Science Journal of Public Health
2017; 5(3): 192-197
http://www.sciencepublishinggroup.com/j/sjph
doi: 10.11648/j.sjph.20170503.16
ISSN: 2328-7942 (Print); ISSN: 2328-7950 (Online)

Prevalence of Intestinal Helminthic Parasitic Infections and Associated Risk Factors Among Students in Tepi Town, South West Ethiopia

Esmael Besufikad Belachew[1], Dagnew Bitew Tarko[1], Yilkal Messelu Wallie[2]

[1]Department of Biology, College of Natural and Computational Sciences, Mizan-Tepi University, Tepi, Ethiopia

[2]Department of Statistics, College of Natural and Computational Sciences, Mizan-Tepi University, Tepi, Ethiopia

Email address:

getbb2006@gmail.com (E. B. Belachew), btdagne@gmail.com (D. B. Tarko), yilkalmes@gmail.com (Y. M. Wallie)

Tocite this article:

Esmael Besufikad Belachew, Dagnew Bitew Tarko, Yilkal Messelu Wallie. Prevalence of Intestinal Helminthic Parasitic Infections and Associated Risk Factors Among Students in Tepi Town, South West Ethiopia. *Science Journal of Public Health.* Vol. 5, No. 3, 2017, pp. 192-197. doi: 10.11648/j.sjph.20170503.16

Received: January 24, 2017; **Accepted**: February 10, 2017; **Published**: March 20, 2017

Abstract: Intestinal helminthic parasites are responsible for considerable morbidity and occasional mortality among infected population all over the world. Their prevalence and specific risk factors was not clearly confirmed especially in African countries including Ethiopia. Based on this fact, the present study was conducted to determine the prevalence and associated risk factors of intestinal helminthic infection among students in Tepi town, south west Ethiopia. To conduct this research we were used a cross-sectional study design. Stool samples were collected from all enrolled students and wet mount and formalin-ether sedimentation concentration procedures were used for each helminthes examination. A total of 380 study participants were included in the study, out of which 94 (24.7%) were positive for intestinal helminthic parasites. The commonest helminthes isolated in this study was *Ascaris lumbricoides* (9.2%) followed by *Trichuris trichiura* (5.8%). Hookworm and *Schistosoma mansoni* infection were more prevalent among males than females. The binary logistic regression result showed that sex, cleanness of the finger nails, school, family size, protective shoe, and religion were significantly associated with intestinal helminthic infection. The overall prevalence rate of helminthes observed in the present study was 24.7%. The commonest helminthes was *A. lumbricoides* (9.2%) followed by *T. trichiura* (5.8%). General health educations among those risky groups are highly recommended in order to reduce its prevalence and to formulate appropriate intervention.

Keywords: *Ascaris lumbricoides*, Hookworm, Intestinal Helminthes, Intestinal Parasites, Prevalence, *Schistosoma mansoni* and *Trichuris trichiura*

1. Introduction

Intestinal parasites adversely affect the health of humans in many parts of the world, are more common in tropical and subtropical regions especially in poor populations. Current estimates showed that 3.5 billion people are affected and 450 million are ill as a result of these infections, the majority is being children. Annually, 16 million deaths occur due to the intestinal parasitic disease worldwide [1].

Intestinal helminthic infections are among the most prevalent and widespread chronic human intestinal infections worldwide with the greatest public health burden occurring in developing countries, particularly in sub Saharan Africa [2].

The majority of these infections result from unsafe and inadequate provision of water, low standard of living, poor socioeconomic status, poor personal hygiene, poor environmental sanitation and overcrowding that favors the development and survival of these parasites and contributes to the high level of intestinal helminthic parasites transmission [1].

The highest prevalence and intensity of infection are usually observed in school-aged children [3], due to their bad habits of playing or handling of infested soils, eating with soiled hands, unhygienic toilet practices, drinking and eating of contaminated water and food [3].

