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Assefa, Nega; Abrham Roba, Aklilu; Abdosh, Tekabe; Kemal, Jelalu; Demissie, Eskindir

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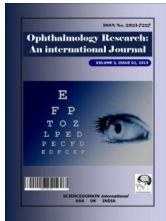
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PO Box 117  
221 00 Lund  
+46 46-222 00 00



## Prevalence and Factors Associated with Trachoma among Primary School Children in Harari Region, Eastern Ethiopia

Nega Assefa<sup>1</sup>, Aklilu Abrham Roba<sup>1\*</sup>, Tekabe Abdosh Ahmed<sup>1</sup>,  
Jelalu Kemal Birmeka<sup>2</sup> and Eskindr Demissie Zergaw<sup>1</sup>

<sup>1</sup>College of Health and Medical Sciences, Haramaya University, Ethiopia.

<sup>2</sup>College of Veterinary Medicine, Haramaya University, Ethiopia.

### Authors' contributions

*This work was carried out in collaboration between all authors. Authors NA and AAR designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors TAA, JKB and EDZ managed literature searches and analyses of the study. All authors read and approved the final manuscript.*

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### ABSTRACT

**Introduction:** Trachoma is the leading infectious cause of blindness worldwide. It is more common in areas where people are socio-economically deprived. Although trachoma is endemic in 571 districts in Ethiopia, its prevalence has not been studied among school children in Harari Region.

**Objective:** To assess the prevalence of trachoma eye infection and factors associated with it among Grades 1-8 schoolchildren in Harari Region, from November 30, 2015 to April 29, 2016.

**Methodology:** A cross-sectional study was done on 1722 students selected from four primary schools. Data were collected using WHO simplified trachoma grading scheme and analysed by SPSS Version 16. The factors influencing the outcome variable were identified via Logistic Regression, and predictors through Odds Ratio and the corresponding confidence intervals.

**Results:** The overall prevalence of trachoma was 1.3% (22/1722) in which 14 had Trachoma Follicular and 8 had both Trachoma Follicular and Trachoma Intense. Unclean face (AOR 3.4,

\*Corresponding author: E-mail: [aklilimnathserah@gmail.com](mailto:aklilimnathserah@gmail.com);

CI 1.01-11.42), no maternal education (AOR 4.324, CI 1.189 to 15.729), family size of >5 (AOR 7.069, CI 2.248 to 22.228), families monthly income of less than 1000 Ethiopian Birr (AOR 5.71, CI 1.643 to 19.823), and solid waste collected by municipality (AOR 12.672, CI 1.289 to 124.57) were associated with trachoma eye infection.

**Conclusion:** Both Trachoma Follicular and Trachoma Intense are less prevalent among Grades 1-8 school children in Harari Regional State.

*Keywords:* Trachoma; school children; prevalence of trachoma in Harari region.

## 1. INTRODUCTION

Trachoma is an eye disease caused by bacterium, *Chlamydia trachomatis*. It is the leading infectious cause of blindness worldwide [1]. Nearly 182 million people live in trachoma endemic areas and are at risk of trachoma blindness. The disease is a public health problem in 42 countries, and responsible for the blindness or visual impairment of about 1.9 million people [2].

Ethiopia is one of the most trachoma endemic countries in the world: more than 75 million Ethiopians, the largest number in the world, live in trachoma-endemic areas [2]. Its 571 districts were projected to be endemic above the treatment threshold for trachoma by 2016 [3].

The World Health Organization's simplified trachoma grading scheme defines active trachoma as TF and/or TI. TF (trachomatous inflammation follicular) is the presence of five or more follicles in the central part of the upper tarsal conjunctiva, each at least 0.5 mm in diameter, and TI (trachomatous inflammation — intense) is pronounced inflammatory thickening of the upper tarsal conjunctiva that obscures more than half of the normal deep vessels [4]. Active trachoma is associated with young age, poor access to water and sanitation, and close contact between people. Discharge from the eyes and nose may facilitate the transmission of ocular *C trachomatis* infection [5].

