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ORIGINAL RESEARCH

Prevalence and Associated Risk Factors of Intestinal Parasitic Infection among Under five Children in University of Gondar Hospital, Gondar, Northwest Ethiopia

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Abstract— Background: Intestinal parasitic infection is a serious health problem in developing countries mainly in children, whichleads to child mortality and morbidity. Objective: To assess the prevalence and associated risk factors of intestinal parasitic infection among underfive children in UoG Hospital.Methodology: A cross-sectional study was conducted from May 2015 to June 2015, a total of 277 children were selected by using systematic random sampling technique. Direct wet mount and formol-ether concentration technique was used for identification of IP; also, an interview-based questioner was prepared to assess the socio-demographic status (of parents and children) and associated risk factors of those under five children. Result: A total of 277 children [(148 (53.4%) females and 129 (46.6%) males] aged 1 year to 5 years was examined for intestinal parasitic infections. The overall prevalence of this study was 25 (9.02%) when examined by wet mount and48 (17.3%) when examined by formol-ether concentration technique. Five (1.8 %) children were infected by multiple parasites in concentration technique. Both intestinal helminthes (84%, 81.1%) and protozoan parasites (16%, 18.9%) were detected in microscopic examination with wet mount and formol-ether concentration techniques respectively. Eight species of intestinal parasites were identified. Of those, the predominant were *Ascaris lumbricoides* (52%, 35.8%), *Hymenolepis nana* (20%, 24.5%) and cyst of *Giardia lamblia* (12%, 9.4%) when examined by wet mount and formol-ether concentration techniques respectively. The least prevalent were *Strongyloides stercoralis (1.9%)*. There was statistically observed association for the prevalence of IP with age, hand washing habit of parents and shortening of fingernails habit of parents. Conclusion: The result of this study indicated that helminthic infection is more predominant than protozoan infection. Children who come from parents who had no hand washing habit and had no shortening fingernails habit were more affected by IP; therefore, Personal hygiene of parents of underfive children must be improved.

Key words—Intestinal parasitic infection, associated risk factors, under five children.

INTRODUCTION

Parasites are organisms living temporarily in or on other organisms (host(Adem M, 2006). The transmission to humans of some helminthes, protozoa and microsporidia is via the fecal-oral route, through direct contact with infected persons, zoonotic transmission, or by ingestion of contaminated food or water (Xiao, 2010). When the water/soil is contaminated, the resilient infective forms (eggs, cysts, spores) of the pathogenic organisms can be transported to vegetables, fruit, hands, tools, handles doors, currency, etc. (Nyarango et al., 2008). The hot and humid climate, high population density, poor conditions of hygiene and the presence of insects as vectors or merely as mechanic carriers of parasites, limited economic resources and some social cultural habits (food and others) promote the transmission of parasites (Adeoye et al., 2007).

Parasitic infections in children are an important public health issue, particularly in developing countries. World-wide, 3.5 billion people are affected by intestinal parasites, and 450 million people, mostly children, present clinical symptoms (Arani et al., 2008). It has been estimated that *Ascaris lumbricoides*, hookworm and

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Trichuris trichiura infect 1,450 million, 1,300 million and 1,050 million people worldwide, respectively. While Schistosomiasis affects over 200 million people (Committee, 2002). *Entamoeba histolytica* and *Giardia lamblia* are also estimated to infect about 60 million and 200 million people worldwide, respectively (Murray PR, 2002). More recently, the emerging microsporidia, especially *Enterocytozoon bieneusi* species has often been described as a frequent human pathogenic microorganism causing gastrointestinal infections and/or disseminated pathology, according to the species involved (Lobo et al., 2012).

