Prevalence of Soil Transmitted Helminths Infection and associated factors among 2-5 years old children in Dodota District, Arsi Zone, Oromia Region Ethiopia: a community based cross sectional study

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Abstract

Background: Soil transmitted helminthes parasites infections are one of the major public health problems in Ethiopia affecting physical growth and cognitive development of the children. To effectively prevent and control these neglected diseases, adequate information is required particularly among such high-risk group.

Objective: To determine prevalence and associated factors of major soil transmitted helminthes parasite infections among children aged 2-5 years.

Methods: A community based cross-section study was conducted. Data was collected from 545 randomly selected children aged 2-5 years old using structured pre-tested questionnaire from June to July 2018. Stool samples were examined using direct wet mount, kato-katz and Formal-Ether concentration methods. Data was entered in to Epi-Info version 7 software and analyzed using SPSS version 21 software. Multivariate analysis was carried out to determine association between soils transmitted helminthes parasite infections and independent variables.

Results: Magnitude of soil transmitted helminthes infection was 24.2%. Children 3-5 years old were 0.649 times less likely to have soil transmitted

helminthes infection compared to 2-3 years old children (AOR=0.649, 95% CI:0.405, 0.898). Children who didn't used toilet/container for defecation were 3.373 times more likely to have the infections compared to those who used toilet/container (AOR=3.373, 95% CI: 1.602, 7.101).Children who had habit of playing with soil were 2.634 times more likely to have the infection compared to their counterpart (AOR=2.634, 95% CI: 1.256, 5.524).Children who were not given deworming supplementation were 1.273 times more likely to have the infection.

Conclusion: A considerable proportion of children aged 2-5 years were affected by Soil transmitted helminthes parasites infections. Child's age, toilet use/container for defecation, habit of playing with soil and deworming supplementation were predictors of Soil transmitted helminthes infections.

Key words: soil transmitted helminthes, children, associated factors, Dodota District, Arsi zone, Ethiopia

1. Introduction

Soil-transmitted helminths (STH) parasites infections are among the most common infections worldwide and affect the poorest and most deprived communities. They are transmitted by eggs present in human faeces which in turn contaminate soil in areas where sanitation is poor. The main species that infect people are the roundworm (Ascaris lumbricoides), the whipworm (Trichuris trichiura) and the hookworms (Necator americanus and Ancylostoma duodenale) (WHO,2017).

The STH parasites have a direct life cycle which requires no intermediate hosts or vectors, so it is also possible for eggs to be transmitted through

direct contact (Pullan *et al.* 2014). Ascaris and Trichuris eggs can remain viable in the soil for several months. Hookworm eggs hatch into larvae which can survive for several weeks without finding a new host, depending on environmental conditions. To infect a new host, Ascaris and Trichuris eggs need to be ingested. This can happen when hands or fingers that have contaminated dirt on them are put in the mouth or by consuming vegetables and fruits that have not been carefully cooked, washed or peeled. The larvae hatch in the intestine and penetrate the intestinal wall into the bloodstream (WHO, 2017).

Soil-transmitted helminths (STH) parasites infections are widely distributed in tropical and subtropical regions of the world, with the greatest numbers occurring in sub-Saharan Africa and East Asia (WHO, 2017 & Pullan *et al.* 2014). Though infections are prevalent among all age groups, the world health organization (WHO) considers preschool-aged children, school-aged children and women of child-bearing age as the segments of people at especial risk of STH infections morbidities (Pullan *et al.* 2014).

Epidemiologic studies show that, people heavily infected with the STH experience the pathological sequels of infection like impairment of growth and nutrition. The hookworms damage the intestinal mucosa leading to bleeding, loss of iron and anemia. Infections by Trichuris trichiura produce chronic reduction of food intake (Pan American Health Organization Communicable Disease Prevention and Control Project, 2010).They are one of the world's most important causes of physical and intellectual growth retardation. It has been estimated that 1.471billion cases of infection globally and 65 000 deaths occur due to A. lumbricoides (Silva R *et al.*2003 &, Drisdelle R, 2007). Hookworm infection is one of the most

common chronic infections with an estimated 1.3 billion cases globally and directly accountable for 65 000 deaths annually (Demissie F *et al.*, 2008).

In children, chronic hookworm disease retards physical growth which is sometimes most apparent at puberty (Stephenson L, 2013). Likewise, T. trichiura considerably affect the physical and mental development in children (WHO, 2002)**.** About 1.049 billion cases of infection occurred due to T. trichiura and 70 000 deaths occur due to T. trichiura annually (Chan M, 1997, Ezeamama A et al.,2005 & Kwame D,2009). Understanding how the spectrum of climate change effects will influence STH infections is therefore of critical importance to the control of the global burden of human parasitic disease (Weaver, 2010).

