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Prevalence and Impact of *Ascaris lumbricoides* Infection on the Physical Growth of Primary School Age Students in Wonago Town, Gedeo Zone, Southern Ethiopia

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Abstract

Ascaris lumbricoides infection is one of the commonest intestinal nematode infections in the world, with a profound negative effect on nutritional status among underprivileged populations. The purpose of this study was to determine the prevalence and impact of *Ascaris lumbricoides* infection in the physical growth of primary school age students in Wonago Town. A cross sectional study was conducted among 325 school students of 7-15 years old from grade 1-8 in Wonago town primary schools from February to April, 2018. Data collected through Stool samples Examination and Anthropometric measurement. Of the study sample, 37.2% showed *Ascaris lumbricoides* parasitic infection. Mild *Ascaris* intensity was (72.7%) were common in ascaris positive subject, followed by moderate (20.7%) and heavy (6.6%) infection. The Intensity of *Ascaris* infection was significantly associated with age category ($X^2= 16.896$ and $P= 0.010$). Prevalence of underweight, Wasting, and Stunting among age group 7-9 years was (36.1%, 4.9% and 9.6%). Prevalence of underweight and sex of the study subjects was significantly associated ($X^2= 8.98$ and $P= 0.0462$). Prevalence of stunting growth was 15.7%. There was significant association between stunting growth, age group and sex of study subjects with ascaris infected students ($X^2= 17.26$; $P= 0.00248$). Prevalence of *Ascaris lumbricoides* is higher in primary school age students of Wonago Town. There was higher association between ascaris infection in underweighted study subjects than wasted and stunted students.

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Introduction

Ascaris lumbricoides parasite is one of the most common helminth affecting humans and causing important medical and social problems especially in the under developing countries. Ascariasis is the name of disease widely distributed especially in tropical and subtropical areas of the world where unhygienic disposal of human excreta is common (WHO, 2015). It is estimated that more than 1.4 billion people are infected with *Ascaris* parasite, representing 25 percent of the world population

(WHO, 2015). The majority of people with Ascariasis infection live in Asia (73%), Africa (12%) and South America (8%), where some population have infection rates as high as 95 percent (CDC, 2016). Ethiopia has the second highest burden rank of *Ascaris lumbricoides* parasitic infection in Sub-Saharan (Hotez and Kamath, 2009). Ascariasis infection causes about 20,000 deaths every year, usually as a result of intestinal occlusion, and it contributes to infant malnutrition. The transmission mode of *Ascaris lumbricoides* parasite is by the ingestion of embryonated eggs in raw vegetables, water or soil-

contaminated hands (WHO, 2015). Heavy infection with *Ascaris* parasite is frequently manifested by abdominal discomfort, anorexia, nausea and diarrhea leading to protein-energy malnutrition and vitamin A deficiency (Khanal *et al.*, 2017). Children are the most unprotected people from Ascariasis infection which usually comes from a poor sanitation area that lacks hygiene, clean water supplement and access to health care (Eidwina *et al.*, 2016). Impaired physical growth of children's is a common health problem of African school children due to Ascariasis infection and many other factors (Reji *et al.*, 2011). The poor nutritional status or malnutrition due to Ascariasis infection has also been implicated in poor physical growth of preschool age students when enrolled in schools (Omitola *et al.*, 2016). The adverse effects of the parasite on the physical growth among school age students are diverse and alarming. Although several studies have been conducted on the distribution and prevalence of Ascariasis infection in Ethiopia (Jemaneh, 2000., Erko and Medhin, 2003., Tadesse *et al.*, 2008., Terefe *et al.*, 2011 and Mathewos *et al.*, 2014). There are still several localities in Ethiopia including the present study area, which epidemiological information and impact of *Ascaris lumbricoides* parasitic infection was not available. This study was initiated with the aim of determining the prevalence and impact of *Ascaris lumbricoides* infection on the physical growth of primary school age students in Wonago Town, Gedeo Zone, Southern Ethiopia.

Materials and Methods

Description of the Study Area

The study was conducted in Wonago Town two governmental primary school age students in Wonago Town Primary Schools (Figure 1). Wonago Town is the center of Wonago Wereda which is located 12 km from Dilla Town the Capital of Gedeo Zone, 99 km from Hawasa the capital of SNNPR and 372 Km from Addis Ababa the Capital City of Ethiopia. Wonago Town is located at an altitude of 1455 m a.s.l with 6°22'-6°42'N latitude and 38°21'- 38°41'E longitude. The Mean annual rainfall in Wonago Town is in the range between 1401–1800 mm per year. The Mean annual temperature registered in the town is 12.6°C-20°C. Wonago Town has one Public Health Center Two Private clinic, Two Governmental Primary Schools namely Belebukisa Primary School and Wonago Primary School and one Secondary and Preparatory School. The inhabitants of Wonago Town use agriculture and trade to lead their livelihood. Agriculture is the source of income in the

area, where the farming system is characterized by production of coffee, small scale production of mixed crops and beef rearing, and trade is the main source of income in the study area (Wonago Wereda Agricultural Office, 2017).