Like other developing countries, the prevalence of intestinal parasites is widely spread in Ethiopia. Among the common intestinal protozoan parasites *Giardia*, *Cryptosporidium*, and helminthes such as *Ascaris*are widely distributed (Berhane, 2005), where there is overcrowding, poor environmental sanitation, limited economic resources and personal hygienic practice are predisposing factors. Most of intestinal parasites are more severs in children than adults, which is associated with malnutrition, growth retardation, and poor care for children. The case is worth in underfive year children because of poor maternal hygiene, play habitats of children, in the house in close proximity to one another that create an appropriate for the transmission and spread of the disease (Birhane, 2007).

Different Cross sectional study conducted elsewhere reported that the prevalence of common intestinal protozoan and helminths parasites were high. For instance, a study in Cuba reported that 104 children *Giardia duodenalis* was the most common parasites found, (54.8%) followed by *Ascaris lumbricoides* (6.7%), the most predominant from transmitted Helminths (STH) infections. Only 1.9% cases were infected by *Entamoeba histolytica/dispar* complex (Cañete et al., 2012). In Pakistan, the overall prevalence of the IPIs was 52.8%, about 43% of samples contained a single parasite, and 10% contained multiple parasites. *Giardia lamblia*, (28.9%) and *Ascaris lumbricoides* (16.5%) was reported as being the most common Intestinal Parasites. In 13.9% of the Ascaris positive samples (5 out of 36) co-infection with *Giardia*was also observed and this association was statistically significant (Mehraj et al., 2008). In Portugal, prevalence of Intestinal Parasitic infection among children aged 0-5 years was 7.8%, and was similar among genders (6.9% in boys and 6.5% in girls (Julio et al., 2012). In Nairobi, Kenya, 25.6% were positive for at least one intestinal parasite, with the common parasites, *Entamoeba histolytica*, 36.7%, and *Giardia lamblia*, 16% (Mbae et al., 2013).

Another cross sectional study in Ethiopia reported that children were found to be infected with one or more intestinal parasites, 85.1% in Wondo Genet (Nyantekyi et al., 2011), (36.52% and 23.47% from diarrheal children and out of non diarrheal children) in Yergalem Hospital (Firdu et al., 2014), 24.3% in wonji (G/hiwot et al., 2014), and 27.5% in Addis Ababa (Adamu et al., 2006). A relatively high prevalence of *Schistsoma mansoni was reported from* Wondo Genet, 37.2%, (Nyantekyi et al., 2011) and wonji, 8.8% (G/hiwot et al., 2014). *E. histolytica/dispar* revealed higher infection in males (10.81% and 5.4%, resp.) than in females (7.32% and 2.43%, resp.); where as G. lamblia infection was higher in females (29.27%) than in males (8.11%) (Firdu et al., 2014). Most of the previous studies conducted in Ethiopia have focused on the prevalence and distribution of intestinal parasitic infections mainly among schoolchildren. Only few studies have been reported the magnitude of intestinal parasitic infections among under-five children (Legesse and Erko, 2005). Intestinal parasitic infection is one of the reasons for under five children mortality and morbidity, it is worse in developing countrieslike Ethiopia. Furthermore, there is limited information on the basic awareness of communities about the cause, transmission, and infection prevention in Ethiopia. Therefore, the aim of this study was to assess the prevalence and associated risk factors of intestinal parasitic infection among underfive children.

Material and Methods

Study area

A cross sectional study was conducted in UoG Hospital from May 2015 to June 2015 among under five children, Gondar town, the town is found in Amhara region, North West Ethiopia 748 km far from Addis Ababa, the capital of Ethiopia and 182 km from BahirDar, central city of Amhara regional state. University of Gondar Hospital was established in 1954 in the regime of Emperor Hale Seliasse in collaboration with WHO, UNICEF & USAID to control malaria epidemic, which was occurred in Koladoba town. The hospitalgives almost all health & health related services and has four OPD and two pediatric wards. All under five year children who were attained at UoG Hospital and suspect with IP were study population.