Studies show that school surveys are important to determine the prevalence of neglected tropical diseases like trachoma in a community [6]. But several studies conducted in different parts of Ethiopia [7-10] were community based, in children 1-9 years, and in adults; they excluded age group of 9-18 years who are attending primary schools and who may be equally infectious. Therefore, the objective of this study was to assess the prevalence of trachoma eye infection and the factors associated with it among primary (Grades 1-8) school children in

Harari Region, eastern Ethiopia, from November 30, 2015 to April 29, 2016.

## 2. METHODS AND MATERIALS

### 2.1 Study Setting and Period

A school based cross-sectional study was conducted in Harari region, Eastern Ethiopia. Harar, the capital of Harari peoples Region, is found in eastern Ethiopia, 515 Kilometres away from Addis Ababa. The region had a projected total population of 210,438 (M: F=102, 369:101,069) in 2010 [11]. The net education attendance ratio in the region was 79.8% for male and 77.6% for female, whereas the health service coverage was estimated to be above 100% [12]. More than half of the population live in urban areas. In the year 2015/16, there were 84 primary schools (Grades 1-8), of which 62 were government schools (39 rural, 23 urban), 17 were private schools, and 5 were inside religious organizations (1 inside mosque and 4 inside church). In same academic year, there were 41,336 students (35,733 in government schools and 5,603 in private/NGO schools [13]. The study was conducted from November 30, 2015 to April 29, 2016.

All the primary school children in Harari Region were included as a source population. And, the primary school children in the randomly selected 4 schools and who were below 18 years of age were the study population.

### 2.2 Sample Size

The sample size was calculated manually by single population proportion formula at a precision of 2%, 95% confidence interval and p value of 0.15 [14] and design effect of 1.5. This gives a sample size of 1836.

### 2.3 Sampling Technique

First, schools were stratified by geographical location of urban and rural. Second, these schools were further stratified as government,

private, and inside religious institutions. One school from each stratum was selected using a lottery method, and this was done after thorough observations that the four schools represent all the primary schools. The randomly selected schools were Deker primary school (Government rural), Ras Mekonin primary school (government urban), SOS primary school (private urban) and Mekane Silassie primary school (inside religious institution). All students in these 4 schools that fulfilled inclusion criteria were included in the study.

### 2.4 Data Collection Instrument and Procedure

Data were collected by 4 BSc nurses on a face-to-face interview using a pre-tested questionnaire. Two-days training was given to the data collectors by an ophthalmologist and investigators on trachoma grading and data collection. Clinical evaluation for trachoma eye infection was done according to the simplified WHO trachoma grading scheme with adequate light in the respective class rooms of students. All the students were subjected for eye examination of TF, TI, corneal opacity (CO), and trichiasis of both right and left eyes. The children were also assessed for facial uncleanness, which was defined by the presence of ocular discharge, nasal discharge and/or flies on the face.

### 2.5 Environmental Variables

Schools were visited three times to cover maximum number of enrolled students. Both positive and negative results were documented

in the questionnaire and confusing cases were confirmed by senior ophthalmologist. All the children with active trachoma eye infection were treated with two tube of tetracycline eye ointment in their respective schools and community according to WHO recommendations.

### 2.6 Data Quality Control

The data collection tool was prepared in English and translated into Afan Oromo and Amharic (the local languages of the students). Two days training was given to data collectors and supervisors. Before the actual data collection, inter-observer agreement exercise involving a reference grader of proven accuracy was conducted in one school other than the selected urban schools, according to WHO criteria [15,16]. Trained data collectors and ophthalmologist with experience on trachoma assessment have examined the upper tarsal conjunctiva for clinical signs of trachoma according to simplified WHO criteria [15]. The presence or absence of TF and TI was documented. The inter-observer agreement between the ophthalmologist and data collectors was good, with weighted Kappa value of 0.64 (95% CI 0.57–0.79) for TF and 0.57 (95% CI 0.47-0.62) for TI. Close supervision was undertaken during data collection by supervisors (Paediatrics nurse and ophthalmologist) and investigators daily until the end of data collection. Every evening the questionnaires were checked by supervisors and investigators for completeness of the data to back trace if any missing variables were detected. Double entry was made on Epi Data Version 3.1 to minimize data entry errors.