Research design

Institutional or school based cross sectional study was conducted to determine the prevalence and impact of *Ascaris lumbricoides* infection on the physical growth of primary school age students (Grade 1-8) in the study area. The survey was conducted from February to April, 2018 at Belebukisa and Wonago Primary Schools.

Study population and criteria for selection

Study population

The whole Wonago Town governmental primary school age students; namely Belebukisa and Wonago primary school students were constituted as the study population who enrolled in 2017/2018 academic year. Currently, the total number of students in two governmental primary schools is 3478 (1805 males and 1673 females).

Criteria selection

The main inclusion criterion was students must be found in the age group between 7-15 years because primary school age students are found in this age group. Those students who were taking antihelminthic drugs in the last two weeks and those who was absent from school on the initial day of stool sample collection were excluded from the study.

Sample size determination and sampling technique

Sample size was determined by taking 10% of the study population, because there is no specific study which was done previously in Wonago Town or around the study area to take the prevalence of *Ascaris lumbricoides* infection to determine the sample size. Simple random sampling technique was used to select the study population. To select the participants, the students were stratified according to their educational level (Grade 1-8) and age group (7-15 years). Then a quota was allocated for each grade level and age group. Finally, by using systematic random sampling technique by using class rosters as a sample frame 348 study participants was selected for the current study purpose based on sample

size determination by taking 10% of study population as study subjects.

Data collection procedures

Collection of stool sample and laboratory analysis technique

After proper instruction, the participants were taken a labeled, leak proof, tightly corked plastic container sample collection cup and applicator stick. Then, from each participant, about 2g of fresh stool sample was collected. Data concerning their sexes, ages and grade level was recorded on the submission of stool sample. The collected stool sample was observed and checked for its label, quantity and procedure of collection physically for its consistency.

After that a portion of each stool sample was observed by using direct wet mount and formol-ether concentration technique directly under microscope to observe and count the presence of eggs or larva of *Ascaris lumbricoides* parasite in the stool sample. The Laboratorial analysis of the study was done with the assistance of two qualified and experienced laboratory technicians in Wonago Town Health Center. Finally the stool sample was processed to prepare specimen and observed under microscopic by using 10× or 40× objective lenses to observe the eggs or larvae of *Ascaris lumbricoides* parasite. For quality control reason, from all of the slides, 10% were randomly selected and re-examined at the end by well experienced laboratory technician.

Intensity of *Ascaris lumbricoides* parasite is measured by Kato-katz examination technique examination of two sub-samples (41.7 mg each) from a single stool specimen, which was thoroughly mixed before slide preparation (WHO, 1991). Epg: 1,000 to 4,999 egg per gram (epg) for mild (light), 5,000 to 49,999 epg for moderate and 50,000 epg or higher for severe (heavy) ascaris infection rate (WHO, 1994).

Anthropometric assessment for measuring the physical growth

Anthropometric data was collected by direct measurement of anthropometric parameters; weight, height/length, and percentages of these parameters among from *Ascaris* positive and negative study participants were compared with the expected calculated values for the child's age using the appropriate formulas

(Azubuike and Nkanginieme, 2007). Weight and height of each child was measured after calibrating to the nearest 0.1 kg and 0.1 cm, respectively (WHO, 2006). Each student was measured while wearing light clothes after removing shoes, belt, cap or any other material that could interfere with their actual height and weight. The students were considered as undernourished when either underweight (weight-for-age Z score or body mass index for-age Z-score < -2SD) or stunted (height-for-age Z score < -2SD) (WHO, 2009). BMI was calculated as the weight in kilograms divided by the square of the height in meters (kg/m^2) WHO, 2007).

Data analysis

The collected data was checked for its completeness and consistency. Then data were arranged according to students' grade level, age group and sexes to analyze the data with mean, average, odd ratio and standard deviation to compare the result of the prevalence of *Ascaris lumbricoides* parasitic infection and physical growth parameter assessment result by their grade level, age group and sexes of the study subjects. The association between *Ascaris lumbricoides* parasitic infection with physical growth parameter result was determined by the independent effect of the variables was tested by using Binary logistic regression analysis. Descriptive statistics were used to show the prevalence and impact of *Ascaris lumbricoides* infection on the physical growth rate by percentage and proportion. Inferential statistics were applied to indicate the association between Ascariasis infection and anthropometric measurement result. The dependent variables were infection status of *Ascaris lumbricoides* parasite and intensity of Ascariasis parasite. Independent variables were grade level, age category, anthropometry measurement results and sexes of study subjects. Finally data were summarized in percentages and present in tables. P-value less than 0.05 were considered as statistically significant.

Results and Discussions

Socio-demographic characteristics of study participants in wonago town primary schools

The analysis is done which is focused on socio-demographic characteristics of the study participants are summarized and presented in Table 1. A total of 348 study participants were selected for the present study, but 23 (6.6%) were intentionally excluded due to inability to provide stool samples or unwilling to participate in the

study. For this reason, a total of 325 study participants were included in the study. A total of 165 (50.8%) and 160 (49.2%) students were randomly selected from Belebukisa and Wonago primary schools, respectively. The sex proportion of the study subjects was 168 (51.7%) and 157 (48.3%) for male and female study participants (Table 1). The sample study subjects were divided in to three age groups: 7-9 years, 10-12 years, and 13-15 years. The mean age of the study subjects was 11 years. From these age category 83 (25.5%) of the students were 7-9 years old, 118 (36.3%) were 10-12 years old and 124 (38.2%) were 13-15 years old. As shown in Table 1, the primary school students were categorized in to two grade groups: From grade 1-4 and grade 5-8, based on these the study population 164 (50.5%) of the students were arranged in grade 1-4 and 161 (49.5%) of the students were arranged in grade 5-8, respectively.

