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RESEARCH ARTICLE

CURRENT STATUS OF INTESTINAL PARASITES AND ASSOCIATED RISK FACTORS AMONG SCHOOLCHILDREN OF HOMESHA DISTRICT IN NORTHWEST ETHIOPIA

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ABSTRACT

Background: Intestinal parasitic infection is one of the major and serious medical and public health problems in developing countries including Ethiopia. Children being major victims, therefore effective prevention and control of intestinal parasitic infections require the identification of local risk factors, particularly among school children. The aim of this study was to assess the prevalence of intestinal parasitic infections and associated risk factors among Homesha District school children, Northwest Ethiopia.

Method: School based cross sectional study was conducted from March-June 2015.A total of 395 school children as study subjects were selected from four primary schools by using simple random sampling technique. Data were gathered through direct interview by using a pretested questionnaire. This data collection technique involve teachers to get correct answer in the case of lower age students. The collected stool specimens were examined microscopically for the presence of eggs, cysts and trophozoites of intestinal parasites using direct saline smear and formol-ether concentration methods. Data entry and analysis was done using SPSS version 20.Chi-square ($\chi 2$) test and crude odd ratio were calculated to verify and measure the possible association between IPIs and potential risk factors.

Result: The overall prevalence of intestinal parasite in the present study was 160/395 (35.44 %), for at least one intestinal parasite. The prevalence rate was 66 (31.88%) for male and 74 (39.36%) for female. The prevalence of intestinal parasites was high in age group of 6-9 years compared to other age groups. Of the nine species of intestinal parasites identified, the most prevalent were *E. histolytica/dispar* 56 (14.17%) followed by *G. lamblia* 50 (12.65%) and Hook worm 27 (10.12%).In this study the most significantly associated risk factors for the occurrence of intestinal parasitic infections were hand washing habit, eating unwashed/undercooked vegetables, waste disposal habit, shoe wearing habit and practice of figure nail trimming ($P<0.05$). The risk factors were also associated with increased prevalence.

Conclusion: Intestinal parasites were prevalent in varying magnitude among the schoolchildren. And they are public health problem. The prevalence of infections were higher for protozoa compared to helminths. Therefore, the District health office in collaboration with schools community and other stake holders should work to take measures including education on personal hygiene and environmental sanitation to reduce the prevalence of intestinal parasitic infections.

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INTRODUCTION

Intestinal parasitic infection is one of the major and serious medical and public health problems in developing countries. Globally two billion individuals were infected with intestinal parasites; out of these majorities were children in resource-poor settings (WHO, 2002a). Intestinal parasites are widely distributed in Sub-Saharan Africa including Ethiopia largely due to the lower socio-economic status, poor environmental and personal hygiene, poor nutrition, low literacy rate, overcrowding and climatic conditions that favor the development and survival of these parasites(WHO, 2001b; Gelaw *et al*., 2013; Wegayehu *et al.*, 2013). School children are one of the groups at high-risk for intestinal parasitic infections (IPIs)(WHO, 2002a; Alemu *et al*., 2011). It is estimated that over 270 million pre-school children and over 600 million of school children are living in areas where the parasites are intensively transmitted and are in need of treatment and preventive interventions (WHO, 2010). According to WHO report, in Ethiopia the two-third proportion of children aged 1–14 years require preventive chemotherapy which mainly

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involve deworming of infected children (WHO, 2002b). Apart from causing morbidity and mortality, infection with intestinal parasites has known to cause poor school performance and absenteeism, growth retardation and mental health problems in children (Harhay *et al*., 2010). A number of studies have been conducted on the distribution and prevalence of intestinal parasites in different parts of Ethiopia Gelaw *et al*., 2013; Wegayehu *et al.*, 2013;Workneh *et al.*, 2014). However, the distribution and prevalence of various species of intestinal parasites differ from region to region because of several environmental, social, economical and geographical factors (Legesse and Erko, 2004). Hence, the aim of this study was to assess the current status of IPIs and associated risk factors among Homesha District school children, Northwest Ethiopia. This study fills the existing gap by providing current epidemiological information about current status of IPIs and local risk factors. This enables decision makers, school community and other stake holders to have current information that will be used in improving health status of schoolchildren in Homesha District, Assosa zone. The obtained information is also crucial in evaluating the different intervention strategies that will be implemented in the future.