Nowadays, evidence showed that helminths infections may actually influence the clinical burden of AIDS (Fincham JE *et al*, 2003) and malaria (Kirwan P *et al*, 2010). Moreover, recent studies indicate that worm infections may disrupt the immune response in ways that could speed up the progression from HIV infection to AIDS (Erikstrup C *et al*, 2008) **.**Studies also revealed that, STH infection produce adverse effects on health, growth, and learning ability with diminished physical fitness as well as impaired memory and cognition (Stoltfuz RJ *et al*. , 1997, Stephenson LS, 1994 & Crompton DW *et al*.,2002) . These adverse health consequences combine to impair childhood educational performance, reduce school attendance and subsequent productivity (Miguel EA *et al*.,2003). As Soil Transmitted Helminths (STHs) affect education and health, it thus directly and indirectly has a negative impact on economic growth. Studies have shown that infection with hookworm during childhood is associated with a

43% reduction in future wage-earning capacity (Bleakley H, 2007 &, Hotez PJ , 2008)

The current global STH control strategy focuses on reducing morbidity in the most-at-risk populations such as pre-school-age children, school-age children, and women of reproductive age through mass drug administration of anti-helminthic drugs such as mebendazole and albendazole, health education, sanitation and clean water supply (WHO, 2012 & 2013). Like many other developing countries, intestinal parasites are widely distributed in Ethiopia, largely due to the low level of environmental and personal hygiene that contaminate food and drinking water from improper disposal of human and animal excreta (Alemu A., *et al. ,* 2011)) .

To our knowledge, there are little data about prevalence and factors contributing to soil transmitted helminths infection among children generally in Ethiopia and particularly in Dodota District. Therefore it is important to assess the prevalence and contributing factors to the infections among 2-5 years children of Dodota District. This will be helpful for community, for policy makers, partners working on child health and other stakeholders to address the problem of soil transmitted helminthes infection among children.

2. Method and materials

2.1. Study area and period

The study was conducted from July to August 2018 in Dodota District of Arsi zone, Oromia Region, southeast Ethiopia. The district is located at 125 km away from Addis Ababa (capital city of Ethiopia) and 50 km from Asella town (capital city of Arsi Zone). The temperature in the district ranges from 20^0 C to 25^0C. The District has a total population of 84,729 of which 10,193 are Children from 2-5 years according to report from the Districts.

2.2. Study design

Community based Cross-Sectional study was conducted.

2.3. Source Population

Total children aged 2-5 years living in Dodota district were source population of the study.

2.4. Study population

All randomly selected children aged 2-5 years old in the selected kebeles of the Districs during data collection period.

Exclusion criteria

Children who received anti-helminths drug within 1 month prior to data collection and children having diarrhea at the time of stool collection were excluded from the study.

2.5. Sample size determination

The sample size was determined using the single proportion population formula ($n = ((Z\alpha/2)^2 P (1-p))/d^2$). Prevalence of STH infection of 35% was taken from study conducted in Dembia district, Northwest Ethiopia (Alemu *et al.,* 2016)) as it was not known in the study area. Other parameters considered for sample size estimation were 5% margin of error, 95% CI,

10% non-response rate and 1.5 design effect. Hence, the calculated sample size was 574.

2.6. Sampling Procedure

Kebeles in the district were stratified in to Urbal and Rural kebeles. Then one kebele from urban and three kebeles from rural were randomly selected. Finally sample size was proportionally allocated to each selected kebeles based on total number of children in the kebeles. Community Health Information System (CHIS) registration which has a list of all children of the indicated age was used as sampling frame (Fig 1).