Prevalence of *Ascaris lumbricoides* parasitic infection by age and sex of examined students in Wonago town primary schools

The result of the prevalence of *Ascaris lumbricoides* parasitic infection among the primary school age students of Wonago Town by age and sex of the study subjects were summarized and presented in Table 2. The overall prevalence of *Ascaris lumbricoides* parasitic infection among all study participants was 121 (37.2%). Of all 121 (37.2%) Ascariasis positive case in males and females was 63 (37.5%), and 58 (36.9%), respectively. Among age group between 7-9 years was 18 (42.9%) and 13 (31.7%) in males and females, respectively.

While, for the age group 10-12 years, it was 26 (44.8%), for males and 28 (46.7%), for females. For the age group 13-15 years, was 19 (27.9%), and 17 (30.4%) for males and females (Table 2). The higher prevalence of Ascariasis was seen in the age groups of 7-9 years and 10-12 years.

A significant association was found between *Ascaris lumbricoides* parasitic infection and age category ($X^2=7.243$, $P=0.027$) in the age group 10-12 years (Table 2).

Prevalence and intensity of *Ascaris lumbricoides* parasitic infection among Wonago town primary school aged students by gender and age category

The result of the prevalence and intensity of *Ascaris lumbricoides* parasitic infection among the primary school age students of Wonago town by age category and

sex of the study subjects were summarized and presented in Table 3. The intensity of *Ascaris lumbricoides* parasite was analyzed for those *Ascaris* positive study subjects. The overall prevalence of Ascariasis intensity, for age group 7-15 years was, 88 (72.7%) for mild infection rate, 25 (20.7%) for moderate infection rate, and 8(6.6%) for severe, respectively. Of these, the prevalence of mild *Ascaris* intensity among the age group 7-15 years, for males and females was 47 (74.6%), and 41 (70.7%), respectively.

While, the prevalence of moderate *Ascaris* intensity among the age group 7-15 years for males and females was 10 (15.9%), and 15 (25.9), respectively. Although, the prevalence of severe *Ascaris* intensity among the age group 7-15 year for males and females was 6 (9.5%), and 2 (3.4%), respectively. The prevalence of *Ascaris* intensity for age group 7-9 years, for mild infection intensity was 11 (61.1%), and 6 (46.1%), for moderate 4 (22.2%), and 5 (38.5%), and for severe 3 (16.7%), and 2 (15.4%) in males, and females, respectively. While, for the age group 10-12 years, for mild it was 19 (73.1%), and 23 (82.1%), for moderate 4 (15.4%), and 5 ((17.9%), and for severe 3 (11.5%), and 0 (0%) in male and females, respectively. Even though, the prevalence of *Ascaris* intensity for age group 13-15 years, for mild *Ascaris* intensity was 17 (89.5%), and 12 (70.6%), for moderate 2 (10.5%), and 5 (29.4%), and for severe *Ascaris* intensity none in both sexes for males and females, respectively. There is significant association between age category and *Ascaris* intensity in the study area ($X^2=16.896$ and $P=0.010$).

Prevalence of weight-for-age, weight-for-height, and height-for-age status among male and female study participants aged 7-9 years in both Belebukisa and Wonago primary schools

As revealed in Table 4, the prevalence of underweight, wasting, and stunting for the age group 7-9 years was, 30 (36.1%), 4 (4.9%), and 8 (9.6%) of the study populations, respectively. Of these, 13 (31%) were males and 17 (41.5%) were females for underweight, 2 (4.8%) were wasted males and 2 (4.9%) were wasted females, and 5 (11.9%) were stunted males and 3 (7.3%) were stunted females, respectively. Prevalence of wasting and stunting was almost the same for girls in the age group 7-9 years. The result of the present study as showed that there was significant association between WAZ (Underweight) and sex of the students ($X^2=8.98$, and $p=0.0462$) in the age group, 7-9 years old. In addition to this there was no significant association between WHZ

(Wasting) and sex of the students for the age group between 7-9, years old ($X^2= 3.593$, and $p= 0.166$). Although, there was significant association between HAZ (Stunting), and sex of the study subjects for the age group 7-9 years old ($X^2= 5.911$, and $p= 0.0341$). Comparison of the three anthropometric indices with the age group of 7-9 years as showed that female students 17 (41.5%) had a higher chance of getting underweight (WAZ) than males students 13 (31%) with in the same age group. While, wasted female students 2 (4.9%) had the same chance for the prevalence of wasting (WHZ) with male students 2(4.8%) for the same age group. Still now stunted female students 3 (7.3%) for the age group 7-9 years old had almost the same (closer) for prevalence of stunting rate with the male students 5 (11.9%) with the same age group.