Methods

Description of the Study Area

The study was conducted in Homesha District, Assosa zone in Benishangul-Gumuz regional state, Western Ethiopia. Homesha District is found around 700 Km West of Addis Ababa and around 40 Km far from Assosa town. Assosa zone, one of the three zones in the region, has a total area of 1,519 Km^2 and a population of 28, 970 (population density of 19.1/Km^2). The Berta ethnic group are the indigenous population resides mainly in Homesha District and more than 96.3% of the population of this ethnic group are Muslims. They use farming and mining as source of income to lead their family (Flatie *et al*., 2009).

Sample Size and Sampling Techniques

The sample size (n) was estimated using the formula for cross-sectional survey (Daniel, 1995):

$n = Z^2 p (1-p)/d^2$

Where,

P = Prevalence of intestinal parasites from previous study
d = Absolute precision and is taken as 0.05 and Z = 1.96 at 95% confidence interval.

$=1.96^2x0.50x0.50/.05^2$, this gives a sample size of 384. Since there were no studies conducted concerning the present topic in the area, p was taken as 50% to achieve the maximum sample size. To minimize errors arising from the likelihood of non-compliance, five percent of the sample size was added, giving a final sample size of 404. All elementary schools in a district were registered first and from the list four schools were selected as a study schools by purposive sampling method. The primary schools selected for this study were Homesha, Tsore Arumela, Tsore Almetema and Shorkele which have 977, 350, 390 and 1050 students attending during data collection. To select the study participant, the students were stratified according to their educational level (grade 1 to grade 8). Classes first selected by simple random sampling technique. Then a quota was allocated for each grade with proportional allocation according to the number of students in each grade. Finally, the participating children were selected using systematic random sampling technique by using class rosters as a sample frame.

Methods of Data Collection

Interview with structured questionnaires

A structured questionnaire was prepared originally in English according to the research objectives and possible risk factors in

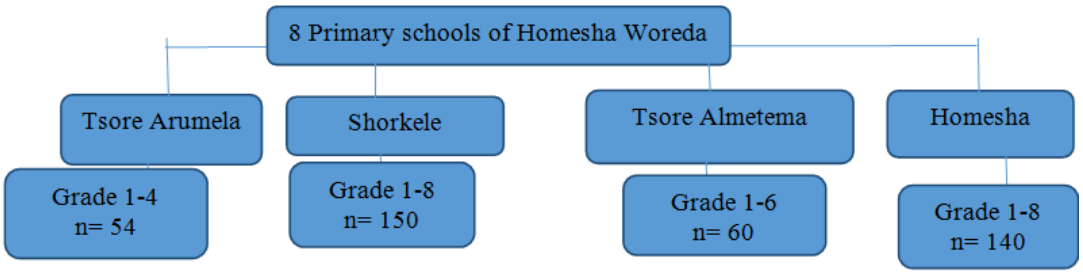

Figure 1. Selection of study participants from Primary schools of Homesha District, Northwest Ethiopia

Study Design and Period

A school based cross-sectional study was conducted from March-April2015 to determine the prevalence of IPIs and associated risk factors.

Study Population

The study population was all schoolchildren found in primary schools of Homesha District. In this District there are around eight elementary schools which have 4214 (2216 male and 1198 female) school children attending from 1 to 8 grade levels. Students were excluded if they had taken anti-parasitic medication in the previous two weeks prior to the study.

the local situation and then was translated in to the local language i.e., Rutanigna. A data collector having diploma in clinical nursing was recruited for data collection. To ensure the reliability of the information given during data collection first pilot study was done, the children were interviewed in their mother tongue. The selected students were asked in the presence of their teachers' using the revised and pretested structured questionnaires. All the questionnaires were checked for accuracy and completeness.

