Original article

# Prevalence of intestinal parasites among schoolchildren in a rural area close to the southeast of Lake Langano, Ethiopia

Mengistu Legesse, Berhanu Erko

**Abstract**

**Background**: Epidemiological information on the prevalence of various intestinal parasitic infections in different regions/localities is a prerequisite to develop appropriate control strategies.

**Objective**: The aim of this study was to determine the prevalence of intestinal parasitic infections in schoolchildren found in a rural area close to the southeast of Lake Langano.

**Methods**: In April 2003, fresh stool samples were collected from 259 students enrolled in two primary schools located in southeast of Lake Langano. The samples were processed using both Kato and formol-ether concentration methods and then microscopically examined for intestinal parasitic infections. A finger prick blood sample was also collected and haematocrit determined for each individual.

**Results**: Of the 259 students surveyed for intestinal parasites, 217(83.8%) had one or more parasites. Prevalence of hookworm was the highest (60.2%), followed by *Schistosoma mansoni* (21.2%), *Trichuris trichuria* (14.7%), *Taenia* spp. (13.9%), *Entamoeba histolytica/dispar* (12.7%), *Ascaris lumbricoides* (6.2%), *Giardia duodenalis* (6.2%) and *Strongyloides stercoralis* (5.8%), in that order. An association was not found between hookworm infection and low haematocrit value of the study subjects.

**Conclusion**: The occurrence of various intestinal parasitic infections and high prevalence of hookworm infection among schoolchildren in southeast of Lake Langano calls for institution of intervention measures. [*Ethiop.J.Health Dev*. 2004;18(2)116-120]

## Introduction

Intestinal parasitic infections are among the major diseases of public health problems in sub-Saharan Africa. Apart from causing mortality and morbidity, infection with intestinal parasites has been associated with stunting of linear growth, physical weakness and low educational achievement in schoolchildren (1-4). Furthermore, chronic intestinal parasitic infections have become the subject of speculation and investigation in relation to the spreading and severity of other infectious diseases of viral origin, tuberculosis and malaria (5-8). However, the role of intestinal parasites in causing morbidity and mortality as well as in the pathogenesis of other infectious diseases differs from species to species. Similarly, the distribution and prevalence of various species of intestinal parasites also differs from region to region because of several environmental, social and geographical factors. Hence, study on the prevalence of various intestinal parasitic infections is a prerequisite not only for formulation of appropriate control strategies but also to predict risk for communities under consideration.

Although several studies have been conducted on the distribution and prevalence of intestinal parasites in Ethiopia (9-12), there are still several localities for which epidemiological information is not available. Therefore, the objective of the present study was to assess the prevalence of intestinal parasitic infections among schoolchildren in two primary schools found in southeast of Lake Langano, Ethiopia.

## Materials and Methods

***Study area and population***: In April 2003, a cross-sectional parasitological survey was conducted in children enrolled in Kime and Langano Society of International Missionaries (SIM) primary schools in southeast of Lake Langano, about 210 km south of Addis Ababa. The two schools are situated at an altitude of 1600 meter above sea level. Children from the two schools were living under similar poor environmental sanitation and low socio-economic status. There was no adequate safe water supply in the areas. The majority of the inhabitants are Muslim Oromo. They chiefly earn their living by cultivation of maize and rearing livestock, mainly cattle and goats. There is only one clinic, which serves the communities of the two areas. Malaria is highly endemic in the area. Detailed description of the study area has been given elsewhere (13).

***Selection of study subjects***: When this study was carried out, the overall student population enrolled in the two schools was 557 (363 in Kime school and 194 in Langano SIM school). The verbal consent was first obtained both from the teachers and students and then students were selected by systematic random sampling using the master list of the schools. Accordingly, 259 students (170 From Kime and 89 from Langano SIM) were selected for the study. Among the selected students, 161 were males and 98 were females, age range from 6 to 25 years.