Prevalence of normal BMI and *Ascaris lumbricoides* parasitic infection status among age group 7-15 years study participants of Wonago town primary schools

In the current study, the prevalence of Normal BMI-for-age (-2SD to 1SD) which was considered as the Normal BMI-for-age group 7-15, years was 92.3 (300/325) (Table 5). Of which, 156 (92.9%) was for males and 144 (91.7%) was for females, respectively. The prevalence of Normal BMI among the age group 7-9 years, in the present study for male was 39 (92.8%) and 35 (85.4%) for females, respectively. While, the prevalence of Normal BMI among the age group of 10-12 years, study subjects was 52 (86.7%) and 55 (91.7%) for males and females, respectively. Although, the prevalence of Normal BMI for the age group between 13-15 years, study subjects was 65 (95.6%), and 54 (96.4%) for males and females, respectively. From these the prevalence of Normal BMI was predominant 119 (96%), among the age group 13-15, years old. There is no significant association between Normal BMI and age of the study subjects among the age group 7-15, years old ($X^2= 1.811$, and $P= 0.404$).

Prevalence of height-for-age (Stunting) and *Ascaris* infectivity status among stunted students of Wonago town primary schools in the age group between 7-15 years

As showed that the overall prevalence of stunting in the study area was 51 (15.7), with in the age group 7-15, years (Table 6). The prevalence of stunting for the age group 7-9, years for males was 5 (11.9%), out of these stunted male students 3 (60%) of them are *Ascaris* positive and 2 (40%) of stunted male students were free

from *Ascaris* infection. Also the prevalence of stunting for female students with in the age group of 7-9, years was 3 (7.3%), all of these stunted female students 3 (100%) of them were *Ascaris* positive and there was no *Ascaris* negative female students in the age group 7-9, years were infected by stunting. While, the prevalence of stunting for the age group 10-12, years for male students was 17 (29.3%), out of these stunted male students 11 (64.7%), of them are *Ascaris* positive and 6 (35.3%), of these stunted male students in the age group 10-12 years were free from *Ascaris* infection. Still now the prevalence of stunting for the age group 10-12, years for female students was 19 (31.7%), out of these stunted female students 12 (63.2%), of them were *Ascaris* positive and 7 (36.8%), of stunted female students were free from *Ascaris* infection, respectively. These result as showed that those female students 19 (31.7%) with the group 10-12, years old possess higher prevalence of stunting than male students (29.3%) with the same age group. Although, the overall prevalence of stunting for the age group 13-15, years for male students was 4 (5.9%), out of these stunted male students 3 (75%), of them were *Ascaris* positive and 1 (25%) of the stunted male student in this age group were free from *Ascaris* infection. While, the prevalence of stunting for the age group 13-15, years for female students was 3 (5.4%), out these stunted female students 3 (100%) of them were *Ascaris* positive, respectively. Based on the above study result the prevalence of stunting was higher in the age group 10-12, year students 36 (30.5%) than other age group. However, the overall prevalence of stunting in *Ascaris* positive study subjects was 39 (76.5%), and in *Ascaris* negative individuals was 12 (23.5%), these result as showed that stunting is more prevalent and severe in *Ascaris* infected individuals than none infected individuals. These variation in stunting among the age group and sex of students was statistically significant ($X^2= 17.26$ and $P= 0.00248$). So there was association between stunting and *Ascaris* infected individuals in the study area.

Association of *Ascaris lumbricoides* parasitic infection with anthropometric measurements of students in both Belebukisa and Wonago primary schools

The result of study has also analyzed with correlation between prevalence of *Ascaris lumbricoides* parasitic infection and anthropometric indices of school-age students of wonago town two governmental primary schools. The overall prevalence of *Ascaris lumbricoides* parasite diagnosed via study subjects employed in the present study and proportion of different anthropometric

measurements result in each age group was presented in Table 7.

The overall prevalence of underweight, wasting, and stunting among students in the age group 7-9, years was 30 (36.1%), 4 (4.8%), and 8 (9.6%), respectively. While, the overall prevalence among students in the age group 10-12, years, was 69 (58.5%), 8 (6.8%), and 36 (30.5%) for underweight, wasting, and stunting, respectively. Although, the overall prevalence among students in the age group 13-15 years, was 32 (25.8%), 9 (7.3%), and 7 (5.6%), for underweight, wasting, and stunting, respectively. The present study as showed that the prevalence of underweight, wasting, and stunting was higher for the age group 10-12 years, than other age group. However, school age students in the age group 10-12 years were highly exposed for underweight, wasting, and stunting than other school age students. A significant association was found between *Ascaris* positive individuals and underweight students ($X^2=10.752$, $OR=12.413$, $P=0.037$) in the age group 7-9, years. Comparison of the three anthropometric indices with the age group as showed that underweighted students with the age group 7-9, years 21 (67.7%) of school age students had a higher prevalence of *Ascaris lumbricoides* parasitic infection than other anthropometric indices. While, wasted and stunted school age students with the age group 7-9, years showed that the prevalence of *Ascaris lumbricoides* parasitic infection was 2 (6.5%), and 5 (16.1%), respectively (Table 7).