Stool sample collection and parasitological examination

After proper instruction, the children were given the labeled collection cups and applicator sticks. From each student, about

2g of fresh stool was collected. At the time of collection, date of sampling, the name of the participant, age and sex were recorded for each subject on a recording format and checked for its label, quantity and procedure of collection. A portion of each of the stool samples was processed and examined blindly by two senior laboratory technologist microscopically using the following methods (WHO, 1991). Two different types of laboratory techniques for the examination of stool were employed.

Direct wet mount method

A small portion of stool sample was emulsified with normal saline (0.85% NaCl solution) and placed on a slide. For lugol's iodine staining technique, the stool sample was mixed with a drop of dilute iodine. Cover slip was placed on the emulsion at an angle of 45% to prevent air bubbles from forming under the cover slip. This method was used to detect the presence of motile intestinal parasites, trophozoite and cysts of protozoan parasites under light microscope at 10X and 40X magnification immediately (WHO, 1991; Simon-oke *et al.*, 2014). The remaining part was preserved with 10% formalin in the ratio of 1 g of stool to 3 ml of formalin for later examination at Assosa hospital.

Formol-ether concentration

A portion of preserved stool sample was processed by formol-ether concentration method. In brief, 1g of the stool was placed in a clean 15 ml conical centrifuge tube containing 7 ml formalin. The sample was suspended and mixed thoroughly with applicator stick. The resulting suspension was filtered through a sieve (cotton gauze) into a beaker and the filtrate pour back into the same tube. After adding 3 ml of diethyl ether to the mixture and hand shaken, the content was centrifuged at 2000 rpm for 3 minutes. Iodine stain preparation was made from the sediments. Finally, the entire area under the cover slip were systematically examined using ×10 and ×40 objective lenses and ova or cyst of different parasites can be observed under the microscope (WHO, 1991; Simon-oke *et al.*, 2014).

Data Analysis

The collected data were coded and entered in to SPSS software version 20 to perform the statistical analysis. Chi-square ($\chi 2$) test was used to verify the possible association between infection and exposure to different factors. Crude odd ratio was also calculated to measure the strength of the association between IPI and potential risk factors. Probability values were considered to be statistically significant when the calculated P-value is equal to or less than 0.05.

RESULTS

Prevalence of Intestinal Parasites (IPs)

Of the 395 study subjects, 150 (37.97%), 140 (35.44%), 55 (13.92%) and 50 (12.65%) students were taken from Shorkele, Homesha, Tsore Almetema, and Tsore Arumela respectively. The overall prevalence of IPIs in both sex of the pupils in all schools was 35.44%. Of the 207 male students and 188 female students, 66 (31.88%) male students and 74 (39.36%) female students were infected with at least one of any intestinal parasite (Table 1).

Table 1. Prevalence of IPs according to school and sex among Homesha District school children, Northwest Ethiopia, March-April 2015

School Name	Sex	No. of Examined	No. Infected	% Infected
Homosha	Male	54	18	33.33
	Female	86	28	32.55
	Sub total	140	46	32.85
	Male	37	12	32.43
Tsore	Female	18	12	66.66
Almetema	Sub total	55	24	43.63
	Male	29	11	37.93
Tsore Arumela	Female	21	11	52.38
	Sub total	50	22	44
Shorkele	Male	87	25	28.73
	Female	63	23	36.5
	Sub total	150	48	32
	Male	207	66	31.88
	Female	188	74	39.36
	Total Population	395	140	35.44

Out of the 395 school children examined, nine species of intestinal parasites were identified with an overall prevalence of 140 (35.44%). The most prevalent intestinal parasites identified were *E. histolytica/dispar* 30 (7.59%), *G. lambilia* 26 (6.58%), Hookworm 23 (5.82) and followed by *E. vermicularis* 7 (1.77%) and *T. saginata* 7 (1.77%) as single infections (Fig.-2).

