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ORIGINAL ARTICLE

PREVALENCE OF INTESTINAL PARASITES AND ASSOCIATED RISK FACTORS AMONG STUDENTS OF ATSE FASIL GENERAL ELEMENTARY SCHOOL AZEZO, NORTHWEST ETHIOPIA

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ABSTRACT

***Background**: In Ethiopia, intestinal parasitoses are among the ten top causes of morbidity, particularly in children. Different studies in the country reported a high prevalence rate of intestinal parasite in school children, but the epidemiological information in Azezo area is not yet available. Therefore, the aim of this study was to determine the prevalence, intensity and associated risk factors of intestinal parasites among school children of Azezo.*

***Methods**: A cross-sectional study was conducted from March 10 to June 30, 2008, on 354 students selected from Atse Fasil General Elementary School in Azezo-Gondar town, northwest Ethiopia using stratified proportionate random sampling method. A stool sample was collected from each student for intestinal parasite examination using direct saline preparation, formol-ether concentration, and Kato-thick smear techniques. Data regarding socio-demographic, environmental and behavioral factors were collected using a pre-tested structured questionnaire; they were cleaned before they were entered and analyzed using SPSS version 16.0 soft ware.*

***Results**: Out of the 354 students examined, 258 (72.9%) were positive for one or more species of parasites. The prevalence rate was 78.9% for males and 68.6% for females. The most common parasites recovered were Schistosoma mansoni 154 (43.5%) followed by Ascaris lumbricoides 102(28.8%) and Trichuris trichiura 64(18.1%). Eleven students (3.1%) showed heavy parasitic infection. Sex, poor personal hygiene, lack of protective shoe, and frequent swimming habits showed statistically significant association with high rates of parasitic infections (P<0.05).*

***Conclusion and recommendation**: The high prevalence of intestinal parasitic infections among school children in the study area indicates the need for therapeutic intervention and health education.*

***Key words**: Intestinal parasites, Schistosoma mansoni, school children*

INTRODUCTION

Intestinal parasites, which are among the most common infections in the world, have been responsible for considerable morbidity and mortality (1). According to the World Health Organization (WHO), more than 3.5 billion people (the majority children) around the world are affected by intestinal parasitic infections (2). Besides causing morbidity, intestinal parasitoses have been associated with malnutrition, growth retardation, physical weakness, and poor school performance among school children (3-6).

Parasitic infections are highly prevalent in sub-Saharan African countries due to factors, like poverty, malnutrition, poor sanitary condition, and suitable tropical climate for the maturation of the various parasites to their infective stages (7-8).

In Ethiopia, intestinal parasitic diseases are among the ten top causes of morbidity, with helminths infection accounting for 6.4% of outdoor patients during a nationwide survey conducted in 1999/2000 G.C (9). Different studies in different parts of the country also reported different prevalence rates of intestinal parasites in school children (10-29), including Wendogenet areas where higher (89%) prevalence rate was recorded (21). Ascariasis and schistosomiasis *man-*

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soni were the most common helminthes infections in the school children of Ethiopia (10-12). For ascariasis, infection rates that ranged from 10% to 74% were reported from different altitudes of Ethiopia (10 -29). Higher prevalence rates of *S. mansoni* were reported from Zarima (85%)(24), Metehara Sugar Estate (71.3%) (22), Zeghie (69.7%) (19), and Gorgora (67%) (24); where this parasite has been highly endemic.

Studies on the prevalence of intestinal parasites in different parts of the country and identifying high-risk groups in the communities are important to design appropriate intervention strategies. Although several studies have been conducted on the distribution and prevalence of intestinal parasites in northwest Ethiopia (24-29), there are still certain localities in Gondar, where epidemiological information regarding intestinal parasites is lacking. Therefore, the aim of this study is to determine the prevalence, intensity and associated risk factors of intestinal parasites among school children of Atse Fasil General Elementary School in Azezo, Northwest Ethiopia. The information from this study will no doubt contribute a great deal in planning intervention methods to promote the health status of the students and the community at large.

MATERIALS AND METHODS

Study design and area: A cross-sectional study was conducted among students of Atse Fasil General Elementary School from March 10 to June 30, 2008 in Azezo. Azezo is located on the southwestern part of Gondar town at 725 km from Addis Ababa, the capital city of Ethiopia. It is located at 12°34'N37°26'E in the globe. It has an altitude of around 1800 above sea level and average temperature ranging from 10 to 31^{o}C. The Demaza River flows through the heart of Azezo, Separating the former military camp from the town while the Shinta River bounds Azezo on the east.