Helminthic infections, as in many developing countries

are also common in Ethiopia, are the second most predominant causes of outpatient morbidity, where children are the most affected group [4, 5]. It cause serious public health problems such as malnutrition, anemia and growth retardation as well as higher susceptibility to other infections [4]. The most prevalent and important helminthes are those of the soil transmitted nematodes, particularly and *Trichuris trichiura.* Hookworm infection, strongyloidiasis and enterobiasis are also public health problem though the magnitude is lesser compared to ascariasis [5]. There is no any kind of study conducted in our study area, Tepi Town. Indeed the study area is characterized by tropical climate, low altitude, high humidity, high amount of rainfall, limited access to clean water, habit of eating raw food and lack of environmental sanitation that highly support the transmission of intestinal helminthic parasites. Therefore, the present study is proposed to investigate the prevalence, risk factors and status of common intestinal helminthic parasites in the study area.

2. Method

2.1. StudyArea

The study was conducted in Tepi town, which is located in Yeki Woreda, Sheka Zone, SNNPR, Ethiopia. It is located about 611 km away from Addis Ababa, capital city of Ethiopia and has an altitude of 1,097 meter. The average annual rainfall is 1415 mm.

2.2. Study Design

A cross-sectional study design was used to investigate the prevalence of intestinal helminthic infection and associated risk factors among students in Tepi town, Sheka zone, SNNPRS.

2.3. Study Population

Parasitological survey was conducted in primary, secondary and preparatory schools in Tepi town. This was on the ground that students usually have higher prevalence rates than other population segments and appropriately designed studies among students may also provide data on the overall prevalence and incidence of intestinal parasitic infections in certain endemic area.

2.4. Sample Size

The sample size is determined on the bases of the prevalence of *Schistosoma mansoni* and other intestinal parasites among elementary school children in Southwest Ethiopia (74%) [6]. Using desired precision 4.5%, confidence level 95% and an anticipated non-response rate of 5%, a total sample size of 383 was determined.

2.5. Sampling Technique

2.5.1. Stratified Sampling

Study populations, students from both governmental and non-governmental schools were stratified according to their educational level (primary (government and private), secondary and preparatory schools respectively). Proportional allocations were used to assign sample value for each stratum.

2.5.2. Simple Random Sampling

In this study each individual was chosen entirely by chance and each member of the stratum has an equal chance of being selected. One way of obtaining a random sample was through using a table of random numbers.

2.6. Stool Collection

Primarily, the study objective was explained to the school director, teachers and students. Only students who assented to provide stool were involved in the study. After that, we informed them to pass the stool specimen directly into the cardboard and to use the applicator sticks to transfer it to the vials. The container was labeled with identification number, date of collection and time the patient passed the stool. To maintain morphology of helminthes egg for accurate identification, stool was collected properly through serious supervision by researchers and unit leaders in the schools in the case of each study participants. The stool specimen was large enough for satisfactory examination. All laboratory activities were finished in school compound and nearly half of each stool sample was preserved with 10% formalin to re-check in Biology Department Laboratory, Mizan Tepi University. At the final of stool collection, the specimen was kept in the coolest and shadiest area in the laboratory for further use. All tool collections were carried out using WHO 1993 protocol [7].

2.7. Stool Examination

The saline wet mount and formalin-ether sedimentation concentration technique was used for the microscopic examination of stools. It is employed primarily to demonstrate worm eggs and larvae.

2.8. Questionnaire

Socio-demographic data which include sex, age, religion and other necessary information was gathered from each selected student (for high and preparatory schools) and parents and caretakers from primary school students. Data related to associate risk factors were collected from each selected student.