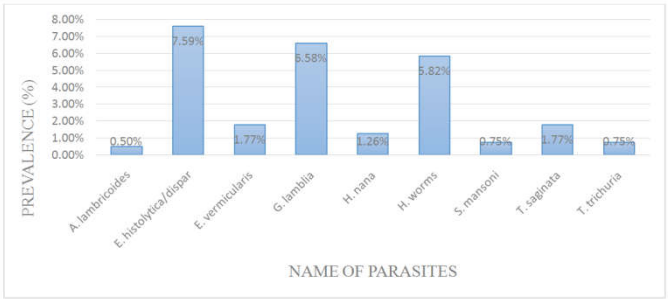

Figure 2. Prevalence of each intestinal parasite as single infection among examined school children of Homesha District, Northwest Ethiopia, March-April 2015

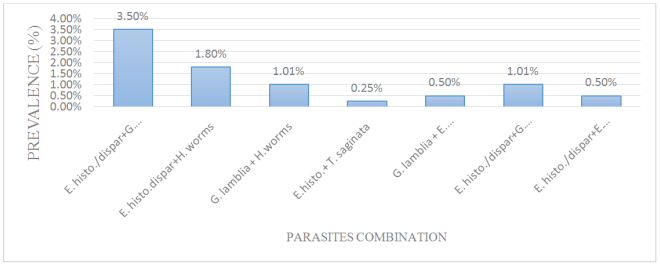

Figure 3. Parasites combination for mixed intestinal parasite infection among Homesha District schoolchildren, Northwest Ethiopia, March-April 2015

Different parasites combine to cause mixed infection that can be either double or triple infection. The most common combination for double infection were *E. histolytica/dispar* + *G. lamblia* 14 (3.5%), *E. histolytica/dispar* + Hookworms 7 (1.8%) and *G. lamblia* +Hookworms 4 (1%). The most common combination for triple infection were *E. histolytica* + *G. lamblia* + H. worms 4 (1.01) and *E. histolytica* + *E. vermicularis* +Hookworms (Fig.-3).

Socio-demographic Characteristics

A total of 404 school children were invited to participate and 395 (97.77%) provided proper stool samples and complete information. Among these, 207 (52.40%) were males and 188 (47.60%) females. The age distribution of the students showed that 237 (60 %) students were 6-9 years, 133 (33.7%) ranged from 10 to 13 years and 25 students (6.3%) were above 13 years of age. The mean age of the children was 11.2 years. Of the study participants, 334 (84.56%) of them were Muslim and 61(15.44%) were Christian by religion. Majority of students were grade 1 to 4, 235 (59.5%). Majority of the students have illiterate mother (51.6 %) and illiterate father (56 .7%) (Table 2).

Crude Associations of Independent Variables with IPIs

The crude odd ratio for age, grade, hand washing before eating and after defecation, practice of eating unwashed/undercooked vegetables, wearing shoes, practice of fingernail trim, and waste disposal were 3.51, 4.20, 5.45, 0.312, 2.3, 0.212 and 1.88 respectively (Table 2).

Table 2. Association of IPIs with socio-demographic factors, behavioral and sanitary habits and crude odd ratios of IPIs among District schoolchildren, Northwest Ethiopia, March-April 2015