Sample size and sampling technique

Sample size was determined using single population proportion formula**:** "P" was taken as 50% n= $\underline{(Z_{\alpha/2})^2. P (1-P)}/d^2$ Where; n=the required sample size,

P=proportion of pediatric patients from the total patient (will be 0.5), *a*=level of confidence, z=degree of accuracy at 95%=1.96, d=margin of error=0.05. Accordingly, after correction the minimum sample size (n) was found to be 277 preschool children. Systematic random sampling technique was used to select the study population.

Data collection and laboratory method

Socio demographic Data and other information were obtained using questionnaires and each parent was interviewed in local language using interview. The stool specimens were collected by using leak proof containers from under five children and microscopic examination was performed as soon as the specimen was collected.

Wet mount microscopic examination and formol-ether concentration techniques were used to detect parasites and ligoul's iodine was used for cyst identification. The stool specimen was examined for the presence of ova, larvae, trophozoite, and cyst of IP.

Table 1. Socio demographic characteristics of underfive children and their parents attending University of Gondar Hospital, Northwest Ethiopia, 2015

Variables		Frequency	Percentage
Sex	M	129	46.6%
	F	148	53.4%
Age(year)	1-2.1	81	29.2%
	2.2-3.1	57	20.6%
	3.2-4.1	79	28.5%
	4.2-5	60	21.7%
Residence	Urban	171	61.7%
	Rural	106	38.3%
Parents' Religion	Orthodox	224	80.9%
	Muslim	42	15.2%
	Protestant	11	4.0%
Parents' educational status	Illiterate	127	45.8%
	Literate	150	54.2%

Data analysis and interpretation

The data was processed and analyzed using SPSS (Version 20) computer software program. Study findings were explained in words and tables. Proportions for categorical variables were compared using chi-square test. In all cases *P-value* less than 0.05 was taken as statistically significant.

Ethical consideration

Approval was secured first from the ethical clearance committee of school of biomedical and laboratory science, university of Gondar. Then a written letter from the school was obtained and submitted to chief executive officer of UoG Hospital and department of pediatrics, before verbal consent was obtained from each parents or guardian to conduct interview and collect specimen from underfive children, the objective of the study was explained. As much as possible those patients who had parasites were referred to the duty physicians in order to get appropriate anti parasitic drugs.

Table 2. Prevalence of IP infection among underfive children attending UoG Hospital, Northwest Ethiopia, 2015

Parasitism	Diagnostic techniques			
	Wet mount		Formol ether concentration	
	Frequency	Percentage	Frequency	Percentage
Single	25	9.02	43	15.5
Multiple	_	_	5	1.8
Over all total	25	9.02	48	17.3

RESULTS

Socio demographic characteristics

In the present study, a total of 277 under five children [(148 (53.4%) females and 129 (46.6%) males] aged 1 year to 5 years were examined for intestinal parasitic infections. From those children parents include in the study 150 (54.2%) were literate while 127 (45.8%) were illiterate (**Table 1**).

Prevalence of IP infection

As indicated in **Table 2**, the overall prevalence rate with one or more intestinal parasite was 25 (9.02%) when examined by wet mount and 48 (17.3%) when examined by formol-ether concentration technique. No Mixed infection was seen in wet mount but in formol-ether concentration technique, 5 (1.8 %) children were infected by multiple parasites. The prevalence was higher in male 27 (21%) than female 21 (14.2%) by formol-ether concentration technique and children who come from illiterate family were more infected than children from literate family. As the age increase, the prevalence was higher. At age one it was 1 (3.4 %) and at age four it become 17 (21.5 %) when examined by formol ether concentration techniques (**Table 3**).

Both intestinal helminthes (84%) by wet mount, (81.1%) by formol-ether concentration and protozoan parasites

(16%) by wet mount and (18.9%) by formol ether concentration techniques were detected in microscopic examination. In this study, eight species of intestinal parasites were found. Out of these (examined by fomol-ether concentration) the predominant were *Ascaris lumbricoides* 19 (35.8%), *Hymenolepis nana* 13 (24.5%) and cyst of *Giardia lamblia*5 (9.4%), the least prevalent was-*Strongyloides stercoralis* 1(1.9%) (**Table 4**).