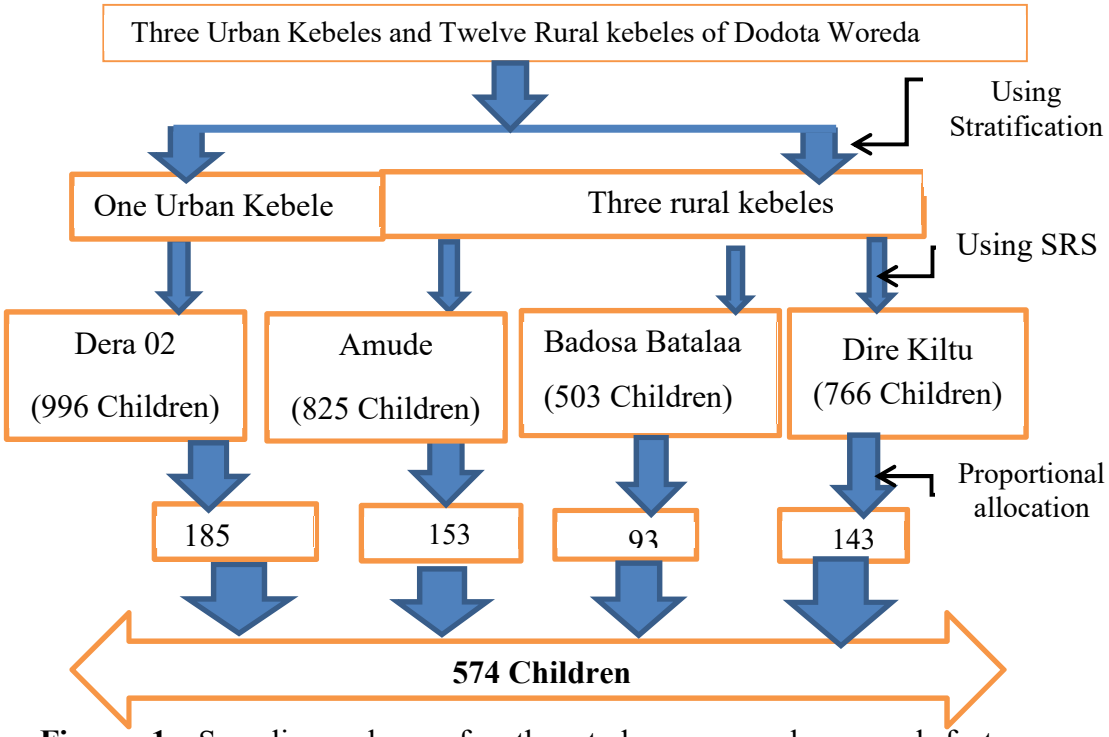

Figure 1: Sampling scheme for the study on prevalence and factors associated with soil transmitted helminthes parasitic infections among 2-5 years children of Dodota Woreda, Arsi Zone, Oromia region, South Eastern Ethiopia, July 2018.

2.7. Data collection instrument and procedure

During data collection, face-to face interview was conducted using pre-tested structured questionnaire which was adopted from other validated published literatures. The tool composed of socio-demographic characteristics of the child and their mother/care taker and environmental and sanitation related questions. The instrument first prepared in English language and then translated in to Afan Oromo and Amharic language (local languages) for data collection purpose.

A fresh stool sample was collected from each study participants using pre-labeled clean, dry, and wide mouthed stool cups, and then transported to Dera Health Center. The approximate time lapse between sample collection and laboratory analysis was 2 hours. Parasitological examination of stool samples was done by McMaster technique for which single slide was examined microscopically by a trained laboratory technologist. Infection intensities of the STH was recorded and graded as light, moderate or heavy based on the number of eggs per gram (EPG) of stool according to WHO threshold (WHO, 1997)

2.8. Data quality control

Tools translation it to local languages were done by native speakers and then back translated to English by other language expert to check for its accuracy. Ten clinical nurses, who were competent in both local languages, were recruited for data collection. Three masters in public health experts also selected to supervise the data collection activities. Data collectors and supervisors were given one day training by principal investigators on the purpose of the study, on the tools and procedures used. The completeness

and consistency of data was assured through direct and daily supervision by supervisors and principal investigators. They returned to interviewers if the data were incomplete and inconsistent. Interviewers re-administered the questionnaire to the respondent under supervision by the supervisors. All laboratory procedures including collection and handling of specimens were carried out in accordance with standard protocols. All the reagents were checked for contamination each time. To ensure general safety, disposable gloves was worn and universal bio-safety precautions were followed at all times. For quality control of the concentration method, preserved stool specimens known to contain parasite ova and larvae were included in each batch of sample to be concentrated to ensure that the procedures were precise. A 10% of stool sample was taken randomly from the samples recorded and re-examined for quality assurance.

2.9. Study Variables

2.9.1. Dependent Variable

Soil transmitted helminths infection among 2-5 years children.

2.9.2. Independent variable

The independent variables include age, sex, family education, monthly family income, family Size, occupation of mothers/care taker, Shoe wearing habit of the child, source of drinking water, hand washing habit after toilet and nail trimming habit of children.

2.10. Data processing and analysis

Data was entered in to Epi-Info version 7 software and then, exported to SPSS version-21 for analysis. Before analysis, data was checked for incompleteness and inconsistency. Descriptive statistics was used to describe

the sample as per the considered characteristics. Bivariate logistic regression was carried out to see the association of each independent variable with STH infection (to select candidate variables for the final model). Independent variables with p- values below 0.2 remained in to the final model (multivariate logistic regressions). Odds Ratios was generated for each variable and the independence of any association was controlled by entering all variables into the model using backward stepwise method (backward conditional). The magnitude of the association between the independent variables in relation to the outcome variable was measured using adjusted odds ratios (AOR) and 95% confidence interval (CI) and P- values below 0.05 was considered statistically significant.

2.11. Operational definitions

Knowledge: A series of 27 questions asked each mother/care taker for this section. Responses was categorized as inadequate knowledge if the respondents answer below 13 correct answers for the questions asked under this section and adequate knowledge when they had at least 13 correct answers for similar question asked.