Risk factors		Intestinal parasites		X^2	P-value	Crude OR(95% CI)
		No. Examined (%)	No. infected (%)			
Age	6-9	237 (60)	88 (37.13)	170.69	0.01	3.51 (2.31-5.81)
	10-13	133 (33.7)	50 (37.59)			
	>13	25 (6.3)	2 (8)			
Sex	Male	207 (52.4)	67 (32.36)	.914	0.08	0.721 (1.090-0.477)
	Female	188 (47.6)	73 (38.82)			
Grade	1-4	235 (59.50)	92 (39.14)	162	0.00	4.20 (3.34-8.50)
	5-8	160 (40.50)	48 (30)			
Mothers educational Status	Illiterate	204 (51.6)	131 (64.21)	170.64	0.21	0.237 (0.10-0.659)
	Primary school	181 (45.8)	6 (3.31)			
	Secondary school & above	10 (2.5)	3 (3)			
Fathers educational Status	Illiterate	224 (56.7)	132 (58.92)	188.35	0.86	0.654 (0.589-0.917)
	Primary school	163 (41.3)	7 (4.2)			
	Secondary school & above	8 (2)	1 (12.5)			
Hand washing habit before eating and after defecation	Yes	108 (27.34)	18 (16.66)	81.11	0.023	5.45 (4.55-11.90)
	No	287 (72.66)	122 (42.5)			
Habit of eating raw meat	Yes	55 (13.9)	51 (92.72)	205.6	0.543	0.397 (0.142-0.519)
	No	340 (86.1)	89 (26.1)			
Habit of eating unwashed/undercooked vegetables	Yes	133 (33.7)	125 (93.98)	42.12	0.011	0.312 (0.015-0.063)
	No	262 (66.3)	15 (5.7)			
Shoe wearing habit	Yes	226 (57.21)	19 (8.4)	8.225	0.001	2.3 (1.2-4.67)
	No	169 (42.78)	121 (71.59)			
Swimming habit	Yes	82 (20.75)	63 (76.82)	135.0	0.635	1.43 (0.987-2.276)
	No	313 (79.25)	77 (24.6)			
Habit of fingernail trimming	Yes	170 (43.03)	19 (11.17)	8.225	0.007	0.212 (0.162-0.276)
	No	225 (56.97)	121 (53.77)			
Water source	Pipe	370 (93.7)	121 (32.7)	993.48	0.984	0.543 (0.362-0.976)
	Spring	7 (1.8)	5 (71.4)			
	River	18 (4.5)	14 (77.77)			
Toilet	Present	373 (94.43)	124 (33.24)	311.9	0.712	2.412 (1.162-2.876)
	Absent	22 (5.56)	16 (72.72)			
	Burry underground	307 (77.72)	73 (18.48)			1.88 (1.12-4.42)
Waste disposal	Open field	72 (18.22)	57 (79.16)	311.9	0.712	
	Incirinate	16 (4.05)	10 (17.54)			

Association of IPIs with Potentially Associated Risk Factors

From the total respondents that had no habit of hand washing before meal and after defecation and had no habit of eating raw meat were 287 (72.66%) and 340 (86.1%) respectively. The majority of the students 370 (93.7%) used pipe water as a source of drinking water. Sex, mother and father educational status, eating raw meat, source of water and habit of swimming were not statistically associated with IPIs (P>0.05). Age, grade, hand washing before eating and after defecation, practice of eating unwashed/undercooked vegetables, wearing shoes, practice of fingernail trim, and waste disposal were statistically associated with IPIs (P<0.05).The high prevalence of IPIs is associated with lower age and grade, with no hand washing before eating and after defecation, practice of eating unwashed/undercooked vegetables, bare foot waking, practice of fingernail trim, and open field waste disposal (Table-2).

DISCUSSION

The present study attempted to assess the prevalence of different IPIs among schoolchildren of Homesha Woreda, Northwest Ethiopia. The observed prevalence of intestinal parasites of 140 (35.44%) is in agreement with study conducted at the University of Gondar Community School, Northwest Ethiopia (Gelaw *et al*., 2013). They reported about 34.2% of the schoolchildren were infected with one or more intestinal parasites. Gebru *et al.* (2015) also reported almost similar but slightly higher prevalence rate (37.8%) from Chelaleki Health Center and Red Cross Clinic, Eastern Wellega. The observed prevalence of intestinal parasites in this study was lower compared with reports of other similar studies, 60.7% in Wukro town, Tigray (Kidane *et al.*, 2014), 77.9% in Dagi primary school, Amhara Region (Alamir *et al.*, 2013), 84.3% in Debre Elias Primary Schools, East Gojjam Zone (Workneh *et al.*, 2014), 79.8% in Delgi school children, North Gondar (Asrat *et al.*, 2011). On the other hand, the prevalence observed in this study was higher than a study conducted in Babile (Tadesse, 2005). The contradictory report on the prevalence of IPI could be due to variation in awareness regarding transmission and prevention of IPs between study participants