Study population and Sample size: The sample size was determined using the single population proportion formula, ($n = (Z\alpha/2)^2 - p\ (1-p)/w^2$) considering 95% level of confidence interval and 50% prevalence which resulted in a sample size of 384. Since the target population (N=2478 students from the record of the school as sampling frame) is <10,000, by using the corrected formula (n/ 1+n/N) we obtained 333. By adding a 10% contingency, we recruited 367 students. Thirteen students were excluded from the study due to insufficient and dried stool sample delivery for the laboratory investigation. Based on their grade level, students were stratified in to eight strata. From each stratum, students were selected by proportionate simple random sampling taking the list of students in every class as a sampling frame.

Stool collection and parasitic examination: Each student was advised to bring about 2gm of fresh stool and was given a clean, dry and leak proof stool cup. The cups were labeled before processing and parasites were examined inside the temporary laboratory established at Atse Fasil General Elementary School. A portion of the specimen (approximately 20 mg) was processed using direct saline preparation for microscopic examination of helminthes ova and larvae, protozoa cysts and trophozoites (30). Similarly, about 41.7 mg of stool was processed for Kato thick smear primarily to detect eggs of *Schistosoma mansoni* and ova and larvae of other nematodes (1). The parasite load, then, was defined as light, moderate and heavy based on the number of egg per gram of stool (EPG) for the *A. lumbericoides*, *S. mansonai* , hookworms and *T. trichura* according to WHO recommendation (1). One gram of stool was also processed by formol-ether concentration technique (30). The consistency of the stool was checked before the samples were processed.

The questionnaire and family information form: A pre-tested structured questionnaire of Amharic version was used to collect socio-demographic data (age, gender, education of mother, family size, income of the family and religion), environmental factors (source of water supply and urban or rural residence) and behavioral habits (use of toilet, swimming habit, hygienic status, shoe wearing and hand washing habits) that could be associated with high prevalence of intestinal parasites in school children. A single interviewer was assigned to document data related to the above information in addition to observational assessment about personal hygiene of the study subjects.

Data analysis: Data were cleaned before analysis using SPSS (Statistical Package for Social Sciences) version 16.0 soft ware. Chi-square, P-value, crude and adjusted odds ratio (OR) were analyzed to evaluate any association between the study variables and intestinal parasitoses.

Ethical Consideration: Permission to conduct the study was obtained from the Department of Medical Laboratory Technology, the University of Gondar and Atse Fasil General Elementary School administrators. Informed verbal consent was also obtained from each student. Students who were positive for

intestinal parasite(s) were treated with appropriate drugs for free.

RESULTS

Three hundred and fifty-four students participated in the research with a response rate of 96.5%. The total number of females was 207 (58.5%). Of the total 354 students, 218(61.6%) were in the age range of 11-15 years (Table 1).

Among the 354 students sampled, 258 (72.9%) were found to be infected with one or more intestinal parasites (Table 2). Single and multiple parasitic infection rates were 136 (38.4%) and 122 (34.5%), respectively. Of the ten intestinal parasites identified from the stool sample, *Schistosoma mansoni* 154 (43.5%) was the most common followed by *Ascaris lumbricoides* 102 (28.8%), *Trichuris trichiura* 64(18.1%), *Entrobius vermicularis* 4(1.1%), *Strongloides stercolaris* 3(0.8%) and *Taenia species* 2 (0.6%) were the least prevalent species (Table 2).

Table-1 - Frequency distribution of Atse Fasil General Elementary School students by socio demographic characteristics, Azezo, Northwest Ethiopia, March 10 – June 30 2008

Socio-demographic characteristics	**Number**	**Percent**
Sex		
Male	147	41.5
Female	207	58.5
Age (years)		
6-10	104	29.4
11-15	218	61.6
> 16	32	9.0
Religion		
Muslim	28	7.9
Christian	326	92.1
Mothers/guardian Education status		
Illiterate	106	29.9
Able read & write	32	9.0
Primary	73	20.6
High school	101	28.5
Above High school	42	11.9
Family monthly income(Ethiopian Birr)		
≤200	88	24.9
201-500	113	31.9
501-800	71	20.1
>800	56	15.8
Unknown	26	7.3
Respondents' Educational Status (Grade)		
One	29	8.2
Two	37	10.5
Three	16	4.5
Four	39	11.0
Five	81	22.9
Six	44	12.4
Seven	49	13.8
Eight	59	16.7
Over all	**354**	**100**

*Figures in parenthesis indicate percentages

Table-2 - Number of male and female students positive for one or more parasite(s) among students of Atse Fasil General Elementary School in Azezo, Northwest Ethiopia, March 10-June 30 2008.