Attitude: Questioner prepared to assess this section was based on Likert scales. Each study participant was asked a series of 5 different questions. The mean response of the mothers/care takes was used to categorize responses in to favorable and unfavorable attitude. The maximum response was 5 and the minimum 20. The order on the questionnaire is 1 for strongly agree, 2 for agree, 3 for disagree and 4 for strongly disagree. The mean response of respondent was 12.5. When all responses for all the 5 questions were strongly agree, the score was 5 and when strongly disagree, it was 20 (range

was between 5 to 20). Hence responses were categorized as favorable attitude if the mean response of correct answers is below 12 and unfavorable attitude when it was equal to or above 12.

3. Result

3.1. Socio demographic, economic and cultural characteristics

A total of 545 children aged 2- 5 years were participated in to the study with 95 % response rate. Of these, 332 (60.9%) were males and 213 (39.1%) were females. The mean age of children examined in this study was 2.96± SD 0.82 years. Three hundred fifty four (65%) children were less than 3 years old. Majority of the assessed children, 473(86.8%), had habit of playing with soil. Three hundred fifty (64.2%) of mothers/care takers had not check health status of their respective child (Table 1).

Table 1: Socio demographic characteristics of children aged 2-5 years old in Dodota District, Arsi zone, Oromia region, Ethiopia, July 2018.

Variables(n=545)	*Frequency*	*Percentage (%)*
Child's Age		
2-3 years	354	65
3-5 years	191	35
Sex		
Male	332	60.9
Female	213	39.1
Birth order		
One	153	28.1
Two	95	17.4
Three	113	20.7
Four	99	18.2
Five and above	85	15.6
Habit of playing with soil		
Yes	473	86.8

No	72	13.2
Did you check your child health status		
Yes	195	35.8
No	350	64.2

3.2. Socio demographic characteristics of mothers/care takers

Three hundred fifty three (64.8%) of mothers/care takers were in age groups of 18-30 years and few 8(1.5%) were between 41-50 years. The mean age was 29.93± SD 5.54. Majority of mothers/care takers, 506(92.8%), were married. Regarding educational status, 208 (38.2%) were unable to read/write and 61(11.2%) were secondary and above. Four hundred forty six (80%), 12(2.2%), 7(1.3%) were housewife, government employee and students respectively. With regards to family size, 330 (60.6%) households had between 4-6 and 105(19.3%) were three and less (Table 2).

Table 2: Socio demographic characteristics of mothers/care takers in Dodota District, Arsi zone, Oromia region, Ethiopia, July 2018

Variables(n=545)	***Frequency***	***Percentage (%)***
Age		
18-30	353	64.8
31-40	184	33.8
41-50	8	1.4
Year living in the area		
<5	141	25.9
10-May	172	31.6
>10	232	42.6
Marital status		
Married	506	92.8
Single	13	2.4
Divorced	14	2.6
Widowed	12	2.2

Education status		
Unable to read and write	208	38.2
Read and write	102	18.7
Primary	174	31.9
Secondary and above	61	11.2
Occupation		
House wife	436	80
Government employee	12	2.2
Private	25	4.6
Merchant	44	8.1
Student	7	1.3
Others	21	3.9
Average Monthly Income		
<1000	123	22.6
1000-2000	228	41.8
2000-3000	146	26.8
3000-5000	24	4.4
>5000	24	4.4
Family size		
≥3	105	19.3
3-6	330	60.6
≤7	110	20.2

3.3. Knowledge of Mothers/ care takers on STH infections

Five hundred and one (91.9%) of children's mothers/care takers responded that they know about intestinal parasite. Four hundred eighty seven (89.4%), 375(68.8%) and 334(61.3%) of mothers/care takers responded that STH infections could transmit by eating contaminated food, drinking contaminated water and eating soil (geophagy) respectively. Four hundred sixty five (83.5%), 461(79.1%) and 352(64.6%) of them also responded that diarrhea, vomiting and abdominal pain are signs and symptoms of intestinal parasites respectively. Of all mothers/care takers participated in this study,

491(90.1%), 277(50.8%) and 226(41.6%) responded that intestinal parasite can be prevented by washing of hands before eating, using clean toilet and cutting nail respectively (Table 3).

Table 3: Knowledge of mothers/caretakers on the prevention and control of STH infections in Dodota District, Arsi zone, Oromia region, Ethiopia, July 2018

Variables(n=545)	Frequency	Percentage
Do you know what intestinal parasites are?		
Yes	501	91.9
No	44	8.1
Any training received on intestinal parasite prevention from extension health workers?		
Yes	209	38.3
No	336	61.7
Transmission mechanism of STH infections		
Eating contaminated food	487	89.4
Eating raw meat	98	18
Drinking contaminated water	375	68.8
Playing with soil	223	40.9
Not cutting nails regularly	143	26.2
Eating soil (geophagy)	334	61.3
Swimming in river	49	9
Walking barefooted	83	15.2
Lack of hygiene	286	52.5
I don't know	19	3.5