Institute of Pathobiology, Addis Ababa University, P.O. Box 1176, E-mail: aau-ipb@telecom.net.et, Addis Ababa, Ethiopia

***Stool sample collection and examination***: From each student, about 2g of fresh stool samples were collected using small clean plastic sheets. A portion of the specimen was processed using Kato technique (14, 15). Because of time constraint, egg count for hookworm was done only for 75 individuals on the spot within one hour after stool collection (16). All slides were examined for *Ascaris lumbricoides*, *Trichuris trichuria* and *Schistosoma mansoni* a week later in the laboratory. Part of the stool samples collected into plastic vials containing 10% formalin was processed by the formol-ether concentration method as previously described (17) and microscopically examined for helminth eggs, larvae and cysts of protozoan parasites.

***Blood sample collection and examination***: A finger prick blood sample was collected into a heparinized capillary tube using sterile lancets for the determination of haematocrit. One sterile lancet was used for one student and then discarded. Since the study area was endemic for malaria, thick blood film was also collected onto a clean and labeled microscopic slide. The slide was fixed, stained with Giemsa and later examined for malaria parasites. Student's t test was used to compare the mean haematocrit difference between the two groups. The median haematocrit value of the sample was used as cut-off point to determine an association between haematocrit value and hookworm infection using Chi-square ($\chi^2$) test and Odds ratio (95% CI).

***Ethical consideration***: The objective of the study was explained to the teachers and students at the time of specimen collection. Positive individuals for intestinal helminths including schistosomiasis were treated with mebendazole and praziquantel under the supervision of a local nurse. Positive individuals for malaria were also treated. However, protozoan infections were not treated since our diagnosis was only based on detection of cysts.

**Results**

Microscopic stool sample examination showed that infections with various intestinal helminths and protozoan parasites were common in children from both schools. The prevalence of infection with different intestinal helminths and protozoan parasites for Kime and Langano SIM schoolchildren is shown in Table 1. Out of 170 stool samples collected from Kime schoolchildren, 150(88.2%) were positive for at least one parasite. Similarly, of the 89 stool samples collected from Langano SIM schoolchildren, 67(75.3%) were positive for at least one parasite. The overall prevalence of at least one intestinal parasitic infection was 83.8% in the study subjects. Among the intestinal helminths, hookworm was the predominant parasite, 64.7% in Kime schoolchildren and 51.7% in Langano SIM. The prevalence of *Schistosoma mansoni*, *Trichuris trichuria*, *Ascaris lumbricoides* and *Taenia* spp. was higher among the children from Kime School than from Langano SIM ($p < 0.05$). Non-pathogenic protozoan parasites such as *Entamoeba coli and Iodamoeba buetschlii* were not found in the stool samples collected from Langano SIM students. On the other hand, cysts of protozoan parasites such as *Entamoeba histolytica/dispar* and *Giardia duodenalis* were found in some of the stool samples collected from Langano SIM and Kime students. Prevalence of infections with more than one parasite was higher in students from Kime than from Langano SIM (Table 2).

Table 1: **Prevalence of intestinal parasites in children from Kime and Langano SIM schools**

| School | Parasite | | | | | |
|---|---|---|---|---|---|---|
| | Sm | HW | Al | Tt | Ts | Ev |
| Kime n=170 | 52(30.6%) | 110(64.7%) | 14(8.2%) | 32(18.8%) | 30(17.6%) | 5(2.9%) |
| Langano SIM n=89 | 3(3.4%) | 46(51.7%) | 2(2.2%) | 6(6.7%) | 6(6.7%) | 2(2.2%) |
| Overall n=259 | 55(21.2%) | 156(60.2%) | 16(6.2) | 38(14.7%) | 36(13.9%) | 7(2.7%) |

Table 5 continued

| School | Parasite | | | | |
|---|---|---|---|---|---|
| | Hn | Strong. | E.H/d | Giardia | E.coli |
| Kime n=170 | 4(2.4%) | 8(4.7%) | 22(12.9%) | 13(7.6%) | 46(27.0%) |
| Langano SIM n=89 | 5(5.6%) | 7(7.9%) | 11(12.4%) | 3(3.4%) | 0(0%) |
| Overall n=259 | 9(3.5%) | 15(5.8%) | 33(12.7%) | 16(6.2%) | 46(17.8) |