Species of parasites	Male n=147	Female n=207	Total n=354
Protozoans			
Giardia lamblia cyst	20(13.6) *	20(9.7)	40(11.3)
Giardia lamblia trophozoite	4(2.7)	2(1)	6(1.7)
Entamoeba histolytica/dispar cyst	3(2)	0(0)	3(0.8)
Entamoeba histolytica/dispar trophozoite	2 (1.4)	0(0)	2(0.6)
Helminthes			
Ascaris lumbricoides	41(27.9)	61(29.5)	102(28.8)
Schistosoma mansoni	73(49.7)	81(39.1)	154(43.5)
Trichuris trichiura	33(22.4)	31(15)	64(18.1)
Hook worm	12(8.2)	17(8.2)	29(8.2)
Hymenolopis species	18(12.2)	16(7.7)	34(9.6)
Entrobius vermicularis	1(0.7)	3(1.4)	4(1.1)
Strongloides stercolaris	2(1.4)	1(0.5)	3(0.8)
Taenia species	2(1.4)	0(0)	2(0.6)
Over all	**116(78.9)**	**142(68.6)**	**258(72.9)**

The prevalence of intestinal parasitic infection was 78.9% and 68.6% for males and females, respectively. Males were 1.9 times more affected by intestinal parasitic infection than females (Adjusted OR= 1.88, CI=1.05-3.37, P<0.05) (Table 3).

The percentage of personal hygienic status of the study subjects that was graded good, medium and poor was 28.0%, 30.8% and 41.2%, respectively. Poor personal hygienic status showed a statistically significant association for a high rate of parasitic infection (P<0.05). Students who had poor personal hygiene were 1.7 times (Adjusted OR= 1.7, CI=0.86-3.33, P<0.05) likely to have intestinal parasitic infection than those who had experienced good hygienic practice (Table 4).

Schistosoma mansoni infection rate was significantly associated with frequent swimming habit (P=0.000). The likelihood of getting *Schistosoma mansoni* infection among students who swam three or more times per week was almost four times higher than among non-swimmers (Adjusted OR= 3.906) (Table 4). *Schistosoma mansoni* infection was 49.7% in males, and 39.1% in females (Table 2). A total of 89.8 % boys and 76 % girls gave a history of swimming in at least one of the rivers in Azezo. A high hookworm infection rate was also associated with the absence of protective shoe (P=0.04). No statistically significant association was found between intestinal parasitic infection and environmental or other behavioral factors (P>0.05) (Table 4).

Ascaris lumbricoides co-infection with *Trichuris trichiura*, *Schistosoma mansoni* and Hookworms showed a statistically significant association (P<0.05). Similarly, *Schistosoma mansoni* and *Trichuris trichiura* showed a significant association for co-infection (P<0.05).

Regarding parasite load, the highest number of egg count per gram of faeces (EPG) was 21,768 eggs of *Ascaris lumbricoides* from one study subject. Eleven students (3.1%) showed heavy infection with the four common intestinal helminthes (*Ascaris lumbricoides*, *Schistosoma mansoni*, *Trichuris trichiura*, and Hookworms) for the Kato thick smear used (Table 5).

Table-3- Intestinal parasitoses by socio demographic characteristics among students of Atse Fasil General Elementary School in Azezo, Northwest Ethiopia, March 10 –June 30 2008.