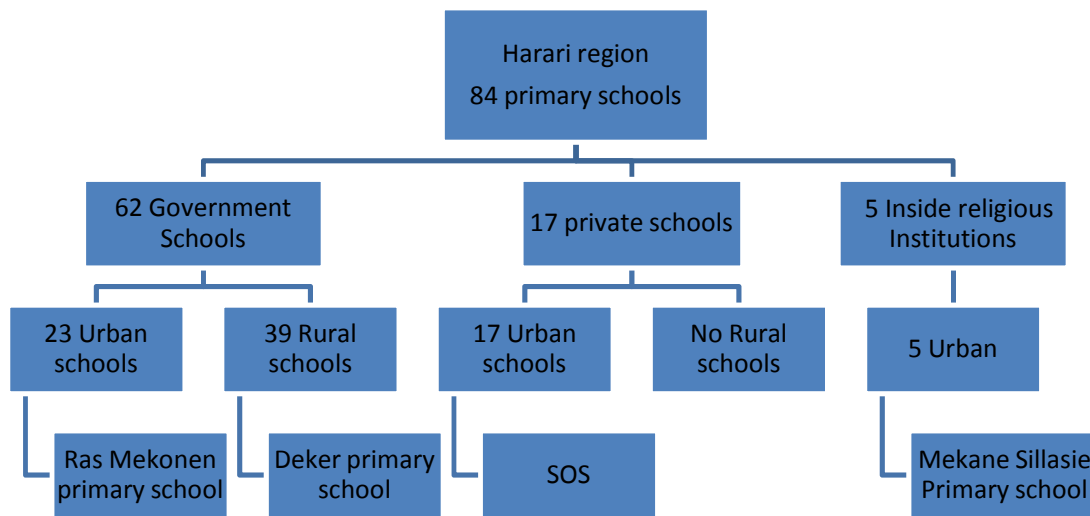


Fig. 1. School enrolment sampling

## 2.7 Data Processing and Analysis

Data were coded, cross-checked and entered to EPI Data Version 3.1 and then exported to SPSS Version 16 for analysis. Both descriptive and analytical statistical analyses were performed. Multiple logistic regressions (Bivariate and multi-variate analyses) was done to control for confounders, and odds ratios and corresponding confidence intervals were used to report the association between dependent and independent variables. By bi-variate analyses, a p-value of  $\leq 0.05$  was considered for multivariate analyses. By multi-variate analyses, the variables which had independent association with active trachoma were identified on the basis of Odds Ratio, with 95 % CI and *p* value less than 0.05. Frequencies, percentages and mean were used to describe the results.

## 2.8 Ethical Considerations

Ethical clearance was obtained from Haramaya University College of Health and Medical Sciences Institutional Health Research Ethics Review Committee (IHRERC) and submitted to Harari Region Educational Bureau, and the selected schools (school principals were consented). Letters of cooperation were written from Harari Region Education Bureau to the respective schools. Parents, students, and their class room teachers were informed about the objectives, risks, and benefits of the study and after participants' information sheet had been read in their respective schools, written and signed consents were obtained from parents. Confidentiality of students' personal information and privacy were strictly maintained throughout the study. After the data collection, information on the causes, clinical features, complications, treatments, and prevention of eye trachoma was given to all the students and teachers.

## 3. RESULTS

### 3.1 Socio-demographic Characteristics of the Students

A total of 1723 students, 804 male and 918 female, were participated in the study: 656 (38.1%), from Ras Mekonin school, 244 (14.2%) from Mekane Silassie, 393 (22.8%) from Deker, and 430 (24.9%) from SOS. The response rate was about 94%. Their mean age was 11.5 years (ranging from 6 to 18 years with SD  $\pm$  2.52), and 430 (25%) were below 9 years, 1221(70.9%) were between 9 and 15 years, and 71 (4.1%) above 15 years. The average reported monthly

income of the families was 2,317 Ethiopian Birr (103.9 USD). The mean and the median family size was 5.6 and 5, respectively, with 42.9% of the households having more than 5 household members. Oromo (36%) and Amhara (35.8%) were the larger ethnic groups (Table 1).