Prevalence of IP and associated risk factors

In this study no significant association was observed between the prevalence of IP by sex, (x^2=2.186, p=0.139). Howevert, there was significant association with age (x^2=8.774, p=0.032). However, there was statistically observed strong association between the prevalence of IP with hand washing habit of parents (x^2=30.125, P=0.000), shortening of fingernail habit of children parents (x^2=33.194, P=0.000) by formol-ether concentration technique. In addition, there was association between latrine usage habit and IP (x^2=10.588, P=0.005) in wet mount but no association was observed in formol-ether concentration technique (**Table 5 and Table 6**).

DISCUSSION

In this study, the overall prevalence of one or more intestinal parasite was 17.3%. The prevalence was less than in previous studies conducted in different parts of Ethiopia namely, Wondo Genet, 85.1% (C, 2010), wonji, 24.3% (G/hiwot, 2014), Yergalem Hospital, 49.5 (Firdu, 2014) and Addis Ababa, 24.3%) (Adamu, 2006). This study also showed low prevalence as compared with studies conducted in different parts of the world like Cuba, 58.2% (Cañete, 2012), Pakistan, (52.8%) (Adeoye, 2007) and Kenya (25.6%) (Mbae, 2013). This difference could be due to the difference in geographical location, time of survey, diagnostic method difference and socio-economic status.

According to the prevalence rate of each parasite species when examined by formol-ether concentration

Table 3. Frequency of IP infection among under five children by different diagnostic methods at UoG Hospital, Northwest Ethiopia, 2015.

			Diagnostic techniques							
			Wet mount				Formol-ether Concentration			
Variables		N	Positive	%	Negative	%	Positive	%	Negative	%
Sex	M	129	13	10	116	90	27	21	102	79
	F	148	12	8.1	136	91.9	21	14.2	127	85.8
Age (year)	1-2.1	81	5	6.2	76	93.8	8	3.4	73	96.6
	2.2-3.1	57	4	7	53	93	7	12.3	50	87.7
	3.2-4.1	79	10	12.7	69	87.3	17	21.5	62	78.5
	4.2-5	60	6	10	54	90	16	26.6	44	73.4
Religion	Orthodox	224	20	8.93	204	91.07	39	17.4	185	82.6
	Muslim	42	4	9.5	38	90.5	6	14.3	36	85.7
	Protestant	11	1	9.09	10	90.91	3	27.3	8	72.7
Residence	Urban	171	18	10.5	153	89.5	33	19.3	138	80.7
	Rural	106	7	6.6	99	93.4	15	14.2	91	85.8
Educational status(parent)	Illiterate	127	14	11	113	89	26	20.5	101	79.5
	Literate	150	11	7.3	139	92.7	22	14.7	128	85.3
Occupation(parent)	Merchant	50	6	12	44	88	10	20	40	80
	Farmer	49	7	14.3	42	85.7	12	24.5	37	75.5
	Civil servant	69	5	7.2	64	92.8	9	13	60	87
	Housewife	94	6	6.4	88	93.6	14	15	80	85
	Other	15	1	6.7	14	93.3	3	20	12	80
Income status(parent)	<2000	141	9	6.4	132	93.6	22	15.6	119	84.4
	2000-5000	111	14	12.6	97	87.4	22	19.8	89	80.2
	>5000	25	2	8	23	92	21	84	4	16
Family members number	<5	184	13	7	171	93	28	15.2	156	84.8
	5-7	82	10	12.2	72	87.8	18	22	64	78
	8-10	9	2	22.2	7	77.8	2	22.2	7	77.8
	>10	2	_	_	2	100	_	_	2	100

N= total number

technique, *Ascaris lumbricoides (35.8%)* was the most predominant followed by *Hymenolepis nana (24.5%)* among helminthes. This finding is comparable with the study conducted in Wondo Genet (C, 2010) and Yergalem (Firdu, 2014), in which *Ascaris lumbricoides* was most prevalent, 37.2% and 16.5% respectively. Children playing habit and the transmission way of the parasite, as this parasite is soil transmitted helminths, when children play they can easily acquire the infection. The result of *Entrobeous vermicularis* 2 (3.8%) was similar with study in Cuba 2 (1.9%) (Cañete, 2012).