Socio demographic Characteristics	Positive n=258	Negative n=96	Total n=354	P-value	Crude OR	95 % CI		Ad-justed OR	95 % CI	
						Lower	Up-per		Lower	Upper
Sex										
Male	116(78.9)*	31(21.1)	147(41.5)	0.031	1.712	1.046	2.805	1.882	1.050	3.373
Female	142(68.6)	65(31.4)	207(58.5)		1.00			1.000		
Age (years)										
6-10	78(75)	26(25)	104(29.4)	0.124	2.330	0.940	5.780	2.843	0.681	11.870
11-15	162(74.3)	56(25.7)	218(61.6)		2.250	0.980	5.130	2.052	0.799	5.270
> 16	18(56.3)	14(43.7)	32(9.0)		1.000			1.000		
Religion										
Muslim	18(64.3)	10(35.7)	28(7.9)	0.286	0.645	0.287	1.452	0.859	0.327	2.258
Christian	240(73.6)	86(26.4)	326(92.1)		1.00			1.000		
Mothers/guardian Education status										
Illiterate	79(74.5)	27(25.5)	106(29.9)	0.801	1.000			1.000		
Able read & write	22(68.8)	10(31.3)	32(9)		0.750	0.290	1.950	0.558	0.191	1.630
Primary	57(78.1)	16(21.9)	73(20.6)		1.220	0.570	2.620	1.052	0.446	2.481
High school	66(65.3)	35(34.7)	101(28.5)		0.640	0.340	1.220	0.651	0.293	1.447
Above High school	34(81)	8(19)	42(11.9)		1.450	0.560	3.880	1.781	0.561	5.651
Family monthly income (Ethiopian Birr)										
≤200	65(73.9)	23(26.1)	88(24.9)	0.280	1.000			1.000		
201-500	90(79.6)	23(20.4)	113(31.9)		1.380	0.680	2.820	1.475	0.674	3.229
501-800	43(60.6)	28(39.4)	71(20.1)		0.540	0.260	1.120	0.746	0.316	1.762
>800	43(76.8)	13(23.2)	56(15.8)		1.170	0.500	2.750	1.287	0.467	3.544
Unknown	17(65.4)	9(34.6)	26(7.3)		0.670	0.240	1.890	0.686	0.205	2.299
Respondents'Edu-cational Status (Grade)										
One	21(72.4)	8(27.6)	29(8.2)	0.260	1.000			1.000		
Two	31(83.8)	6(16.2)	37(10.5)		1.970	0.520	7.640	1.926	0.509	7.284
Three	12(75)	4(25)	16(4.5)		1.140	0.240	5.760	0.786	0.154	4.005
Four	25(64.1)	14(35.9)	39(11)		0.680	0.210	2.170	0.509	0.144	1.805
Five	64(79)	17(21)	81(22.9)		1.430	0.480	4.190	1.392	0.323	5.996
Six	32(72.7)	12(27.3)	44(12.4)		1.020	0.310	3.270	0.670	0.130	3.453
Seven	30(61.2)	19(38.8)	49(13.8)		0.600	0.200	1.810	0.663	0.136	3.239
Eight	43(72.9)	16(27.1)	59(16.7)		1.020	0.340	3.080	0.999	0.210	4.761
Over all	**258(72.9)**	**96(27.1)**	**354(100)**							

**Figures in parenthesis indicate percentages*

Table-4 - Association of risk factors and intestinal parasitic infections among students of Atse Fasil General Elementary School in Azezo, Northwest Ethiopia, March 10-June 30 2008.