There were also significant association between *Ascaris lumbricoides* parasitic infection and underweighted students ($X^2=7.29$, $OR=7.56$, $P=0.049$), in the age group, 10-12 years. Comparison of the three anthropometric indices with the age group of 10-12 years, as showed that underweighted students was 35 (64.8%) of school-aged students in these age group had a higher prevalence of *Ascaris lumbricoides* parasitic infection than other anthropometric indices. While, wasted and stunted school-aged students as showed that the prevalence of *Ascaris lumbricoides* parasitic infection was 5 (9.3%) and 28 (51.9%), respectively (Table 7).

The result of the present study showed that there was significant association between *Ascaris lumbricoides* parasitic infection and underweighted students ($X^2=7.930$, $OR=8.271$, $P=0.033$) in the age group, 13-15 years old. Comparison of the three anthropometric indices with age group of 13-15 years, as showed that underweighted students 23 (63.9%) of school-aged students had higher prevalence of *Ascaris lumbricoides* parasitic infection than other anthropometric indices of students in the same age group. While, wasted and stunted school-aged students in the age group 13-15, years as showed that the prevalence of *Ascaris lumbricoides* parasitic infection was 5 (13.9%), and 6 (16.7%), respectively (Table 7). However, there was no significant association between *Ascaris* positivity with wasted, and stunted students among the age group 7-15 years old.

Table.1 Socio- demographic characteristics of study participants in Wonago town primary schools

Characters	Frequency	Percent (%)
Sex		
Male	168	51.7
Female	157	49.3
Age category (in years)		
7-9	83	25.5
10-12	118	36.3
13-15	124	38.2
Primary Schools		
Belebukisa Primary School	165	50.8
Wonago Primary School	160	49.2
Educational Category		
Grade 1-4	164	50.5
Grade 5-8	161	49.5

Table.2 Prevalence of *Ascaris lumbricoides* parasitic infection by age and sex of examined students in Wonago Town primary schools

Age category (in year) and sex	No of Examined (%)	Ascaris status		X ²	P-value
		Positive	Negative		
		Frequency (%)	Frequency (%)		
7-9 Male Female	42(50.6) 41(49.4)	18(42.9) 13(31.7)	24(57.1) 28(68.3)	7.243	0.027
10-12 Male Female	58(49.2) 60(50.8)	26(44.8) 28(46.7)	32(55.2) 32(53.3)		
13-15 Male Female	68(54.8) 56(45.2)	19(27.9) 17(30.4)	49(72.1) 39(69.6)		
All age group Male Female	168(51.7) 157(48.3)	63(37.5) 58(36.9)	105(62.5) 99(63.1)		
Total	325(100)	121(37.2)	204(62.8)		

Table.3 Prevalence and intensity of *Ascaris lumbricoides* infection among Wonago town primary school aged students by gender and age category

Age category (in year) and sex	No of Examined (%)	Ascaris positive (%)	Intensity of Ascaris			X ²	P-value
			Mild (%)	Moderate (%)	Severe (%)		
7-9 Male Female	42(50.6) 41(49.4)	18(42.9) 13(31.7)	11(61.1) 6(46.1)	4(22.2) 5(38.5)	3(16.7) 2(15.4)	16.896	0.010
10-12 Male Female	58(49.2) 60(50.2)	26(44.8) 28(46.7)	19(73.1) 23(82.1)	4(15.4) 5(17.9)	3(11.5) 0(0)		
13-15 Male Female	68(54.8) 56(45.2)	19(27.9) 17(30.4)	17(89.5) 12(70.6)	2(10.5) 5(29.4)	0(0) 0(0)		
All age group Male Female	168(51.7) 157(48.3)	63(37.5) 58(36.9)	47(74.6) 41(70.7)	10(15.9) 15(25.9)	6(9.5) 2(3.4)		
Total	325(100)	121(37.2)	88(72.7)	25(20.7)	8(6.6)		

Table.4 Prevalence of weight-for-age, weight-for-height, and height-for-age status among male and female study participants aged 7-9 years in both Belebukisa and Wonago primary schools

Participants age group	No of Examined (%)	Nutritional Indicator to physical growth		
		WAZ (Underweight)	WHZ (Wasting)	HAZ (Stunting)
		Frequency (%)	Frequency (%)	Frequency (%)
7-9				
Male	42(50.6)	13(31)	2(4.8)	5(11.9)
Female	41(49.4)	17(41.5)	2(4.9)	3(7.3)
Total	83(100)	30(36.1)	4(4.9)	8(9.6)
X ²		8.98	3.593	5.911
P-value		0.0462	0.166	0.0341

Table.5 Prevalence of normal BMI and *Ascaris lumbricoides* Infection status among age group 7-15years study participants of Wonago town primary schools

Age category In year) and sex	No of Examined	Normal BMI status -2SD to 1SD (%)	Ascaris Infectivity status		X ²	P-value
			Positive (+)	Negative (-)		
			Frequency (%)	Frequency (%)		
7-9					1.811	0.404
Male	42(50.6)	39(92.8)	14(35.9)	25(64.1)		
Female	41(49.4)	35(85.4)	11(31.4)	24(68.6)		
10-12						
Male	58(49.2)	52(86.7)	24(46.2)	28(53.8)		
Female	60(50.8)	55(91.7)	22(40)	33(60)		
13-15						
Male	68(54.8)	65(95.6)	15(23.1)	50(76.9)		
Female	56(45.2)	54(96.4)	17(31.5)	37(68.5)		
Male	168(51.7)	156(92.9)	53(51.5)	103(52.9)		
Female	157(49.3)	144(91.7)	50(48.5)	94(47.1)		
Total	325(100)	300(92.3)	103(34.3)	197(65.7)		