Signs and symptoms of STH infections		
Abdominal pain	352	64.6
Abdominal cramp	348	63.9
Diarrhea	465	83.5
Dysentery	91	16.7
Vomiting	431	79.1
Loss of appetite	98	18
Weight loss	96	17.6
Itching of Anal area	50	9.2
Don't know	22	4
Prevention and control methods for STH infections		
Washing of hands before eating	491	90.1
Wearing shoes	66	12.1
Cutting nail	226	41.5
Taking de-worming drugs	87	16
Using clean toilet	277	50.8
Don't know	39	7.2
Knowledge of Mothers/care takers on STH infections		
Adequate	319	58.5
Inadequate	226	41.5

3.4. Attitude of mothers/care takers towards STH infections

From the total mothers/care takers participated in this study, 399 (73.2%) agreed that lack of hygiene is cause for intestinal parasite. Three hundred seventy six (69%) of mothers/care takers agreed intestinal parasite could be

prevented and controlled by treatment of intestinal parasite disease and 386(70.8%) of then responded health education can reduce intestinal parasite prevalence. Three hundred fifty (64.2%) of them responded if these infections left untreated, can be transmitted to other family member (Table 4).

Table 4: Attitude of mothers/care takers towards STH infections prevention and control in Dodota District, Arsi zone, Oromia region, Ethiopia, July 2018

Variables(n=545)	***Strongly Agree (%)***	***Agree (%)***	***Strongly disagree (%)***	***Disagree (%)***
Lack of hygiene is cause for intestinal parasite	120(22)	399(73.2)	-	26(4.8)
We can prevent and treat intestinal parasite disease	133(24.4)	376(69)	1(0.2)	35(6.4)
Health education can reduce intestinal parasite prevalence	125(22.9)	386(70.8)	3(0.6)	31(5.7)
If intestinal parasite untreated, it can transmit to other family member and cause growth retardation	123(22.6)	350(64.2)	-	72(13.2)
Uses soap when washing hands is preventive for intestinal parasite	137(25.1)	386(70.8)	-	22(4)
Attitude of mothers to ward intestinal parasite(n=545)				
Favorable attitude	369(67.7%)			
Unfavorable attitude	176(32.3%)			

3.5. Practice on the prevention and control

Of all children participated in the study, 329(60.4%) had ever infected with intestinal parasite and 201(36.9%) had history of previous stool examination. Majority of the children, 500(91.7%), had a practice to use toilet/container for defecation of which 462(84.8%) had a practice of hand washing after defecation which was usually done by their mother/care takers (Table 5)

Table 5: Mothers/care takers practice on the prevention and control of STH infections Dodota District, Arsi zone, Oromia region, Ethiopia, July 2018

Variables(n=545)	Frequency	Percentage
Ever infected with intestinal parasite		
Yes	329	60.4
No	216	39.6
Any stool examination previously		
Yes	201	36.9
No	344	63.1
Toilet use or container for child defecation		
Yes	500	91.7
No	45	8.3
Washing fruit before consuming it		
Yes	290	53.2
No	255	46.8
Cutting your child nail when it grows		
Yes	458	84.0
No	87	16.0
Washing your child hand after defecation		
Yes	462	84.8
No	83	15.2
Chimerically treated or tap water drinking		

Yes	514	94.3
No	31	5.7
Deworming supplementation		
Yes	226	41.5
No	319	58.5

3.6. Prevalence of STH infection

The prevalence of at least one STH infection among children aged 2-5 years in the study area was 24.2% (95 % CI: 20.61, 27.83). Seventy (53%), 55(41.7%), 6 (4.5%) and one (0.8%) of the children were infected with Ascaris Lumbricoides, Trichiuris trichiura, Hookworm and Strongyloide stercolaris parasite during the study period. Hence, Ascaris Lumbricoides were the most dominant parasitic infections followed by Trichiuris trichiura infection. Double infection (Ascaris Lumbricoides *and* Trichiuris trichiura) was found in 20 (15.2%) children (Table 6).

Table 6: Prevalence of soil transmitted helminths infection among children aged 2-5 years in Dodota District, Arsi zone, Oromia region, Ethiopia, July 2018

Variables(n=545)	**Frequency**	**Percentage (%)**
Soil transmitted helminths infection		
No	413	75.8
Yes	132	24.2
Type of STH(n=132)		
Ascaris lumbricoides	70	53
Hookworm	6	4.5
Trichiuris trichiura	55	41.7
Strongyloide stercolaris	1	0.8
Dose of infection(n=132)		
Single infection	112	84.8