Risk factors	Positive n=258	Negative n=96	Total n=354	P-value	Crude OR	95% CI Lower	95% CI upper	Adjusted OR	95 % CI Lower	95 % CI Upper
Family size										
≤4	70(66.7)*	35(33.3)	105(29.7)	0.370	1.000			1.0000		
5-7	154(77)	46(23)	200(56.5)		1.670	0.960	2.920	1.697	0.909	3.166
8 and above	34(69.4)	15(30.6)	49(13.8)		1.130	0.510	2.510	1.058	0.433	2.588
Latrine avail-ability										
Yes	197(70.6)	82(29.4)	279(78.8)	0.064	0.551	0.292	1.041	0.312	0.123	0.788
No	61(81.3)	14(18.7)	75(21.2)		1.000			1.000		
Latrine usage										
Always	208(75.1)	69(24.9)	277(78.2)	0.141	1.000			1.000		
Some times	15(60)	10(40)	25(7.1)		0.500	0.200	1.260	0.239	0.092	0.622
Not at all	35(67.3)	17(32.7)	52(14.7)		0.680	0.340	1.360	0.477	0.173	1.315
Drinking water source										
Pipe water & protected well and spring	253(73.1)	87(26.9)	346(97.7)	0.447	1.000			1.000		
River, unpro-tected well and spring	5(62.5)	3(37.5)	8(2.3)		0.573	0.134	2.448	0.777	0.086	7.024
Protective shoe										
Present	20**(6.8)	273(93.2)	293(82.8)	0.040	1.000			1.000		
Absent	9**(14.8)	52(85.2)	61(17.2)		2.360	0.940	5.850	1.217	0.584	2.534
Total	29**	325	354							
Any shoe wearing habit										
Always	13**(7.4)	163(92.6)	176(49.7)	0.583	1.000			1.000		
Sometimes/ Not at all	16**(9.0)	162(91)	178(50.3)		1.240	0.540	2.830	1.098	0.618	1.952
Total	29**	325	354							
Swimming frequency per week										
0	31(25.6)ǂ	90(74.4)	121(34.2)	0.000	1.000			1.000		
1-2	76(46.1)ǂ	89(53.9)	165(46.6)		2.480	1.440	4.270	1.760	0.963	3.218
≥3	47(69.1)ǂ	21(30.9)	68(19.2)		6.500	3.210	13.260	3.906	1.585	9.628
Total	154ǂ	200	354							
Resident loca-tion										
Rural	25 (78.1)	7(21.9)	32(9)	0.483	1.360	0.540	3.600	0.459	0.140	1.509
Urban	233 (72.4)	89(27.6)	322(91)		1.000			1.000		
Hygienic status										
Poor	117(80.1)	29(19.9)	146(41.2)	0.035	1.840	0.980	3.450	1.689	0.856	3.333
Medium	73(67)	36(33)	109(30.8)		0.920	0.500	1.730	0.727	0.370	1.430
Good	68(68.7)	31(31.3)	99(28)		1.000			1.000		
Over all	**258(72.9)**	**96(27.1)**	**354(100)**							

***** *Figures in parenthesis indicate percentages* ǂ*Positive for Schistosoma mansoni only.*
****** *Positive for Hook worm ova only.*

Table-5 - Intensity of the four common intestinal helminthes using Kato-thick smear technique among students of Atse Fasil General Elementary School in Azezo, Northwest Ethiopia March 10 - June 30 2008.

Species of parasites	Intensity of infection		
	Light	**Moderate**	**Heavy**
Ascaris lumbricoides	83(23.45)*	12(3.4)	0(0)
Trichuris trichiura	55(15.5)	3(0.008)	0(0)
Hook worm	15(0.04)	4(0.01)	1(0.003)
Schistosoma mansoni	87(24.5)	51(14.4)	10(2.8)
Total	240(67.8)	70(19.8)	11(3.1)

** Figures in parenthesis indicate percentages*

DISCUSSION

Knowledge on the distribution and extent of intestinal parasitic infections in a given community is a pre -requisite for planning and evaluating intervention programs. The present study also assessed intestinal parasites prevalence, intensity of infection, and associated local risk factors among students in Azezo.

Nearly three- fourth (72.9%) of the students in Azezo were infected by intestinal parasites which is almost similar to the prevalence documented in Jimma 73.5% (15), while quite higher as compared with studies done elsewhere in Ethiopia (14, 20). The high total prevalence in this study might be due to the use of combined methods and socio-demographic differences of the study subjects.

The overall intestinal parasitic infection in this study was significantly higher in males 116(78.9%) than females 142(68.6%) ($P<0.05$). This result is consistent with the study done in Wonji Shoa (14) and Asendabo school children (16).

In this study, 136(38.4%) students had a single parasitic infection and 122(34.46%) harbored more than one species of intestinal parasites. This finding of single infection is almost the same as that of a study done by Worku and his colleagues in Gondar Town (25). A previous study from Gondar (10.9%) (25) reported a lower mixed infection than the present finding (34.46%). This might be due to the combination of three methods used for the diagnosis in this study. On the other hand, mixed infection in this study was lower than that of the school children of Wonji Shoa Sugar Estate 48% (14).This difference might be due to climatic, geographic as well as study time differences in the study areas.

Schistosoma mansoni (43.5%) infection in this study showed a lower prevalence rate compared to other endemic areas such as Zarima (85%) (24), Metehara Sugar Estate (71.3%) (22), Zeghie (69.7%) (19), and Gorgora (67%) (24). Studies done in different parts of the country showed lower rates for *Schistosoma mansoni* ranging from 2.4% to 24.9% (17-20, 23). The high prevalence in this study might be due to high contamination of the nearby rivers with fecal materials near the study area. The methods employed for stool examination might also have a contribution to a high prevalence three methods were not used in any of the results compared.