### 3.2 Household Environment

Most of the households, 1537 (89.26%), got water from pipe to their yard, but 689 (40%) of the households said that the quantity of the supply was not enough. Most of them, 1534 (88.2%), collected solid waste in temporary storage bins and disposed it in nearby receptacles which was emptied by city municipality. See Table 2.

### 3.3 Knowledge about Trachoma Eye Infection

About 1693 (98.3%) students and 1636 (95%) parents understood trachoma as a blinding disease, and 1020(59.2%) students knew that washing face prevents trachoma eye infection. During the survey, 1589 (92.3%) of the students were with clean face, no discharge and flies on their eyes.

### 3.4 Prevalence of Active Trachoma Eye Infection

The overall prevalence of active trachoma among the primary school children in Harari Region was 1.3% (22/1722). From the 22 cases, 14 had Trachoma Follicular (TF) and 8 had both Trachoma Follicular (TF) and Trachoma Intense (TI), and 13(59.1%) were in age group of 10-18 years. The disease was more in SOS (11/22) and Deker (8/22) schools.

### 3.5 Factors Associated with Trachoma

The factors which were associated with trachoma eye infection were unclean face (AOR 3.4, CI 1.01-11.42, no maternal education (AOR 4.324, 95% CI 1.189 to 15.729), maternal education lower than primary school (AOR 8.583, 95% CI 1.046 to 70.439), family size of  $>5$  (AOR 7.069, 95% CI 2.248 to 22.228), families' monthly income of less than 1000 Ethiopian Birr (AOR 5.71, 95% CI 1.643 to 19.823) and of 1001-5000 Ethiopian Birr (AOR 3.382, 95% CI 1.003 to 11.398), and solid waste collected by municipality (AOR 12.672, 95% CI 1.289 to 124.57).

**Table 1. Socio-demographic characteristics of parents of grade 1-8 students, Harari regional state, Ethiopia, 2015/16**

<b>Variables</b>	<b>Frequency (n=1722)</b>	<b>Percentage</b>
<b>Ethnicity</b>		
Oromo	621	36.06
Amhara	611	35.5
Tigray	113	6.6
Gurage	201	11.67
Somale	15	0.87
Harari	66	3.83
Others	95	5.5
<b>Maternal education</b>		
No education	537	31.18
Primary education (grade 1-8)	370	21.49
Secondary education and above	815	47.33
<b>Paternal education</b>		
No education	357	20.73
Primary education (1-8)	290	16.84
Secondary education and above	1,075	62.43
<b>Maternal occupation</b>		
House Wife	349	20.27
Civil servant	402	23.35
Merchant/Non-governmental Organization	486	28.22
Daily Labourers	138	8.01
Others	347	20.15
<b>Paternal occupation</b>		
Unemployed	33	1.92
Civil servant	482	27.99
Merchant/Non-governmental Organization	467	27.12
Daily Labourers	153	8.88
Others	587	34.09

**Table 2. Household environment among grade 1-8 students, Harari regional state, Ethiopia, 2015/16**

<b>Characteristics</b>	<b>Frequency (n=1722)</b>	<b>Percentage</b>	
Source of drinking water	Piped to the yard	1537	89.26
	Public tap	114	6.62
	Protected well	60	3.48
	Surface water	6	0.35
	Unprotected spring	5	0.29
Household solid waste disposal	Collected by the Municipality	1527	88.68
	Garbage pit	186	10.8
	Burn	9	0.52
Adequacy of water for daily consumption	Yes	1033	60
	No	689	40
Kitchen status	Separate from main house	943	54.76
	Attached to main house	561	32.58
	No kitchen	218	12.66

**Table 3. Factors associated with active trachoma eye infection among grade 1-8 students, Harari regional state, Ethiopia, 2015/16**