2.9. Variables Used in the Study

2.9.1. Dependent Variables

$$\text{Intestinal helminthes parasites status} = \begin{cases} 0, if\ negative\ for\ intestinal\ helminthes \\ 1, if\ positive\ for\ intestinal\ helminthes \end{cases}$$

2.9.2. Independent Variables

Residence
Sex

School Type
Family size
Age of a student
Parent education status
Grade level
Religion
Parent occupation
Protected shoe
Dirty materials in the right hand fingers
Hand washing with soap after deification
Practice of eating raw/unwashed vegetables
Water source for drink
Latrine availability at home
Habit of latrine usage
Practice of finger nail trim
Water contact activities such as swimming in the river
Personal hygiene

2.10. Statistical Analysis

SPSS version 16 was used to analyze the distribution of helminthic infection among students. To check the association between risk factors and helminthic infection univaraite analysis was carried out using the chi-square test and odds ratios with 95% CI were computed to measure the strength of association. Logistic regression was used to calculate predictors of infection. A statistical significance was set at $P< 0.05$.

3. Result

A total of 380 study participants were enrolled in this study, of which 94 were positive for intestinal helminthic parasites. As indicated in table 1, here under four intestinal helminthic parasites were identified and *A. lumbricoides* (9.2%) were highly prevalent.

Table 1. *The distribution of worm infestation among among students in Tepitown, Southwest Ethiopia, Nov 15-Dec 25, 2015.*

Helminthes	Frequency	Gender		Agegroup		
		Female	Male	5-9years	10-14years	>=15years
Total population	380(100%)	143(37.6%)	237(62.4)	64(16.8%)	196(51.6%)	120(31.6)
Ascaris lumbricoides	35(9.2%)	15(3.9%)	20(5.3%)	10(2.6%)	18(4.7%)	7(1.8%)
Trichuris trichuria	22(5.8%)	9(2.4%)	13(3.4%)	3(0.8%)	5(1.3%)	14(3.7%)
Schistosoma mansoni	12(3.2%)	3(0.8%)	9(2.4%)	0(0%)	8(2.1%)	4(1.1%)
Hook worm	12(3.2%)	1(0.3%)	11(2.9%)	1(0.26%)	3(0.8%)	8(2.1%)
Ascaris lumbricoides & hook worm	3(0.8%)	1(0.26)	2(0.5%)	0(0%)	3(0.8%)	0(0%)
Entrobius vermicularis & *Trichuris trichuria*	1(0.2%)	0(0%)	1(0.26%)	0(0%)	0(0%)	1(0.26%)
Trichuris trichuria & *Schistosoma mansoni*	3(0.8%)	1(0.26%)	2(0.5%)	1(0.26%)	2(0.5%)	0(0%)
Ascaris lumbricoides & *Trichuris trichuria*	4(1.1%)	2(0.5%)	2(0.5%)	2(0.5%)	0(0%)	2(0.5%)
Hook worm and *Trichuris trichuria*	1(0.2%)	0(0%)	1(0.26%)	0(0%)	0(0%)	1(0.26%)
Schistosoma mansoni & *Ascaris lumbricoides*	1(0.2%)	1(0.26%)	0(0%)	1(0.26%)	0(0%)	0(0%)
Positive	94(24.7%)	33(8.7%)	61(16%)	16(4.2%)	39(10.3%)	37(9.7%)

The frequency of helminthic parasite were high among male students, students who live in rural area, who study in governmental school, who attend elementary class, whose family size is above five, who have orthodox religion, whose parent occupation is farmer (Table 1). In addition study participants who have no protected shoe, who have dirty material on the right hand finger, who have medium practice of eating vegetables and who have water contact activities have relatively high frequency of parasites (Table 2).

Table 2. *The Distribution of basic factors Analyzed with Intestinal helmenth parasites among students in Tepi town, Southwest Ethiopia, Nov 15-Dec 25, 2015.*