Double infection	20	15.2

3.7. Factors associated with STH parasites infections

In the bivariable logistic regression analysis, child's age, year of family living , toilet use or container for defecation , habit of playing with soil and deworming supplementation were associated with STH infections at a P value of less than 0.2 and hence included it to multivariable logistic regression analysis. On multivariable logistic regression analysis child's age, toilet use or container for defecation, habit of playing with soil and deworming supplementation found to be independent predictors of STHI. Children 3-5 years old were 0.649 times less likely to have soil transmitted helminths infection compared to those 2-3 years old (AOR=0.649, 95% CI:0.405, 0.898). On the other hand, Children who didn't use toilet/container for defecation were 3.373 times more likely to have soil transmitted helminths infection compared to those who used toilet/container for defecation (AOR=3.373, 95% CI:1.602, 7.101). The study also revealed that, children who had a habit of playing with soil were 2.634 times more Likely to have soil transmitted helminths infection compared to their counterpart (AOR=2.634, 95% CI: 1.256, 5.524).Children who were not given deworming supplementation were 1.273times more likely to have soil transmitted helminths infection compared to their counterpart (AOR=1.273, 95% CI: 1.014, 2.004) (Table 7).

Table 7: Bivariate and multiple logistic regression analysis of factors associated with STHI among children aged 2-5 years in Dodota District, Arsi zone, Oromia region, Ethiopia, July 2018

Variables (n=545)	STHI		COR (95%CI)	AOR(95%C)	P-value
	Present	Absent			
Child's Age					
2-3 years	98	256	1	1	
3-5 years	34	157	0.556(0.365,0.876)	0.649(0.405,0.89)*	0.042
Year of family living					
<5	40	101	1	1	
10-May	28	144	0.962(0.604,1.533)	0.607(0.344,1.07)	0.084
>10	64	168	0.491(0.28,0.84)	1.184(0.717,1.95)	0.509
Toilet/container use					
Yes	110	390	1	1	
No	22	23	3.391(1.821,6.31)	3.37(1.60,7.10)*	0.001
Habit of playing with					
Yes	122	351	2.155(1.071,4.335)	2.634(1.25,5.52)*	0.01
No	10	62	1	1	
Deworming					
Yes	45	181	1	1	
No	87	232	1.508(1.00,2.27)	1.27(1.01,2.00)*	0.026
Washing fruit before					
Yes	68	222	1	**1**	
No	64	191	1.094(0.73,1.62)	0.947(0.61,1.45)	0.805
Washing child hands					
Yes	108	354	1	1	
No	24	59	1.333(0.792,2.245)	0.810(0.43,1.51)	0.508
Chimerically treated					
Yes	123	391	**1**	1	
No	9	22	1.300(0.583,2.899)	0.861(0.33,2.23)	0.759

***Statistically significant at P value <0.05**

4. Discussion

In this study, the overall prevalence of soil transmitted helminths infection was 24.2 %(95 % CI: 20.61, 27.83).This is in line study conducted in Wonji Shoa in which the prevalence of at least one intestinal parasite species infection was 24.3% (Degarege A. & Erko B. ,2014). But the finding in our study is higher when compared with more recent findings conducted in Debre Birhan (17.4%) (Zemene T. & Shiferaw MB., 2018) and in Dessie (15.5%) (Daniel Gebretsadik, 2018). However, our finding is lower than studies done in Uganda (70.6%) (Reckhow & J ensen Dalton, 2014) and Jimma (46.6%) (Dana D *et. al.* 2014).This variation could be due to different in geographical distribution of the parasites and differences in availabilities of prevention and control measures.

Child age showed statistical significant association with soil transmitted helminths infections which is in-line with other studies conducted in Debre Birhan , North Shoa, Ethiopia (Zemene T. & Shiferaw MB., 2018)) , Wonji Shoa ,Ethiopia (Degarege A. & Erko B.,2014), Gondar, Northwest Ethiopia (Yetemwork Aleka *et al.* ,2015) and southeastern Anatolian region of Turkey (Nebiye Yentür Doni *et al*.,2015).

The odd of being infected by STH infection were increased by more than threefold among children who didn't use toilet/container for defecation as compared with children who used toilets/container for defecation. This findings supported by study conducted in Teda Health Centre, Northwest Ethiopia which showed statistically significant association between STH infection and not using toilet (Abraraw Abate *et al*., 2013) .This could be due to people in the rural areas and poor socioeconomic communities live with absence or inadequate sanitation including the absence of toilets and lack of provision of clean and treated water supply which can facilitate

transmission of STH infections (United Nations International Children's Education Fund, 2007).

In these study children's who had habit of playing with soil were more than two times more likely to be infected with STH infection compared to their counterparts. This is in-line with other study conducted in Wolayita, southern Ethiopia (Wadilo F., 2016)), Debre Birhan, Ethiopia (Zemene T. & Shiferaw MB., 2018), Wonji, Ethiopia (Degarege A. & Erko B., 2014)), Gondar, Northwest Ethiopia (Yetemwork Aleka *et al*., 2015) and southeastern Anatolian region of Turkey (Nebiye Yentür Doni *et al*., 2015). This could be due the fact that children living in a setting of continuous exposure to contaminated soil and water, lack awareness of the need for good personal hygiene and like to play with soil are at a greater risk for STH infections (Wadilo F., 2016).