The prevalence of *Schistosoma mansoni* infection was also significantly higher in boys than in girls ($p<0.05$). This gender-associated difference was also reported by a similar study in South Wollo (18). The existence of more swimming habit among boys 111 (89.8%) than girls 122 (76%) could be one of the reasons which increased the boys' exposure to cercarial-infested water. Further studies are required to investigate the snail intermediate hosts in Azezo. There was also a significant association between frequent swimming with high *Schistosoma mansoni* infection rate ($P=0.000$).

The hygienic status of most of the students 146 (41.2%) was poor, and out of them 117(80.1%) were infected with one or more intestinal parasites. Poor personal hygienic status and the presence of intestinal parasites showed a statistically significant association ($P=0.035$) (Table 3). This finding is similar with that of a study done in Asendabo, southwestern Ethiopia (16).

Most of the respondents 293(82.8%) used to wear protective shoes, while 61(17.2%) students had no protective shoes, and their hookworm infection rate was 6.8% and 14.8%, respectively. This finding showed a statistically significant association between

absence of protective shoe and hookworm infection (P=0.04) which is inline with that of a study done at Koladiba (26).

Previous studies in Gondar reported mixed multiple infections of *Trichuris trichiura*, *Ascaris lumbricoides* and the hookworms and *Schistosoma mansoni* in addition to *Ascaris lumbricoides* and *Trichuris trichiura* infections (27-29). In this study, however, a statistically significant association was detected for co-infection of *Ascaris lumbricoides, Trichuris trichiura*, *Schistosoma mansoni* and Hookworm (P<0.05) as well as *Schistosoma mansoni* and *Trichuris trichiura* (P<0.05).

Of the total school children sampled, 67.8% had light, 19.8% moderate, and 3.1% heavy infections of these helminthes. This result could indicate the seriousness of the problem of intestinal parasite infections in school children in the study area although the effect of these parasites was not evaluated clinically. Such evaluation should have been done in addition to evaluating the nutritional status of the study subjects. Further investigations in these areas are required.

Determining the quantity of helminthes eggs is very important to estimate the effects that will result when there is a heavy intensity of infection. Sixty one (17.2%) students had moderate or heavy intensity of infection of *Schistosoma mansoni* which is in agreement with the result of a study done in South Gondar 14.6 % (23). Eleven students (3.1%) had heavy intensity of common intestinal helminthes infection. According to WHO, this community (with >50% cumulative prevalence and <10% heavy intensity of infections) is categorized as Community category II (31).

CONCLUSION AND RECOMMENDATION

The majority of the students were infected with one or more species of intestinal parasites. *Schistosoma mansoni* is the leading intestinal parasite. Males were more affected than females by intestinal parasites and *Schistosoma mansoni* infections. Absence of protective shoes, increased swimming frequency, and poor personal hygienic status were the risk factors identified in this study area. Therefore, this calls upon concerned bodies to take measures to control the transmission of intestinal parasites. Health education should be given to increase the awareness of the students on personal hygiene and about the risk of swimming in infested rivers. Parents/guardians should also buy protective shoes for the students. Application of deworming programs should be also considered for the students once in a year.

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REFERENCES

1. World Health Organization Basic Laboratory Methods in Medical Parasitology, Geneva: WHO, 1991:9-79
2. WHO Control of tropical diseases. WHO, 1991:25-26
3. Cooper E, Bundy DAP.Parasitic helminth infection and cognitive function in school children. *Proc R Soc Lond. B Biological Sci* 1992; 247:77 -81
4. Nokes C, Bundy D. Does helminth infection affect mental processing and educational achievement? *Parasitol Today* 1994; 10:14-8.
5. Crompton DW,Neshem MC Nutritional impact of intestinal helmenthiasis during the human life cycle. *Annu Nutr* 2002; 22:35-59
6. De Silva NR, Brooker S, Hotez PJ,Montresor A, Engels D,Savioli L.Soil transmitted helminth infections: updating the global picture. *Trends in Parasitology* 2003; 19:547-551.
7. WHO Prevention of schistosomiasis and soil transmitted helminthiasis: Report of WHO Expert Committee. *WHO Technical Report Series 912. Geneva* 2002.
8. WHO. *Global Water Supply and Sanitation Assessment report.* WHO and United Nations Children Fund, USA, 2000: 84-87
9. Health and Health related indicators. Report of Ethiopian Ministry of Health, 2000.
10. Tedla S, Ayele T. Ascariasis distribution in Ethiopia. *Ethiop Med J* .1986; 24:79-85.
11. Haile G, Jirra C, Mola T. Intestinal parasitism among Junior Elementary and Junior Secondary School, South-western Ethiopia. *Ethiop J Health Dev.* 1994; 8:37-41.