Variables	Levels	N	N (%)	Having intestinal parasite		Chi-square	p-value
				No (%)	Yes (%)		
Residence	Urban	279	73.42	64.74	8.7	93.954	0.000*
	Rural	101	26.58	10.53	16.1		
Protected shoe	Present	215	56.58	49.47	7.1	39.447a	0.000*
	Absent	165	43.42	25.79	17.6		
Sex	Male	187	49.21	33.16	16.1	12.291	0.000*
	Female	193	50.79	42.11	8.7		
School	Government	330	86.84	63.42	23.4	6.716	0.005*
	Private	50	13.16	11.84	1.3		
Dirty materials in the right hand fingers	Present	136	35.79	18.68	17.1	60.481	0.000*
	Absent	244	64.21	56.58	7.6		
Family size	Below five	172	45.26	37.11	8.2	7.607	0.004*
	Above five	208	54.74	38.16	16.6		
Age of a student	5-9 years	64	16.84	12.37	4.5	4.483	0.106
	10-14y ears	196	51.58	41.05	10.5		
	>15 years	120	31.58	21.84	9.7		
Parent education status	No education	80	21.05	15.79	5.3	.044	.978
	Primary	151	39.74	29.74	10.0		
	Above secondary	149	39.21	29.74	9.5		

Variables	Levels	N	N (%)	Having intestinal parasite		Chi-square	p-value
				No (%)	Yes (%)		
Grade level	Elementary	296	77.89	59.21	18.7	1.446a	.485
	High school	59	15.53	10.79	4.7		
	Preparatory	25	6.58	5.26	1.3		
Parents occupation	Merchant	130	34.21	26.05	8.2	.472a	0.925
	Employee	94	24.74	18.95	5.8		
	Farmer	132	34.74	25.79	8.9		
	Daily worker	14	3.68	4.47	1.8		
Personal hygiene	Good	310	81.58	61.32	20.3	.009	0.529
	Poor	70	18.42	13.95	4.5		
Religion	Orthodox	202	53.16	41.84	11.3	6.839	0.033*
	Muslim	97	25.53	19.74	5.8		
	Others	81	21.32	13.68	7.6		
Hand washing with soap after deification	Yes	264	69.47	52.37	17.1	.015	0.499

N= total population

The result indicated in Table 2, residence, protective shoe, sex, school type, having dirty materials in the right hand fingers, family size and religion were significantly associated with helminthic parasite at 5% significance level.

Interpretation of Logistic Regression Coefficients

After the assessment of the overall model evaluation and goodness of fit test, statistical tests of individual predictors were conducted to identify the associated risk factors with intestinal parasite among students. The statistical significance of individual regression coefficients (β's) was tested using the Wald chi-square statistic which is displayed in Table 3 and significantly associated predictors were selected using stepwise regression (Likelihood ratio) method.

Result displayed in Table 3 revealed that residence, protected shoe, sex, having dirty finger nail and family size were significantly associated with intestinal parasite among students prior to the survey.

Table 3. *Logistic regression results of intestinal helminthic parasites among students of Tepi governmental and non- governmental School, South west Ethiopia, Nov 15 - Dec 25, 2015.*

Variables	$\hat{\beta}$	$SE.$	$wald$	df	P-value	$Exp(\hat{\beta})$	$95\%CIfore^{\hat{\beta}}$	
							Lower	*Upper*
Residence (rural=reference)	-2.017	.328	37.869	1	.000	.133	.070	.253
Having Protected shoe (absent = reference)	-1.744	.338	26.673	1	.000	.175	.090	.339
Sex (female = reference)	1.015	.329	9.512	1	.002	2.759	1.448	5.257
Having dirty finger nail (absent = ref)	1.626	.322	25.519	1	.000	5.084	2.705	9.554
Family size (>5 = ref)	-.856	.331	6.696	1	.010	.425	.222	.813
Constant	-.005	.699	.000	1	.994	.995		

Student's intestinal parasite was significantly associated with place of residence. Students who live in urban area were 86.7% (1-0.133, OR=0.133) less likely to have intestinal parasite than students who live in rural area.

Protected shoe was significantly associated with intestinal parasite (P<0.05). Students who wear protected shoe were 82.5% (1-0.175) less likely to have intestinal parasite than students who have no protective shoe. Intestinal infection rate was significantly associated with gender (P<0.05), male students were 2.759 times more likely to have intestinal parasite than female students. Having of dirty finger nail was significantly associated with intestinal parasite. Students those who have dirty finger nail were 5.084 times more likely to have intestinal parasite than those who don't have dirty finger nail. Intestinal infection rate was significantly associated with family size (P<0.05), student those who have family size less than five were 57.5%(1-0.425) less likely to have intestinal parasite than family size greater than five.