Yet again, Children who were not given deworming supplementation of albendazole or mebendazole were 1.273 times more likely to have soil transmitted helminths infection compared to their counterpart (AOR=1.273, 95% CI: 1.014, 2.004) which is in line with the studies conducted in Arbaminch, Ethiopia (Alemu *et al*.,2018) and Jimma, South-West Ethiopia (Dana D.*et. al*., 2014). This is probably why WHO strongly recommends preventive chemotherapy (deworming), using annual or biannual single-dose albendazole (400 mg) or mebendazole (500 mg) as a public health intervention for all young children 12–23 months of age, preschool children 1–4 years of age, and school-age children 5–12 years of age living in areas where the baseline prevalence of any soil-transmitted helminths infection is

20% or more among children, in order to reduce the worm burden of soil-transmitted helminths infection (WHO,2005).

5. Conclusion

The findings of this study showed that prevalence of STH infections among children aged 2-5 years was 24.2 %. Children's' age, using toilet/container for defecation, habit of playing with soil and deworming supplementation were independent predictors of soil transmitted helminths infection.

6. Recommendation

Dodota District Health office and other partners should conduct health education on the benefits of use of toilet in the community so that open field defecation will be avoided. This could be achieved by strengthening health extension programs in the area. The District health office should also supplement deworming supplementations routinely and timely for children with in the age of 2-5 years. Personal hygiene should also receive priority in all households having children in the districts.

We also recommend further studies with stronger study designs (analytic studies) to investigate the underlying causes of STH infections among children aged 2-5 years in the.

7. Ethical consideration

Ethical clearance was obtained from Institutional Review Board (IRB) of Arsi University College of Health Sciences. Letter of permission to conduct the study was obtained from Arsi zone and other local government structures. Before data collection, the participants were informed about the purpose of the study, their right to refuse participation and discontinue the

interview/sample collection. The interviewers discussed the issue of confidentiality and obtained verbal consent from all mother/care takers of the selected children before actual data collection. Children diagnosed with STH infection were linked to Dera health center for treatment.

8. Competing Interest

The authors declare that there is no conflict of interests.

9. Acknowledgments

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10. Reference

Abraraw Abate et al (2013) Cross-Sectional Study on the Prevalence of Intestinal Parasites and Associated Risk Factors in Teda Health Centre, Northwest Ethiopia. Hindawi Publishing Corporation http://dx.doi.org/10.5402/2013/757451.

Alemu A., et al (2011) Soil transmitted helminths and Schhistosoma mansoni infections among school children in Zarima town, northwest Ethiopia. BMC Infectious Disease 11: 189.

Alemu et al (2016) Schistosoma mansoni and soil-transmitted helminths among preschool-aged children in Chuahit, Dembia district, Northwest Ethiopia: prevalence, intensity of infection and

associated risk factors. BMC Public Health 16:422: DOI 10.1186/s12889-016-2864-9

Alemu ,Getaneh Alemu, Zeleke Aschalew and Eshetu Zerihun (2018) Burden of intestinal helminths and associated factors three years after initiation of mass drug administration in Arbaminch Zuria district, Southern Ethiopia. Journal of BMC Infectious Diseases 18:435.

Bleakley H (2007) Disease and development: evidence from hookworm eradication in the American South. Q. J. Econ 122: 73–112.

Chan M (1997) The global burden of intestinal nematode infections-Fiftyyears on. Parasitol Today 13: 438-443.7

Crompton DW, Nesheim MC (2002) Nutritional impact of intestinal helminthiasis during the human life cycle. Annu. Rev. Nutr 22:35–59.

Dana D. etal (2014) Prevalence and intensity of soil-transmitted helminth infections among preschool age children in 12 kindergartens in Jimma Town, southwest Ethiopia · Oxford University Press doi:10.1093/trstmh/tru178.

Daniel Gebretsadik, Yeshi Metaferia, Abdurahaman Seid, Genet Molla Fenta and Alemu Gedefie (2018) Prevalence of intestinal parasitic infection among children under 5 years of age at Dessie Referral Hospital: cross sectional study. BMC 11:771.

Degarege A, Erko B (2014) Prevalence of intestinal parasitic infections among children under five years of age with emphasis on

Schistosoma mansoni in Wonji Shoa Sugar Estate, Ethiopia. PLoS ONE 9(10):e109793

Demissie F, Petros B, Kebede A (2008) Hookworm species distribution among school children in Asendabo town Jimma zone, south Ethiopia. Ethiop J Health Sci 18: 53-56.

Drisdelle R (2007) Ascaris lumbricoides :food borne pathogenic helminthes. Intest Inflect 45: 13-28.