in this study and previous studies. In addition, the occurrence of diversified IPs might be due to poor environmental and personal hygiene, habit of walking on bare foot, lack of education which increases overall magnitude of IPs. On the other hand, as the collection period was short, potential seasonal fluctuations might have affected the actual prevalence. Modified acid-fast staining technique was not used to detect *Cryptosporidium species*. Moreover, we conducted single stool examination for detection of intestinal parasites, which could have underestimated the prevalence. In the present study *E. histolytica/dispar* 56 (14.17%) was the most predominant parasite followed by *G. lamblia* 50 (12.65%), Hook worm 27 (10.12%). This is in agreement to a finding from a study conducted in Chelaleki Health Center and Red Cross Clinic, Eastern Wellega, *E. histolytica/dispar* 60 (16.3%) was the most predominant parasite followed by *G. lamblia* 33 (9%) and Hookworm 14 (3.8%) (Gebru *et al.*, 2015). In contrary to this study, the research conducted in Debre Elias Primary Schools, East Gojjam Zone by Workneh *et al.* (2014) reported *E. histolitica/dispar* with prevalence of6.7%. This could be due to difference in environmental and living conditions of the study participants. The high occurrence of the parasitic protozoan infections in the present study may be due to poor environmental sanitation.

The present study also assessed the possible association of intestinal parasite infection with potential risk factors among school children. Several recent studies have identified a range of environmental, behavioral and social risk factors associated with intestinal parasite infections (Alamir *et al.*, 2011; Gelaw *et al*., 2013; Wegayehu *et al.*, 2013; Workneh *et al.*, 2014 ; Gebru *et al.*, 2015). However, some of them were significantly associated in this study making it comparable to earlier studies in Ethiopia and other less developed countries and explained as follow:

Intestinal parasitic infections were significantly associated with poor hand washing practice and habit of eating unwashed/undercooked vegetables ($p < 0.05$). The likelihood of acquiring infections among students who do not practice hand washing before eating and after defecation was 5.45 times higher than among those who had good hand washing practice. Moreover, the likelihood of acquiring infections among students who had the habit of eating unwashed/undercooked vegetables was 0.312 times higher. This is probably due to low knowledge of schoolchildren about the feco-oral transmission of intestinal parasite through their unwashed hands. In addition to this contamination of vegetables with fecal materials in the farm and contamination of the vegetation with wastes in home produce conducive environment for transmission intestinal protozoa. In this study, the level of education of the study participants and their age were significantly associated with intestinal parasitic infections ($P < 0.05$). This agree with a report in Zarima town (Alemu *et al.*, 2011) and Dagi primary school (Alamir *et al.*, 2011). The prevalence among students who were under 4^{th} grade and age of 6-9 were 4 and 3.5 times higher as compared to the other students. The possible explanation might be the level of awareness about washing hands, playing in the open fields and other personal hygiene measures in children whose grade become (1-4) was lower than those whose grade become 5-8. This causes passing viable ova to one another when they use dirty hands to share foods. The other reason might be those students whose grade from 1 to 4 was less immunized compared to grade 5 to 8 (Workneh *et al.*, 2014).Thus, as age increases the prevalence of parasitic infection decreases possibly due to improved personal hygiene, reduced contact with soil and developing immunity against parasites. Though IPIs were not significantly associated with sex, the prevalence is higher in female students (39.36%) as compared to male students (31.88%). This may be is so because female are more actively involved in carrying out activities in and out of their immediate environment, and may have increased exposure thereby exposing them to infection.

Conclusion

The findings of the present study showed IPIs were prevalent health problemamong school children of Homesha District. Public education program on personal hygiene, improved sanitation including proper waste disposal, avoiding eating unwashed/undercooked vegetables, proper nail trimming and wearing shoes should be provided to prevent and reduce the prevalence of IPIs. In addition to this, regular monitoring of these practices by school director and teachers is also suggested. Further detailed investigation by using the Kato-Katz method should be conducted to determine the prevalence and intensity of schistosomiasis in the area.

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