SM = Schistosoma mansoni, HW = Hookworm, Al = Ascaris lumbricoides,
Tt = Trichuris trichiura, Ts = Taenia sp., Ev = Enterbius vermicularis,
Hn = Hymenolepis nana, Strong = Strongyloides, E.h/d = Entamoeba histolytica/dispar
E.coli = Entamoeba coli

Table 2: **Prevalence of single and mixed infections in the study subjects**

| No (%) of parasites | Kime school (n=170) | Langano SIM school (n=89) |
|---|---|---|
| None | 20 (11.8%) | 22 (24.7%) |
| One | 36 (21.2%) | 46 (51.7%) |
| Two | 46 (27.1%) | 19 (21.3%) |
| Three | 40 (23.5%) | 1 (1.1%) |
| Four | 15 (8.8%) | None |
| Five | 11 (6.5%) | 1 (1.1%) |
| Six | 2 (1.2%) | None |

The intensity of infection for hookworm, *Schistosoma mansoni*, *Trichuris trichuria and Ascaris lumbricoides* is shown in Table 3. The highest egg count for hookworm was 1440 eggs per gram (epg) of stool in one male student in Kime School and 1200 epg for one male student in Langano SIM School.

Microscopic examination of thick blood film showed that 29 (11.2%) subjects had either gametocytes of *Plasmodium falciparum* or trophozoites of *Plasmodium vivax* in their peripheral blood. Hence, haematocrit data of these subjects were not included in the haematocrit data analysis. Five haematocrit test tubes were broken during the centrifugation process and haematocrit data of these subjects were not obtained. For the rest of the samples assessment was made on the association between hookworm infection and haematocrit value of the study subjects. There was no association between hookworm infection and haematocrit value except for a slight association in male students older than 15 years (p= 0.044) (Table 4). Similarly, significant difference was not observed between the overall mean haematocrit values of hookworm infected and non-infected individuals (38.7 versus 39, p > 0.05). There was no significant difference between the mean haematocrit values of those individuals free from intestinal parasite(s) and individuals who had one or more intestinal parasites (39.6 versus 38.7, p =0.314).

Table 3: **Intensity of infection for hookworm, *Schistosoma mansoni*, *Trichuris trichiura and Ascaris lambricoides* among the sub-set of the study subjects (combined results for Kime and Langano SIM schools)**

| Parasite | Epg | No. of subjects | Parasite | Epg | No. of subjects |
|---|---|---|---|---|---|
| Hookworm | 24-100 | 34 | Ascaros | 24-100 | 4 |
| | 101-500 | 36 | | 101-500 | 4 |
| | 501-1000 | 3 | | 501-1000 | 1 |
| | >1000 | 2 | | >1000 | 3 |
| ***S. mansoni*** | 24-100 | 34 | Trichuris | 24-100 | 20 |
| | 101-500 | 15 | | 101-500 | 6 |
| | 501-1000 | None | | 501-1000 | None |
| | >1000 | None | | >1000 | None |

Table 4: **Association between haematocrit value and hookworm infection**

| Sex and Age (year) | Haematocrit | Hookworm | | Odds Ratio | 95% Confidence Interval | $\chi^2$ | P-value |
|---|---|---|---|---|---|---|---|
| | | Yes | No | | | | |
| Female (6-14) | <40 | 23 | 15 | | | | |
| | 40 | 29 | 16 | 0.846 | 0.347 – 2.064 | 0.135 | 0.713 |
| Male (6-14) | <40 | 39 | 24 | | | | |
| | 40 | 27 | 22 | 1.324 | 0.620 – 2.827 | 0.527 | 0.468 |
| Male (>15) | <40 | 3 | 8 | | | | |
| | 40 | 13 | 7 | 0.202 | 0.040 – 1.014 | 4.045* | 0.044 |
| Total | <40 | 65 | 47 | | | | |
| | 40 | 69 | 45 | 0.902 | 0.530 – 1.534 | 0.145 | 0.703 |

* Significant odds ratio

**Discussion**

Epidemiological study on the prevalence of infection of intestinal parasites in different regions/localities is a primary objective to identify high-risk communities and formulate appropriate intervention. In line with this view, the present study attempted to assess the prevalence of different intestinal parasitic infections in schoolchildren in southeast of Lake Langano. The results of the study showed the occurrence of several intestinal parasites of public health importance among schoolchildren in two primary schools found in southeast of Lake Langano.