Giardia lamblia cyst and *Entamoeba histolytica\dyspar cyst* were highest prevalence among protozoan parasites (9.4%). This finding is supported by studies conducted in Addis Ababa (6.3%) (Adamu, 2006), Pakistan (28.9%) (Adeoye, 2007), Cuba (54.8%) (Cañete, 2012) with prevalence of *Giardia lamblia* in which it was most prevalent among protozoan parasites. *Entamoeba histolytica\dyspar* was the least prevalent protozoan parasites inWondo Genet (0.35%) (C, 2010) and yergalem 6.09% (Firdu, 2014).

Considering the prevalence of *Strongylodes stercoralis* 1(1.9%), which was the least prevalent in our finding was also least prevalence in study conducted in Cuba 1%. Differently it was 13.2% prevalent in the study conducted in wondo Genet, Ethiopia (C, 2010). In contrast, the study conducted in Addis Ababa showed *Strongylodes stercoralis* was not identified (Adamu, 2006). In Wondo Genet, *Hymenolepis nana* (4.5%) was the least prevalent (C, 2010) but in this study *Hymenolepis nana was the second predominant helminthes parasite*.

This study revealed that there is no significant association between sex, residence, educational status and source of drinking water for positivity of parasite but the study in Addis Ababa showed association of sex (P=0.035) with IP infection (Adamu, 2006). However, there was significant association between age (x2=8.774, p=0.032) and IP infection and parents personal hygiene status (hand washing habit (x2=30.125, p=0.000) and shortening fingernails (x2=33.194, p=0.000). This showed similarity with study conducted in Pakistanin in which, there was association between hand washing habit of parents (P=0.003). Unlike this study finding there was association between parents educational status (P<0,001) and IP infection (Mehraj, 2008). Similarly to this study, in Kenya statistical association between age (P<0.001) and IP infection was observed. In contrast to this study finding the study in Kenya showed association between sex (P=0.045) and IP infection (Mbae, 2013).

Table 4. Frequency of specific parasites by different techniques from underfive children in UoG Hospital, Northwest Ethiopia, 2015

Type of parasite	Wet mount		Formol-ether Concentration	
	Frequency	Percentage	Frequency	Percentage
Ascaris lumbricoides	13	52	19	35.8
Hookworm	1	8	3	5.7
Schistosoma mansoni	2	8	5	9.4
Hymenolepis nana	5	20	13	24.5
Giardia lamblia cyst	3	12	5	9.4
Entamoeba histolytica\dyspar cyst	1	4	5	9.4
Entrobeous vermicularis	0	0	2	3.8
S.mansoni &Giardia lamblia cyst	0	0	1	1.9
A.lumbricoid &S.stercolaris	0	0	1	1.9
A.lumbricod &H.nana	0	0	1	1.9
E.histlytica cyst&A.lumbricoid	0	0	2	3.8
Total helminthic infection	21	84	43	81.1
Total protozoan infection	4	16	10	18.9

Table 5. Distribution of IP infection regarding to sex, age, residence and educational status of parents among under five children attending at UoG Hospital, Northwest Ethiopia, 2015