Erikstrup C et al (2008) Schistosomiasis and infection with human immunodefi ciency virus 1 in rural Zimbabwe: systemic inflammation during co-infection and after treatment for schistosomiasis. American Journal of Tropical Medicine and Hygiene 79:331–337.

Ezeamama A, Friedman J, Acosta L, Bellinger D, Langdon G, Manalo D, et al (2005) Helminth infection and cognitive impairment among Filipino children. J Trop Med Hyg 72: 540-548.

Fincham JE, Markus MB, Adams VJ (2003) Could control of soil-transmitted helminthic infection influence the HIV/AIDS pandemic? Acta Tropica 86(3):15–333

Hotez PJ (2008) Forgotten people and forgotten diseases, the neglected tropical diseases and their impact on global health and development. ASM Press 275.

Kirwan P et al (2010) Impact of repeated four-monthly anthelmintic treatment on Plasmodiuminfection in preschool children: a double-blind placebo-controlled randomized trial. BMC Infectious 10:277.

Kwame D(2009). Infection disease: T. trichiura. University of California; Los Angeles Medical Center. Miguel EA, Kremer M (2003) Worms: Identifying impacts on education and health in the presence of treatment externalities. Econometrica 72:159–217.

Nebiye Yentür Doni, Gülcan Gürses, Zeynep Şimşek, Fadile Yıldız Zeyrek (2015) Prevalence and associated risk factors of intestinal parasites among children of farm workers in the southeastern Anatolian region of Turkey. Annals of Agricultural and Environmental Medicine 22(3): 438–442.

Pan American Health Organization Communicable Disease Prevention and Control Project(2010) Prevalence and intensity of infection of Soil-transmitted Helminths in Latin America and the Caribbean Countries: Mapping at second administrative level; 2000-2010.

Pullan *et al.* (2014) Global numbers of infection and disease burdenof soil transmitted helminth infections in 2010. Parasites & Vectors 7(37). http://www.parasitesandvectors.com/content/7/1/37.

Reckhow, J ensen Dalton(2014) Soil-T ransmitted Nematode Infections Among School-Age Children In Rakai District. Yale University press: 2014. Yale http://elischolar.library.yale.edu/ysphtdl/1242.

Silva R, Brooker S, Hotez P, Montresor A, Engels D, Savioli L (2003) Soil-transmitted helminth infections: updating the global picture. Trends Parasitol 19: 547-551.

Stephenson L, Latham M, Kury K, Brigham H (2013) Treatment with a single dose of albendazole improves growth of Kenyan

schoolchildren with hookworm, T. trichiuraand A. lumbricoide sinfection. Am J Trop Med Hyg 41: 78-87.

Stephenson LS (1994) Helminth parasites, a major factor in malnutrition. World Health Forum 15:169–172.

Stoltfuz RJ, Albonico M, Tielsch JM, Chwaya HM, Savioli L (1997) Linear growth retardation in Zanzibari schoolchildren. J Nutr 127:1099–1105.

United Nations International Children's Education Fund (2007) Water, Sanitation and Hygiene (WASH) in Schools *https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2981586/*

Wadilo F (2016) Magnitude of Intestinal Parasitosis among Under Five Year Children Presenting with Acute Diarroheal Illness in South Ethiopian Hospital. Journal of Health, Medicine and Nursing. 2016;31.

Weaver, Haylee J.; Hawdon, John M.; and Hoberg, Eric P (2010) Soil-T ransmitted Helminthiases: Implications of Climate Change and Human Behavior . Manter Laboratory of Parasitolog y 26(12).

World Health Organization (2002) Prevention and control of schistosomiasis and soil transmitted helminthiasis. Geneva.

World Health Organization (2005) Deworming for Health and Development(Report of the third global meeting of the partners for parasite control). *whqlibdoc. who.int/hq/2005/WHO_CDS_CPE_PVC_2005.14.pdf*

World Health Organization (2012) Eliminating soil-transmitted helminthiases as a public health problem in children: Progress report 2001-2010 and stragetic plan 2011-2020. Geneva.

World Health Organization. Weekly epidemiological record. Soil-transmitted helminthiases: number of children treated in ;2013.

World Health Organization (2017) Soil-transmitted helminth infections: WHO fact sheet.

World Health Organization (1991) Basic Laboratory Methods in Medical Parasitology. WHO Geneva, Switzerland.

Yetemwork Aleka, Seife G/egziabher, Workineh Tamir, Meseret Birhane, Agersew Alemu (2015) Prevalence and Associated Risk Factors of Intestinal Parasitic Infection among Under five Children in University of Gondar Hospital, Gondar, Northwest Ethiopia, Biomedical Research and Therapy 2(8): 347-353

Zemene T, Shiferaw MB (2018) Prevalence of intestinal parasitic infections in children under the age of 5 years attending the Debre Birhan referral hospital, North Shoa, Ethiopia. BMC Res Notes 11(1):58.