples. These vials were kept in refrigerator but were not allowed to freeze.

Laboratory Processing

Human stool samples were examined by direct wet mount at 2.5 percent potassium dichromate solution. The recovery of oocysts of *Cyclospora* was confirmed by using acid-fast staining, oculo-stage micrometer and bisporulation methods. For bisporulation assay, *Cyclospora* positive specimens were stored at an ambient temperature (approximately 23 degree centigrade) and were examined at regular intervals over a period of 2 weeks starting from the time of excretion[6, 7]. The observed cysts, oocysts, eggs and larvae were confirmed by text books and the laboratory manuals[8-12]. These laboratory methods were conducted in Department of Biology, Bagmati Modern College, Naxal and a private laboratory in Kathmandu.

Results

In this study, the prevalence of the intestinal parasites was 100.0%. The Table 1 shows the recorded intestinal protozoa and helminths species. The protozoan species were *Entamoeba histolytica:* 47.3% *Entamoeba coli:* 34.4% *Giardia lamblia:* 31.2%, *Cryptosporidium* spp: 18.3% and *Cyclospora* spp: 16.1%. Similarly, the intestinal helminths recorded were *Ascaris lumbricoides:* 55.9%, *Trichuris trichiura:* 46.2%, Hookworm: 29.0%, *Taenia* spp: 25.8%, *Hymenolepis nana:* 21.5%, *Strongyloides:* 9.7%, *Hymenolepis diminuta:* 4.3%, *Enterobius vermicularis:* 4.3% and *Dipylidium caninum:* 4.3% as can be observed in table 1.

Similarly, the physical characteristics of the stools were also noted in this study as in Table 2. The maximum percentage of the stool was brown or pale yellow while the least percentage was that of white colour. The maximum percentage (78.5%) of stool was soft formed, and the least percentage (9.7%) of stools was unformed or liquid or watery. Only 3 samples (3.2%) had blood whereas the maximum 96.8% samples were without blood. A majority of stools (62.4%) contained mucus and the least percentage of stools (3.2%) contained the adult worms. Among three samples, two samples contained adult worms of *Ascaris lumbricoides* and one sample contained detached gravid segment of *Taenia solium*. *Taenia* spp was confirmed by the characteristic features of passively passed proglottids in groups as described in some literatures[11, 12].

The intensity of the intestinal parasitic infection was also assessed in this study. The table 3 describes the number and percentage of the different type of parasite load as single: 7.3%, double: 44.1%, triple: 35.4%, quadruple: 12.9%, quintuple: 4.3%. *Entamoeba histolytica* and

Ascaris lumbricoides were co-infected in the highest numbers of samples whereas, in two samples, *Cyclospora* were present solitary.

Discussion

Open defecation is widespread in South and Southeast Asia including Nepal. It makes the areas around settlements quite unsanitary. It is a major source of sickness and mortality, and ill-being for children and old people who lack access to the privacy of a latrine[13]. Over the years, Nepal has focused on extending the safe disposal of excreta. By 2002, toilet coverage had risen to 27 per cent [14]. Sanitation facilities in Kathmandu are better than rural areas but are far from ideal. Large populations in this area still do not have access to latrines and go for open defecation. Approximately 67 percent of Nepal's households do not have a toilet. Open defecation in crop fields, orchards, riverbanks, ponds and canals remain a preferred practice in rural areas, whereas defecation near riverbanks and main roadside is the predominant among street children and homeless persons in cities. Studies of water quality from shallow aquifers throughout Nepal have found that the faecal coliform contamination consistently exceeds World Health Organization (WHO) guidelines for water for human consumption[1]. Drinking water supplies are often polluted through runoff into storage sites or cross-leakages between overloaded sewer lines and water pipes. Sewage is the primary cause of drinking water pollution in Kathmandu Valley [15]. The sanitation program is not successful due to the lack of political will, low prestige and recognition of the importance of sanitation, poor policy framework at all levels, poor institutional framework, inadequate and poorly used resources, inappropriate approaches, neglect of consumer preferences and low public awareness and lack of public health leadership[16].

The cent percentage infection of intestinal parasites in the street faecal samples in the studied sites in Kathmandu Valley shows that these diarrhoeal agents are highly dominant in this area. The parasites have been increasingly recognized as an important public health problem, particularly in developing countries such as in Nepal[17,18].

The pattern of detection of *Entamoeba histolytica, Cyclospora,* and *Giardia* shows the usual consumption of contaminated food, untreated water contaminated by human sewage or by wild rodents, flies, infected fingers by the street children in these areas. Besides these modes of transmission, *Cryptosporidium* is easily transmitted among children living in groups because it is infectious at the time of excretion[15]. The rain water is the mean of transmitting oocysts from resources such as cattle dung to the open places in the roadside. Cattle are openly freed in the city areas and are the good sources of fresh dung. *Cryptosporidium* is zoonotic parasite[15] and can be susceptible to the street children easily.