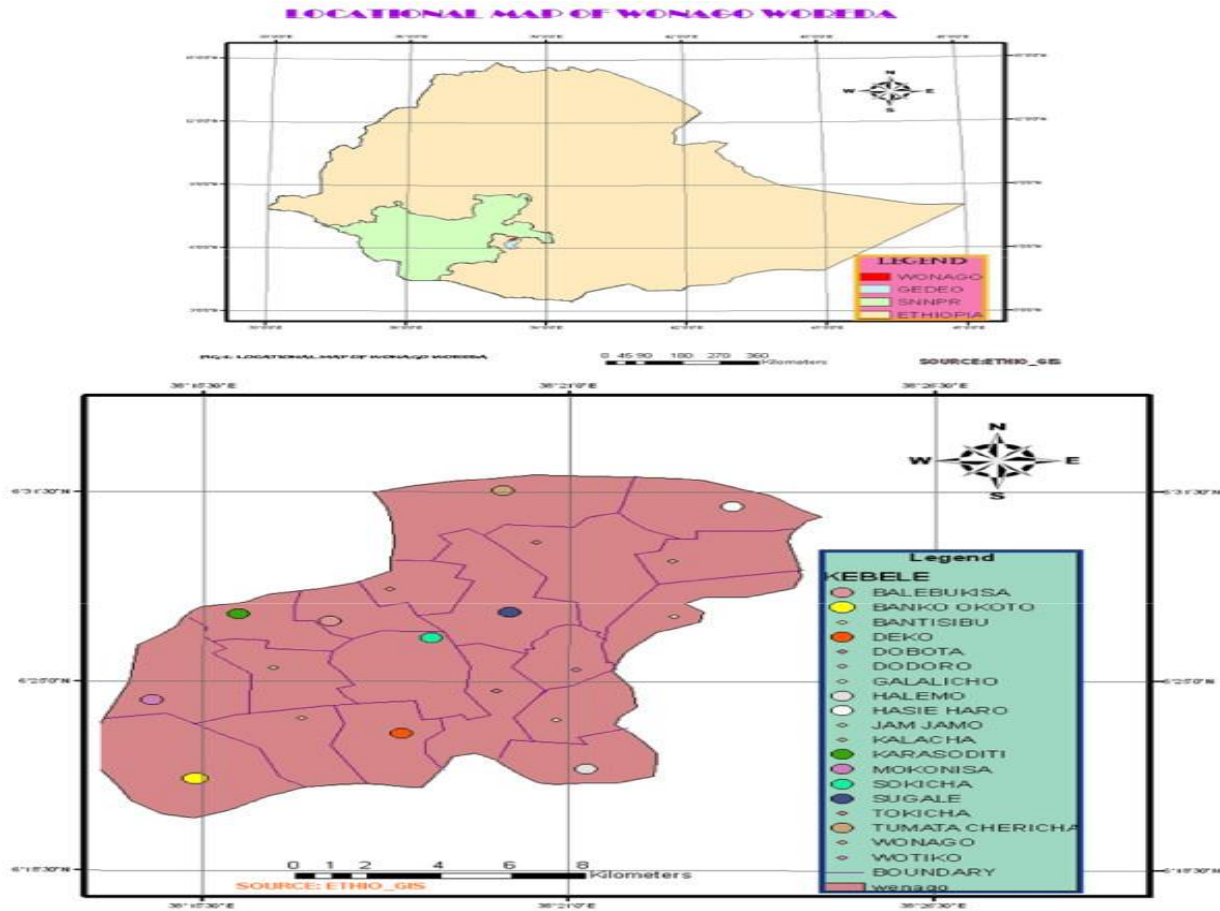
Table.6 Prevalence of height-for-age (Stunting) and *Ascaris* infectivity status among stunted students of Wonago town primary schools in the age group between 7-15years

Age category (in year) and sex	No of Examined	Stunted	Ascaris Infectivity status		X ²	P-value
			Positive (+)	Negative (-)		
			Frequency (%)	Frequency (%)		
7-9					17.26	0.00248
Male	42(50.6)	5(11.9)	3(60)	2(40)		
Female	41(49.4)	3(7.3)	3(100)	0(0)		
10-12						
Male	58(49.2)	17(29.3)	11(64.7)	6(35.3)		
Female	60(50.8)	19(31.7)	12(63.2)	7(36.8)		
13-15						
Male	68(54.8)	4(5.9)	3(75)	1(25)		
Female	56(45.2)	3(5.4)	3(100)	0(0)		
Total	325(100)	51(15.7)	39(76.5)	12(23.5)		

Table.7 Association of *Ascaris lumbricoides* infection with anthropometric measurements students in both Belebukisa and Wonago primary schools