4. Discussion

Epidemiological study on the prevalence of helminthic intestinal parasites and associated risk factors in different localities is a main objective to identify high-risk communities and formulate appropriate intervention. In line with this, the present study was attempted to determine the prevalence and associated risk factors of intestinal helminthic parasites among students in Tepi town governmental and private schools. The overall prevalence rate of helminthes (24.7%) observed in the present study was found to be lower than earlier reports from different parts of the Ethiopia. For instance Teklemariam, *et al* (2014) [8] reported 41.6% of helminthic prevalence. However the present study was in agreement with research conducted in Babile town eastern Ethiopia (27.2%) [9], and from India which was 22.8% [10]. Apart from this, the present study intestinal helminthic parasite infection rate were far higher than, those reports from Tigray and Hawassa, Ethiopia with 13.9% and 8% respectively [11, 12]. The difference in observed prevalence among the studies might be due to varied factors including socioeconomic condition, individual behavioral habits, climate, altitude, humidity, temperature, rainfall, access to clean water, environmental sanitation and the time of the study conducted.

This study also tried to assess the possible association of intestinal helminthes infections with socio-demographic and

behavioral risk factors among students. The analysis in this study indicated that male students were at high risk of intestinal helminthes infection as compared to female students. Of 94 positive individuals 61 (16%) were male and 33 (8.7%) were female students and males were 2.759 times more likely to have intestinal parasite than females. It agrees with the study conducted by Emana *et al* (2015) [13] in which (43.1%) male and (40.5%) female students were infected. The gender difference of helminthes infection might be because males are more likely to involve in outdoor activities than females due to social and religious restriction and participation in agricultural activities which are a common place for defecation. Therefore, contamination of soil in the area would facilitate the transmission of intestinal helminthes.

In current study, high degree of association between cleanness of the finger nails and intestinal helminthic infection was well recognized. Students those who have dirty finger nail were 5.084 times more likely to have intestinal parasite than those who don't have dirty finger nail. This was in agreement with earlier reports in different parts of Ethiopia. Thus, lack of personal hygiene might increase the probability of exposure to intestinal helminthes infection.

The prevalence of parasitic infections among school type (public and private) was significant ($P < 0.05$), indicating that the occurrences of these infections were school type dependent. The prevalence of this infection in this study among public school was 23.4% whereas 1.3% was in private schools. The observed high prevalence among public school could be due to lack of sanitation and their economical income. Even though there was a slight difference in the infection rate, this finding was in line with a comparative study conducted in different parts of Ethiopia in which the rate of helminthiasis was higher among government school students than private school students, where 53.5% and 20.9% students were positive for helminthiasis respectively [13].

Analyses of the data showed that intestinal helminthic infection was depend on family size, students those who have family size less than five were 57.5% (1-0.425) less likely to have intestinal helminthic parasite than having family size greater than five. In contrary, study conducted by Tadesse (2005) [9] showed that intestinal helminthic infection was independent of family size. In this study, having of large family size was a risk factor for prevalence of the helminthic parasites. The probable reason could be transmission of the parasite from infected family member to the other healthy individual.

Student who wear protected shoe was significantly associated with the prevalence of intestinal parasite ($P<0.05$). Students who wear protected shoe were 82.5% (1-0.175) less likely to have intestinal parasite than students who have no protective shoe, which agree with the study conducted by Alemayehu (2011) [14].

The prevalence was also high among students who live in rural areas as compared with urban resident students which were significant ($p< 0.05$). No significant difference from urban areas (26.4%) and rural areas (28.6%) was observed by Mulatu *et al* (2015) [12]. This fact was also not in agreement with the study conducted by Dejenie and Petros (2009) [11]. The reason for having high parasite among rural student in our study could be due habit of walking with barefoot, defecation in open field and having of low levels of services such as sewage, garbage disposal and water supply.