The prevalence of hookworm infection was high in the study children in both schools with an overall prevalence of 60.2%. This is comparatively higher than those previously reported from different regions of Ethiopia (18-23). Although the prevalence of hookworm was high in the study subjects, data on egg count suggested low intensity of infection in subjects who had egg count for hookworm.

A nation-wide study conducted on ascariasis in Ethiopia has indicated a low prevalence of ascariasis in the low and dry areas of the country (12). In agreement with this previous report, the study showed relatively low prevalence of ascariasis (6.2%) and trichuriasis (14.7%) among schoolchildren found in southeast of Lake Langano.

The prevalence of *S. mansoni* was found to be higher among children in Kime school (30.6%) than among children in Langano SIM School (3.4%). This corroborates the previous report made by Erko et al. (13) where several *S. mansoni* transmission foci were identified in Kime school area. Although the presence of *Biomphalaria pfeifferi (*snail host for *Schistosoma mansoni*) was noted around Langano SIM School (13), there has been no known schistosomiasis transmission focus in this area. Nevertheless, the presence of schistosome-infected children in Langano SIM School still represents a risk for the introduction of a new transmission focus where the snail hosts are already available. Hence, extensive study on the transmission foci in the area is recommendable to take timely intervention measures.

Because of high prevalence of hookworm infection in the study subjects, an attempt was made to assess an association between hookworm infection and haematocrit value for the study subjects. In agreement with the previous report from southern Ethiopia (23), the present study revealed the absence of significant association between low haematocrit value and hookworm infection. On the contrary, other studies have shown strong association between low haematocrit value and hookworm infection (24,25). This could be explained by such factors as low intensity of hookworm infection, nutritional status of the study subjects (26) or due to differences in the species of hookworm (9).

In conclusion, the study showed that intestinal parasites were prevalent in varying magnitude among schoolchildren found in the southeast of lake Langano. This calls for the institution of control measures including treatment of infected individuals, improvement of sanitation and provision of clean water. The impact of each measure would be maximized through a health education program directed to schoolchildren in particular, and to communities in general.

**Acknowledgments**

We would like to acknowledge students and teachers of the study schools for their unfailing cooperation during the survey. We would like to acknowledge the technical staff of Medical Parasitology Unit of the Institute of Pathobiology, Addis Ababa University, for their technical assistance. We are also grateful to Mr Paulos Gutema for his assistance in data analysis.