Nutritional Indicator	No of Examined (%)	Ascariasis Positive (%)	Value		
			OR	X ²	P-value
For 7-9 age group	83(25.5)	31(37.3)			
WAZ					
Not underweight	53(63.9)	10(32.3)	12.413	10.752	0.037
Underweight	30(36.1)	21(67.7)			
WHZ					
Not wasted	79(95.2)	29(93.5)	3.715	3.829	0.579
Wasted	4(4.8)	2(6.5)			
HAZ					
Not stunted	75(90.4)	26(83.9)	2.972	2.976	0.827
Stunted	8(9.6)	5(16.1)			
For 10-12 age group	118(36.3)	54(45.8)			
WAZ					
Not underweight	49(41.5)	19(35.2)	7.56	7.29	0.049
Underweight	69(58.5)	35(64.8)			
WHZ					
Not wasted	110(93.2)	49(90.7)	0.763	0.759	0.385
Wasted	8(6.8)	5(9.3)			
HAZ					
Not stunted	82(69.5)	26(48.1)	5.937	5.735	0.064
Stunted	36(30.5)	28(51.9)			
For 13-15 age group	124(38.2)	36(29.0)			
WAZ					
Not underweight	92(74.2)	13(36.1)	8.271	7.930	0.033
Underweight	32(25.8)	23(63.9)			
WHZ					
Not wasted	115(92.7)	31(86.1)	0.494	0.457	0.853
Wasted	9(7.3)	5(13.9)			
HAZ					
Not stunted	117(94.4)	30(83.3)	0.673	0.669	0.347
Stunted	7(5.6)	6(16.7)			

Figure.1 Location Map of Wonago Town (Study Area)



Many studies have already indicated that prevalence of *Ascaris lumbricoides* parasite among Ethiopian primary school age students in various parts of the country. However, there was scarce of specific data on the prevalence and impact of *Ascaris lumbricoides* parasitic infection among primary school age students in this study area. The overall prevalence of *Ascaris lumbricoides* parasitic infection was 37.2% among Wonago Town primary school age students in this study. Similar study on prevalence of *Ascaris lumbricoides* parasitic infection among primary school age students of Arbaminch Town, Zarima Town, South Gondar, and Dilla Town primary schools was done and the result shows lower prevalence of *Ascaris* infection rating 10.6% (Haftu *et al.*, 2014), 21.9% (Alemu *et al.*, 2011), 28.9% (Jemaneh, 2000) and 36% (Eriso, 2014), respectively than the present study result (37.2%). This discrepancy on prevalence difference might be occurred, due to altitudinal difference and Socio-demographic background difference between the study areas.

The prevalence of *Ascaris lumbricoides* parasitic infection among primary school age students of Jimma Town, Tilili Town, North Gondar, Dawro Zone, and Chenchu Town the rate of *Ascaris* infection was 39.5% (Tadesse *et al.*, 2008), 39.7% (Abera and Nibret, 2014), 39.8% (Mathewos *et al.*, 2014), 47.3% (Alemayehu and Tomass, 2015), and 60.5% (Abossie and Seid, 2014), respectively the result of those study were relatively higher than in case of the present study when compared with 37.2% of the present study. This higher prevalence rate might be occurred due conduciveness of the climatic condition and nature of soil for the parasite survival for a long period of time to increase the intensity of the parasite.

Still the prevalence of *Ascaris lumbricoides* parasitic infection in Bushilo village in Hawasa was 37.2% (Terefe *et al.*, 2008), this result was the same with the present study this result might be occurred due to different ecological and climatic factors that determine the prevalence of *Ascaris* parasite might be the same or

similar with the present study area. However, the prevalence of *Ascaris lumbricoides* parasite in this study area was higher (37.2%), as compared with the study result of school age children of Thailand (Asia) which shows 8% (Piangjai *et al.*, 2002), and the result of Caparao and Altocaparao (Brazil) the result was 12.2% (Carneiro *et al.*, 2002), respectively. The differences in findings among the studies might be explained by variations in geography, socio-economic conditions, and awareness of the society about transmission and prevention of *Ascaris* parasite, hygienic disposal of human excreta, and cultural practices of the population under consideration.

An epidemiological study from Madagascar found that female children's had a significantly higher prevalence and intensity of Ascariasis infection than males (Kightlinger *et al.*, 1995). While, another study from Guatemala did not find any gender differences with respect to Ascariasis prevalence rate (Anderson *et al.*, 1993), these result similar with the present study. The study result also shows the intensity of Ascariasis for the mild, moderate and severe *Ascaris* intensity was observed in the age group 7-15 years, showing the result was 88 (72.7%), 25 (20.7%), and 8 (6.6%), *Ascaris* intensity rates respectively (Table 3).

However, age had significant effect on intensity of *Ascaris lumbricoides* (Seid *et al.*, 2015). The highest prevalence and intensity of *Ascaris* infection are usually observed in school age children (WHO, 2003). Although, similar study on the prevalence and intensity of *Ascaris lumbricoides* parasitic infection among preschool children was done in Kandy district (Srilanka) and Caparao, Altocaparao (Brazil) the result of *Ascaris* intensity as shown that (73.8%, 19.9%, and 6.4%) for Srilanka and (26.8%, 11.8%, and 6.7%) for Brazil, respectively (Carneiro *et al.*, 2002; Galgamuwa *et al.*, 2018).