Hymenolepis nana, A. lumbricoides, Enterobius vermicularis, Trichuris trichiura are dominant helminths with common mode of infection such as through contaminated soil, water and food[19]. Among them, the eggs of *Enterobius vermicularis* are highly transmissible in the environment even through air[5]. *H. nana, H. diminuta, A. lumbricoides* and *T. trichiura* are already reported parasites in soil of Kathmandu[20]. These parasites are dominant in the soil and have been implicated as a measure source of parasitosis in this area. The presence of *Taenia* species shows the usual contact of street children with its primary hosts such as cattle, pigs, dogs etc[10]. The presence of *Dipylidium caninum* shows usual contact with dog flea, cat flea, human flea, and dog louse in dogs, cats and street-dwelling poor people. Similarly, for *Strongyloides,* there is usual contact with reservoir hosts such as dogs, cats, sheep, pigs etc. The street children rarely use footwear which is not able to protect *Stronglyloides* and Hookworms[21].

Humans are the occasional hosts of *Hymenolepis diminuta,* a cestode parasite of rodents. The risk factors include the consumption of dried fruits and precooked breakfast cereals containing the larvae and adults of meal moths (*Pyralis farinalis*), nymphs and adults of earwigs (*Anisolobis annulipes*), adults of various grain beetles such as *Tenebrio* and *Tribolium*, dung beetles, the larvae of fleas, and myriapods or infected from rat or mouse droppings are present[9]. Though in this study, these epidemiological factors of Hymenolepiasis were not evaluated, on the basis of distribution and feeding behaviour of rat and mouse, it can be said that these common animals in Kathmandu act as the mechanical vectors for the *H. diminuta*.

The open defecation by the street children and homeless people has many consequences in the

environment. They spend most of time on searching plastic, lead, paper and recycled materials in garbage of metropolitan area without footwear. They hardly use the soap and water to wash hands before eating and after defecation. They consume any type of food and water whenever and whatever they find even in the street. They are usually in contact with dogs, cats, mechanical flies and parasites infected soil, water, faeces, foods, fomites and filth. The open defecation followed by seepage of rainwater carries the distribution of cysts, oocysts, ova, larvae and adult stage of parasites into different places such as in vegetables and other foods which have been kept for selling over a thin plastic. These parasites are also carried by shoes or feet into all parts of the home resulting into a serious hygiene situation. In endemic areas, the eggs of *Ascaris* have been found adhering to cooking and eating utensils, fruits, vegetables, furniture, door handles, money and fingers[8].

In this study, the physical characteristics of the stools were also taken to evaluate the type of infection. The liquid or watery stool and bloody stool signify their gastrointestinal symptoms. The bloody and black stools with mucus are the characteristic features of hookworm and *Entamoeba* infection whereas; the liquid or watery stools with mucus are the characteristic features of *Cyclospora, Cryptosporidium* and *Giardia*. Naked eye as well as microscopic examination reveals the adult worms such as *Ascaris lumbricoides* and the proglottids of *Taenia* spp which are very important causes of environmental pollution.

The presence of multiple infections of parasites in the same stool sample suggests that these people have very high intensity or burden of the parasites. Co-infection of the parasites also suggests the similar modes of transmission as well. It indicates that these people are the major point sources of parasitic transmission within the city.

The high prevalence of intestinal parasites in street children in Kathmandu is due to ingestion of cysts, oocysts and embryonated infective eggs, developed in soil by soiled hands, drinking untreated (neither boiled nor chlorinated) water, usual contact with contaminated water, soil, food and rare habit of using sandal, usual contact with animals such as street dogs. Governmental and non-governmental organizations who are conducting a program in the health of street children should start a joint venture with metropolitan and medical and veterinary experts from academic and research institutions. The program should conduct the treatment of intestinal parasitic infection in animals such as street dogs, cows, cats and humans especially the street children. The strict laws and orders should be carried into action by government for those people who defecate openly in the metropolitan areas. An awareness program, accompanied by installing toilets for free of cost should be prioritized for these children.

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Table 1: Prevalence rate of different intestinal parasites in street stool samples in Kathmandu Valley, Nepal from May 2008 to July 2008.

Parasites	Number (N=93)	Prevalence rate (n/N)
Protozoa		
Entamoeba histolytica	44	47.3
Entamoeba coli	32	34.4
Giardia lamblia	29	31.2
Cryptosporidium spp	17	18.3
Cyclospora spp	15	16.1
Helminths		
Ascaris lumbricoides	52	55.9
Trichuris trichiura	43	46.2
Hookworm	27	29.0
Taenia spp	24	25.8
Hymenolepis nana	20	21.5
Strongyloides	9	9.7
Hymenolepis diminuta	4	4.3
Enterobius vermicularis	4	4.3
Dipylidium caninum	4	4.3

Table 2: Physical characteristics of the collected ninety three stool samples from street around Kathmandu, Nepal from May 2008 to July 2008.

Physical characteristic of stool	Numbers (N=93)	Percentage (%)
Colour		
Black	27	29.0
Brown or pale yellow	59	63.4
White	7	7.6
Consistency		
Formed (normal shape)	11	11.8
Soft-formed	73	78.5
Unformed or liquid (watery)	9	9.7
Blood in stool		
Presence	3	3.2
Absence	90	96.8
Mucus in stool		
Presence	58	62.4
Absence	35	37.6
Adult worms in stool		
Presence	3	3.2
Absence	90	96.8

Table 3: Intensity of Different Intestinal Parasitic Infections in Street Stool Samples in Kathmandu Valley, Nepal from May 2008 to July 2008.

Intensity of parasitosis	Total Number	%
Single (only)	3	7.3
Double	41	44.1
Triple	33	35.4
Quadruple	12	12.9
Quintuple	4	4.3
Total	**93**	**100.0**

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