Variables		Diagnostic methods							
		Wet mount				Formol ether concentration			
		Positive (%)	Negative (%)	X^2	P value	Positive (%)	Negative (%)	X^2	P value
Sex	M	10	90	0.326	0.586	21	79	2.186	0.139
	F	8.1	91.9			14.2	85.8		
Age (year)	1-2.1	6.2	93.8	2.422	0.490	3.4	96.6	8.774	0.032
	2.2-3.1	7	93			12.3	87.7		
	3.2-4.1	12.7	87.3			21.5	78.5		
	4.2-5	10	90			26.6	73.4		
Residence	Urban	10.5	89.5	1.226	0.268	19.3	80.7	1.210	0.271
	Rural	6.6	93.4			14.2	85.8		
Educational status(parent	Illiterate	11	89	1.141	0.286	20.5	79.5	1.618	0.203
	Literate	7.3	92.7			14.7	85.3		

Table 6. Frequency of factors associated with IP among under five children at UoG Hospital, Northwest Ethiopia, 2015
N =total number, % =percentage

Variables		N	Diagnostic methods							
			Wet mount				Formol-ether concentration			
			PositiveN (%)	NegativeN (%)	X^2	P value	Positive N (%)	NegativeN (%)	X^2	P value
Hand washing habit(parent)	Yes	263	21(8)	242(92)	6.861	0.028	38(14)	225(86)	30.125	.000
	No	14	4(28.6)	10(71.4)			10(71)	4(29)		
Shortening of finger nails (parent)	Yes	254	17(7)	23(93)	20.267	0.000	34(13)	220(87)	33.194	.000
	No	23	8(34.8)	15(65.2)			14(61)	9(39)		
Source of drinking water	Tap	216	16(7.4)	200(92.6)	4.074	0.254	33(15)	183(85)	4.955	.175
	River	19	2(10.5)	17(89.5)			3(16)	16(84)		
	Spring	41	7(17)	34(83)			12(29)	29(71)		
	Others	1	_	1			_	1		
Walking on bare foot	Yes	98	11(11)	87(89)	0.893	0.383	18(18.4)	80(81.6)	0.114	.735
	No	179	14(8)	165(92)			30(16.8)	179(83)		
Eating uncooked food	Yes	98	8(8)	90(92)	0.137	0.828	19(19.4)	79(80.6)	0.449	.503
	No	179	14(7.8)	165(92.2)			29(16)	150(84)		
Latrine presence	Yes	251	21(8.4)	230(91.6)	1.413	0.235	41(16)	210(84)	1.844	.175
	No	26	4(15)	22(85)			7(26.9)	19(73.1)		
Latrine usage habit	Always	244	18(7.4)	226(92.6)	10.588	0.005	39(16)	205(84)	4.854	.088
	Sometimes	16	5(31.2)	11(68.8)			6(37.5)	10(62.5)		
	Never	17	2(11.8)	15(88.2)			3(17.6)	14(82.4)		

In this study, there was difference in results between parasite detection methods **(**wet mount and formol-ether concentration techniques) according to different species of parasites. When we compare prevalence of the two methods we found that tests which were negative in wet mount become positive when examined by formol-ether concentration technique and there was 23(8.3%) difference between the prevalence of IP infection of the two techniques. This showed similarity with study conducted in Gondar, Ethiopia in which the prevalence for intestinal helminthic infection by we mount (38.4%) was increased to 57.1% by formol-ether concentration technique.

Conclusion and Recommendations

The result of this study indicated that helminthic infection is highly predominant than protozoan infection, the most predominant helminth was *Ascaris lumbricoid*. Children at age four and males were more affected by IP.This study also demonstrate that some tests that were negative by wet mount examination become positive by formol-ether concentration technique. In the present study significant association was observed between IP infection and age, parent's personal hygiene status (hand washing habit and shortening fingernails. The study therefore recommends improvement of personal hygiene of caregivers of under five children and for better identification of parasites, it is better to practice concentration techniques. Since some physicians treat IP suspect children clinically, we also recommend physicians to request lab tests for any IP suspected children

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

AA, YA, WT, SG, and MB conceived, designed and drafted the manuscript. YA, WT and SG involved in data acquisition. AA, YA, WT, SG, and MB involved in data analysis and critically reviewed the manuscript. All authors contributed to the writing of the manuscript and approved the submitted version.

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