Characteristics		Trachoma		COR	AOR
		Yes	No	(95% CI)	(95% CI)
Cleanliness of child's face	Yes	16	1573	1	1
	No	6	127	3.986(1.536-10.34)*	3.4 (CI 1.01-11.42)*
Residence	Urban	11	1318	1.921(0.8-4.612)	2.724(0.615-12.061)
	Rural	11	382	1	1
Maternal education	No education	5	532	0.467(0.17-1.282)	4.324(1.189-15.729)*
	Primary	1	369	0.135(0.018-1.019)	8.583(1.046-70.439)*
	Secondary +	16	799	1	1
Family size	Less or equal to 5	4	977	1	1
	Greater than 5	18	723	6.089(2.089-18.069)*	7.069(2.248-22.228)*
Age category	Less than 9 years	9	419	0.469(0.199-1.105)	0.604(0.224-1.631)
	9-18 years	13	1281	1	1
Family monthly income	Less or to 1000	9	970	0.247(0.081-0.747)	5.71(1.643-19.823)*
	1001-5000	8	613	0.347(0.112-1.078)	3.382(1.003-11.398)*
	5001 +	5	117	1	1
Solid Waste disposal/Management	Collected by municipality	17	1448	1.331(0.386-4.583)	12.672(1.289-124.57)*
	Pit in the compound	3	192	10.647(1.261-89.875)	9.141(0.73-114.509)
	Burn	2	60	1	1
Kitchen status	Attached to main house	15	893	0.502(0.204-1.238)	0.518(0.198-1.352)
	Separately constructed	7	807	1	1

Significant at P-value of 0.05

Active trachoma eye infection was slightly higher among male cases (12/22) than female ones (10/22) cases), but gender showed no statistical difference ( $P=0.337$ ). Students from Grade one were more affected (6/22) than those from other classes ( $P=0.035$ , COR 5.675, CI 1.128-28.548). See Table 3.

#### 4. DISCUSSION

The prevalence of active trachoma eye infection in this study (1.3%) was lower than the one found by a longitudinal study conducted in rural Ethiopian schools, in which 15% of the students had the disease before intervention and 6.7% after intervention ( $p<0.001$ ) [14]. This finding is comparable with 0.2% to 2.2% prevalence in Lao People's Democratic Republic [17]. It was lower than the prevalence of 22.16% in Shandong Province in China [18], 5% prevalence in Brazil and Australian studies [19,20]. This difference might be due to the fact that most of our study subjects were from urban areas.

Like similar studies in Gamo Gofa (AOR =2.4 95% CI: 1.5, 3.9) of [21], Nigeria (OR 4.14; CI 2.72-6.29) [22], Gambia ( $P < 0.01$ , OR = 9.23, 95% CI 1.97-43.23) [23] and Burkina Faso (AOR 2.45, 95% CI 1.85-3.25) [24], in this study unclean face during data collection period and active trachoma were significantly associated. The students with unclean face were 3.4 times more likely to develop active trachoma than those with clean face (AOR 3.4, 95% CI 1.01-11.42,  $P=0.001$ ). This finding was in line with the one in Dera woreda, in which children with unclean face were 4.68 times more likely to develop active trachoma (AOR=4.68, 95% CI 2.24-9.81) [25].

In this study, like the ones in Ankober and Enemor districts [8,9,26] in Ethiopia, Tanzania and Gambia, no or only primary school maternal education was associated with trachoma eye infection. Moreover, small monthly income was associated with active trachoma infection in this study. This is similar with study findings in Baso Liben District, Ethiopia [5] and Sao Polo, Brazil [27]. This may be due to children's wellbeing is highly associated with maternal education and wealth status. As the mother is better off, the possibility of getting good nutrition, proper hygiene and health care seeking for trachoma eye infection would be high.

Family size of  $>5$  had association with trachoma eye infection (AOR 4.88, CI 1.62-14.73). This is

similar with a study report from Gonji Kolella District, Ethiopia (AOR = 14.32, 95 % CI = 6.108-33.601) [28].

#### 5. CONCLUSIONS AND RECOMMENDATION

The study found that the overall prevalence of trachoma eye infection among primary school children in Harari Regional State was 1.3% (22/1722). Both Trachoma Follicular and Trachoma Intense are less prevalent. But, further investigation is needed at community level especially in the rural areas to classify Harari region according to WHO criteria.

#### CONSENT

As per international standard or university standard, patient's written consent has been collected and preserved by the authors.

#### ETHICAL APPROVAL

As per international standard or university standard, written approval of Ethics committee has been collected and preserved by the authors.

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#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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