12. Mammo B, Assefa B. Intestinal helminthes in Akaki Town, with special emphasis on the Epidemiology of *Schiostosma manson. Ethiop Med J* .1989 27(49): 183-91
13. Jemaneh L. Comparative prevalence of some common intestinal helminth infections in different altitude regions in *Ethiopia. Ethiop Med J* 1998; 36:1-8
14. Woldemichael T, Assefa T, Seyoum, S. Intestinal parasitism among the student population of Wonji-Shoa Sugar Estate. *Ethiop J Health Dev*. 1990; 4:45-49.
15. Assefa S, Mulugeta G, Mulu A. Intestinal parasitism and related risk factors among students of a school; southwest Ethiopia, *Focus chronicle (Unpublished)* 2005 5(3): 230-39
16. Ali I, Mekete G,Wodajo N. Intestinal parasitism and related factors among school students of Asendabo Elementary School ,South Western Ethiopia. *Ethiop J Health Dev.* 1999; 13 (2): 157 -161
17. Tadess G. The prevalence of intestinal helminthic infections and associated risk factors among school children in Babile town,Eastern Ethiopia. *Ethiop J Health Dev.* 2005; 19 (2): 140-147
18. Assefa T, Woldemicheal T, Dejene A. Intestinal parasitism among student in three localities in South Wello, Ethiopia. *Ethiop J Health Dev*. 1998; 12 (3): 231-35
19. Erko B and Tedla S. Intestinal helminth infections at Zeghie town, Ethiopia, with emphasis on *schistosoma mansoni*. *Ethiop J Health Dev*. 1993; 7 (1): 21-26
20. Legess M., Erko B. Prevalence of intestinal parasites among school children in rural area close to the South East of lake Langano, Ethiopia. *Ethiopia Med J* .2004, 18(2): 116-20
21. Roma B and Worku S. Magnitude of Schistosoma mansoni and intestinal helminth infections among school children in Wondogenet Zuria, Southern Ethiopia. Ethiop. J. Health Dev. 1997; 11:125-129.
22. Abebe F, Tedla S, Birrie H and Medhin G.Transmission dynamics of *S. mansoni* in an irrigation setting in Ethiopia. Ethiop. J. Health Dev.1995; 9:147-156.
23. Jemaneh L. The epidemiology of *Schiostosma mansoni* in elementary school children from the South Gondar zone of the Amhara National Regional State, Ethiopia. *Ethiop Med J.* 2000,38 (2): 105-18
24. Tiruneh M, Fentahun M, Kassu A, Tiruneh G, Lieshout LV, Polderman AM. Schistosomiasis in school attainders and non-attainders in North West Ethiopia. *Ethiop J Health Dev.* 2001; 15 (2): 117-123
25. Worku N, Erko B, Torben W, Belay M, Kassu A, Fetene T and et al. Malnutrition and intestinal parasitic infections in school children of Gondar, North West Ethiopia. Ethiop Med J. 2009 Jan; 47(1):9-16.
26. Jarso G, AyalewA, Bezel G.Prevalence of intestinal helmentniasis among koladiba Elementary School Students. *Focus on GCMS* 2004 *(Unpublished)*; 40-41.
27. Jemaneh L. Schistosomiasis mansoni and geohelminthiasis in school children in the Dembia Plains, Northwest Ethiopia. Ethiop J. Health Dev 1998; 12:237-244.
28. Jemaneh L. Intestinal helminth infections in rural and urban school children in Gondar town and the surrounding areas, Northwest Ethiopia. SINET: Ethiop J Sci 1999; 22:209-220.
29. Jemaneh L. Soil-Transmitted Helminth Infections and Schistosomiasis mansoni in School Children from Chilga District, Northwest Ethiopia. Ethiop. J. Health Sci.2001; 11:79-87.
30. WHO. Bench Aids for the diagnosis of intestinal parasites. World Health Organization, Geneva 1994.
31. WHO. Prevention and control of Intestinal Parasitic Infections. Report of a WHO Expert committee. World Health Organization, Geneva. Technical Report Series 749;1987:12-15