The prevalence intestinal helminthic parasites are also associated with religion, were prevalent among students who have orthodox religion with (11.3%), as compared with the other religions and Muslim which accounts (7.6%) and (5.8%) respectively. Other studies conducted in Ethiopia also reported as the infection was high among orthodox religion [9, 15]. This could be due to cultures and values associated with each religion for instance the habit using water for toilet during defecation is most common by Muslim followers unlike Christians.

There was no significant difference in the rate of infection due to helminthes in relation to age; similar report was also reported by Mengistu *et al* (2007) [16]. However, parent education status, grade level, parents occupation, personal hygiene, hand washing with soap after deification, practice of eating raw/unwashed vegetables, water source for drinking, latrine availability at home, habit of latrine usage, water contact activities, personal hygiene, practice of finger nail trim did not show statistically significant associations with helminthic infections.

The commonest helminthes isolated in this study was *A. lumbricoides* (9.2%). It is also similarly confirmed by Yong *et al* (2008) [17]. However, the result was lower than reported from southern and central zone of Tigray [11]. The occurrence of parasitic infections at high rates is indicator of fecal pollution of soil and domestic water supply around homes due to poor sanitation and improper sewage disposal in those areas. This may also because of the nature of the soil which is clay. Ascaris eggs are known to develop best in less permeable clay soils, with survivability increasing with their soil depth [18]. Thus, the eggs would have been more concentrated in the soils found in this area leading to higher rates of infection.

The second commonest helminthic parasite in this study was *T. trichiura* (5.8%). The result is far lower than the other studies [16, 19]. It has been suggested that the prevalent *T. trichiura* infections can be attributed to overcrowding, lack of adequate water and sanitation.

In the present study, *S. mansoni* was also cover 3.2% helminthic infection. The prevalence of *S. mansoni* infection was found to be higher in male (2.4%) than in female (0.8%), agreed with the research conducted by Tadesse (2005) [9]. The difference in *S. mansoni* among sex can be explained in behavioral difference in which male have high frequency of water contact habit (swimming habit).

The prevalence of hookworm is also high among males (2.9%) than females (0.3%). The result was not accord with the study conducted Odebunmi *et al* (2007) [20] in which hookworm infection was higher among females (6.5%) than in males (1.9%). The skewness in hookworm prevalence towards males could be due to their active participation in

field activities and their habit of walking barefoot which allow penetration of skin by infective filariform larvae.

5. Conclusion

The overall prevalence rate of helminthes observed in the present study was 24.7%. The commonest helminthes isolated in this study was *A. lumbricoides* (9.2%) followed by *T. trichiura* (5.8%). High degree of association between cleanness of the finger nails with intestinal helminthic infection was well recognized. It is also school dependent, public school students have high burden of intestinal infection. Student who have greater than five family size were (1-0.425) more likely to have intestinal parasite than student who have family size less than five. Students who wear protected shoe were 79.1% (1-0.175) less likely to have intestinal helminthic parasite than students who have no protective shoe. Students who have orthodox religion are highly prone for helminthes. However, parent education status, grade level, personal hygiene, hand washing with soap after deification, practice of eating raw/unwashed vegetables, water source for drinking, latrine availability at home, habit of latrine usage, water contact activities and practice of finger nail trim did not show statistically significant associations with helminthic infections. As result, serious health education and awareness campaigns with strategic planning and targeting among the risk groups and school-based prevention and control programs could be promoted. Health workers should work hard on family planning, because having family size greater than five were a significant factor for intestinal helminthic infections. In addition, further study with large scale among zonal government and private school students especially in rural area are highly suggested.

References

[1] World Health Organization. Intestinal parasite: Burden and trends. https://apps.who.int/ctd/intpara/burdens.htm, *World Health Organization (2013)."Soil-transmitted helminth infections Fact sheet; 2013.*

[2] Bethony J, Brooker S, Albonico M, Geiger SM, Loukas A, Diemert D and Hotez PJ. Soil-transmitted helminth infections: ascariasis, trichuriasis and hookworm. *Lancet*. 2006; 367: 1521-1532.