**References**

1. Nokes C, Cooper ES, Robinson BA, Budy DAP. Geohelminth infection and academic assessment in Jamaican children. Trans Roy Soc Trop Med Hyg 1991;85:272-3.
2. Nokes C, Bundy DAP. Does helminth infection affect mental processing and educational achievement? Parasitol Today 1994;10:14-8.
3. Nokes C, Grantham-McGregors SM, Sawyer AW, Cooper ES, Bundy DAP. Parasitic helminth infection and cognitive function in schoolchildren. Proceed Roy Soc London B 1992;247:77-81.
4. Stephenson LS, Latham MC, Kurz KM, Kinoti SN, Brigham H. Treatment with a single dose of albendazole improves growth of Kenyan school children with hookworm, Trichuris trichiura, and Ascaris lumbericoides infections. Am J Trop Med Hyg 1989;4:78-87.
5. Actor JK, Shirai M, Kullberg MC, Buller RML, Sher A, Berzofsky JA. Helminth infection results in decreased virus-specific CD8+ cytotoxic T-cell and TH1 cytokine responses as well as delayed virus clearance. Proc Nat Acad Sci USA 1993;90:948-52.
6. Bentwich Z, Kalinkovich A, Weisman Z. Immune activation is a dominant factor in pathogenesis of African AIDS. Immunol Today 1995;16:187-91.
7. Diniz LM, Zandonade E, Dietze R, Pereira FEL, Rodrigues RR. Do intestinal nematodes increase the risk for multibacillary leprosy? Am J Trop Med Hyg 2001;65:852-4.
8. Nacher M, Singhasivanov P, Gay F, Phumratanaprapin W, Silachamroon U, Looareesuwan S. Association of helminth infection with decreased reticulocyte counts and hemoglobin concentration in Thai falciparum malaria. Am J Trop Med Hyg 2001;65:335-7.
9. Tedla S, Jemaneh L. Distribution of *Ancylostoma duodenale* and *Necatoramericanus* in Ethiopia. Ethiop Med J 1985;23:149-58.
10. Zein AZ, Assefa M. The prevalence of intestinal parasites among farming cooperatives Gondar region, northwestern Ethiopia. Ethiop Med J 1985;23:159-67.
11. McConnell E, Armstrong JC. Intestinal parasitism in fifty communities on the central plateau of Ethiopia. Ethiop Med J 1976;14:159-70.
12. Tedla S, Ayele T. Ascariasis distribution in Ethiopia. Ethiop Med J 1986;24:79-86.

13. Erko B, Gebre-Michael T, Balcha F, Gundersen SG. Implication of *Papio anubis* in the transmission of intestinal schistosomiasis in three new foci in Kime area, Ethiopia. Parasitol Int 2001;50:259-66.
14. Peters PA, Elalamy M, Warren KS, Mahmoud AAF. Quick Kato smear for field quantification of *Schistosoma mansoni* eggs. Am J Trop Med Hyg 1980;29:217-219.
15. Birrie H, Medhin G. Comparison of different Kato templates for quantitative faecal egg count of intestinal helminth parasites. Ethiop J Health Dev 1996;10:129-30.
16. Albonico M, Smith PG, Hall A, Chwaya HM, Alawi KS, Savioli L. A randomized controlled trial comparing mebendazole and albendazole against Ascaris, Trichuris and hookworm infections. Trans Roy Soc Trop Med Hyg 1994;88:585-9.
17. Ritchie LS. An ether sedimentation technique for routine stool examinations. Bull US Army Med Dept 1948;8: 326.
18. Tedla S. Hookworm infections in several communities in Ethiopia. East Afr Med J 1986;63:134-9.
19. Jemaneh L. Comparative prevalence of some common intestinal helminth infections in different altitude regions in Ethiopia. Ethiop Med J 1998;36:1-8.
20. Assefa T, Woldemichael T, Dejene A. Intestinal parasitism among students in three localities in south wello, Ethiopia. Ethiop J Health Dev 1998;12:231-5.
21. Birrie H, Medhin G, Erko B, Beshah G, Gemetchu T. Intestinal helminth infections among the current residents of the future Finchaa Sugar plantation area, western Ethiopia. Ethiop J Health Dev 1997;11:219-28.
22. Ali I, Mekete G, Wodajo N. Intestinal parasites and related risk factors among students of Asendabo Elementary and Junior secondary school south western Ethiopia. Ethiop J Health Dev 1999;13:157-61.
23. Erosie L, Merid Y, Ashiko A, et al. Prevalence of hookworm infection and hemoglobin status among rural elementary school children in southern Ethiopia. Ethiop J Health Dev 2002;16:113-5.
24. Bulto T, Haile-Meskal F, Endeshaw T, Dejene A. Prevalence of hookworm infection and its association with low haematocrit among resettles in Gambela, Ethiopia. Trans Roy Soc Trop Med Hyg 1992;86:184-6.
25. Tsegaye A, Mekonnen Y, Taticheff S. Types of anaemia due to hookworm infection among the populations of Waliso. Ethiop J Health Dev 1999;13:33-9.
26. Guyatt H. Do intestinal nematodes affect productivity in adulthood? Parasitology Today 2000;16:153-8.