However, from the present study result in comparison with study of Srilanka and Brazil, the intensity of *Ascaris lumbricoides* parasitic infection in Wonago Town primary schools is higher than study of Srilanka and Brazil. This higher intensity of Ascariasis infection rate in the present study area might be observed due to different risk factors such as ecological, climatic, socio-economic, nutritional status of the infected individual and awareness of the pupils are the main factors and conducive for the survival of the parasites in Wonago Town.

The dominantly infected age group with *Ascaris* parasite in this study was 10-12 years old. According to Haftu *et al.*, 2014, higher intensity of *Ascaris* infection in this age group might be occurred due to school age students 10-15 years, are more exposed for *Ascaris lumbricoides* parasitic infection because they were participate in agricultural activities with parents and they were exposed for *Ascaris* infection and indicating soil contamination is one of the common determinant factors for *Ascaris* infection. Furthermore, moderately and rarely, *Ascaris* infected school-aged students in this study was 7-9 years and 13-15 years old.

Anthropometric indices were analyzed to determine the relation of *Ascaris* infection rate with physical growth rate of children's in the study subjects. Based on these the prevalence of *Ascaris lumbricoides* parasitic infection in underweighted students of the present study was (67.7 %) this result were higher than wasted (6.5%), and stunted (16.1%) among pupils of the age group 7-9 years respectively. Different studies as indicated that Poor physical growth and *Ascaris* infection are significantly associated (Haftu *et al.*, 2014). *Ascaris* positive children's were more exposed for underweight than wasting and stunting. The prevalence of WAZ, WHZ, and HAZ in Babile town was 5.2%, 11.6% and 5.4% (Girum, 2005). The prevalence of in WAZ, WHZ, and HAZ in Wukro town school children aged 6-9 was 44.3%, 28.6% and 27% (Kidane *et al.*, 2014). However, a study done Mexico has shown a higher prevalence of *Ascaris lumbricoides* infection among underweighted children compared to the properly nourished children (Quihui-Cota *et al.*, 2004). The prevalence of underweight, stunting, and wasting among preschool children in Lucknow (India) was 67.6% (Weight-for-age <-2SD), 62.8% (Height-for-age <-2SD), and 26.5% (Weight for-height <-2SD), respectively (Awasti and pande, 1997).

The results of the present study disagree with the above study. While, the prevalence of underweight and stunting in gender among the age group of 7-9 years ($X^2= 8.98$, $P= 0.0462$ and $X^2= 5.911$, $P= 0.0341$), respectively. There is significant association between underweight, stunting and gender of study subjects. However, there is no significant association between wasting and gender of study subject among age group 7-9 years ($X^2= 3.593$ and $P= 0.166$), respectively.

Underweighting of the body composition might be leads to *Ascaris lumbricoides* parasitic infection or the presence of heavy *Ascaris* parasite in the body cause

underweight in school age students. Inadequate food intake and repeated *Ascaris* infection have been recognized as two crucial factors contributing to the poor physical growth on school age children (shetty *et al.*, 1994). The prevalence of *Ascaris lumbricoides* parasitic infection was significantly associated with underweighted students among the age group of 10-12 years (P= 0.049) respectively. Treatment of infected student had been performed by an authorized clinical nurse in wonago health center. All study subjects tested positive for *Ascaris lumbricoides* ova were treated with a single dose of Albendazole at 400mg 1 tablet, respectively.

In conclusion, the current study has revealed a relatively high prevalence of *Ascaris lumbricoides* parasitic infection among school age students of Wonago Town Primary Schools. There is no relation between gender and prevalence of *Ascaris* infection. The higher intensity of *Ascaris* infection is determined by different risk factors. The prevalence of underweight is higher in *Ascaris* infected study subjects than non infected students in the study area. The prevalence of underweight was observed to be high in this study and *Ascaris* positivity is associated as a risk factor for underweight problem and both of the problems are simply preventable.

School age students with the age of 10-12 years are highly prevalent for *Ascaris* infection than other age groups; In order to this public sanitation, health education and taking antihelminthic drugs regularly is essential to combat against this problem. *Ascaris* positive school age students are highly exposed for mild *Ascaris* intensity than moderate and severe *Ascaris* intensity. The prevalence of stunting wasting does not increase the risk for *Ascaris* infection in the age group of 7-9 years. There is association between *Ascaris* infection and BMI status of study subjects in the study area. This is of grave public health problem as it affects both physical and mental development of the study subjects. *Ascaris* infection increases the chance of getting stunting in school age students.

Recommendation

- Further investigation is needed to find other unknown risk factors which may contribute to high prevalence of *Ascaris* parasite, underweighting, wasting and stunting in study subjects and also future detailed research with

long term follow up on the nutritional impact of *Ascaris* infection in this study area is required.

- Create awareness about the route of transmission of *Ascaris lumbricoides* parasitic infection and their prevention and controlling mechanism.
- Community mobilization is needed by health care service providers because it is important to develop the habit of personal and environmental hygiene.
- Supplying food and deworming based program is essential to mitigate *Ascaris lumbricoides* infection, underweight, stunting and wasting in primary schools.

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