[3] World Health Organization. Action against worms. PPC Newsletter. March, Issue 1, World Health Organization, Geneva; 2003.

[4] De Silva NR, Brooker S, Hotez PJ, Montresor A., Engles D and Savioli L. Soil-transmitted helminth infections: updating the global picture. *Trends in Parasitology.* 2003; 19: 547-51.

[5] Chala B. Prevalence of intestinal parasitic infections in Mojo Health Center, Eastern Ethiopia: a 6-year (2005-2010) retrospective Study. *Epidemiol*. 2013; 3: 119.

[6] Ayalew J, Endalew Z, Yayehirad A, Zemenu M. High prevalence of Schistosoma mansoni and other intestinal parasites among elementary school children in South west Ethiopia: a cross-sectional study. *BMC Public Health*. 2015; 15: 600.

[7] WHO. Control of schistosomiasis, second report of the WHO expert committee. WHO, Geneva. *WHO Technical Report Series*. 1993; 830: 1-86.

[8] Teklemarim A, Degene T and Tomass Z. Infection prevalence of intestinal helmenths and associated risk factors among school children in selected kebeles of Enderta district, Tigray Northern Ethiopia. *Journal of Parasitology and Vector Biology*. 2014; 6 (11): 166-173.

[9] Tadesse G. The prevalence of intestinal helminthic infections and associated risk factors among school children in Babile town, eastern Ethiopia. *Ethiop. J. Health Dev*. 2005; 9 (2): 141-147.

[10] Kattula D, Sarkar R, Ajjampur S, Minz S. and Levecke B. Prevalence & risk factors for soil transmitted helminth infection among school children in south India. *Indian J Med Res.* 2014; 139: 76-82.

[11] Dejenie T and Petros, B. Irrigation practices and intestinal helminth infections in Southern and Central Zones of Tigray. *Ethiop. J. Health Dev*. 2009; 23 (1): 48-56.

[12] Mulatu G, Zeynudin A, Zemene E, Debalke S and Beyen G. Intestinal parasitic infections among children under five years of age presenting with diarrhoeal diseases to two public health facilities in Hawassa, South Ethiopia. *Infectious Diseases of Poverty*, 2015; 4: 49.

[13] Emana D, Jemal K, Bajiro M and Mekonnen Z. Prevalence and intensity of soil-transmitted helminths among school-aged children in Sigmo primary school, Jimma Zone, South-Western Ethiopia. *Clinical Medicine Research.* 2015; 4 (4): 98-103.

[14] Alemayehu B. The health impact of intestinal helminth infections among podoconiosis patients in Wolaita Zone, Southern Ethiopia. MSc. Thesis, Addis Ababa University, Addis Ababa; 2011.

[15] Haftu D, Deyessa N and Agedew E. Prevalence and determinant factors of intestinal parasites among school children in Arba Minch town, Southern Ethiopia. *American Journal of Health Research.* 2014; 2 (5): 247-254.

[16] Mengistu A, Gebre-Selassie S and Kassa T. Prevalence of intestinal parasitic infections among urban dwellers in southwest Ethiopia. *Ethiop. J. Health Dev.* 2007; 21 (1): 12-17.

[17] Yong E, Asuquo E and Effiong EJ. Prevalence of intestinal helminths infections among schooling children in tropical semi urban communities. *Animal Research International*, 2008; 5 (1): 804-810.

[18] Crompton DW. "How Much Helminthiasis Is There in the World?" *Journal of Parasitology.* 1999; 85: 397-403.

[19] Ahmed T, Khanum H and Hossain A. Prevalence of *Trichuristrichiura* among the children of age under five years. *Bangladesh J. Zool*. 2013; 41 (1): 97-103.

[20] Odebunmi JF, Adefioye OA and Adeyeba OA. Hookworm infection among school children in Vom, Plateau State, Nigeria. *American-Eurasian Journal of Scientific Research.* 2007; 2 (1): 39-42.