

Research Article

Prevalence of Trachoma and Associated Factors among Children Aged 1–9 Years in Kombolcha District, East Hararge, Oromiya Regional State, Ethiopia, 2021

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Abstract

Introduction: Trachoma, caused by the bacterium *Chlamydia trachomatis*, remains a significant public health concern and the leading infectious cause of blindness worldwide. In 2021, trachoma was endemic in 42 countries, primarily located in Africa, and accounted for 80% of the global burden of blindness due to an infectious disease. Despite the availability of effective prevention strategies and treatment, trachoma continues to be a major issue in certain regions, including Ethiopia. **Objectives:** This study aimed to assess the prevalence and identify factors associated with trachoma among children aged 1-9 years in rural communities of the Kombolcha district, East Hararge zone, Oromia Regional State, Ethiopia. **Methods:** A cross-sectional study design was employed, involving children aged 1-9 years in rural communities. A multistage random sampling method was utilized to select 622 study participants. Data were collected through face-to-face interviews using a structured questionnaire, which was pretested on 5% of the sample size. After data cleaning and entry into Epi Info version 7.1, data were exported to SPSS version 23 for analysis. Variables with a p-value < 0.20 in bivariate binary logistic regression were included in a multivariate binary logistic regression model to identify factors associated with trachoma. Adjusted odds ratios (AORs) with 95% confidence intervals (CIs) were calculated to evaluate the strength of associations at a p-value < 0.05. **Results:** The overall prevalence of active trachoma among children aged 1-9 years was 7.55%. Of the affected children, 83% exhibited trachomatous inflammation follicular (TF), 11% had trachomatous inflammation intense (TI), and 6% had both TF and TI. The prevalence ranged from 2.7% in children aged 1-4 years to 10.4% in children aged 5-9 years. In the multivariate analysis, factors significantly associated with the presence of active trachoma in the study population included: * Households with unprotected water sources (AOR = 0.32, 95% CI: 0.15-0.67) * Regular towel usage (AOR = 8.03, 95% CI: 2.18-29.6) * Not using soap to wash the face (AOR = 4.53, 95% CI: 2.13-9.63) * Family history of eye problems (AOR = 4.76, 95% CI: 2.19-10.35) **Conclusion and Recommendation:** The overall prevalence of active trachoma in the study area was 7.55%. While this prevalence is below the WHO threshold for mass drug administration (MDA) (>10%), it remains a significant public health concern. The findings highlight the need to implement the WHO-endorsed SAFE strategy, which focuses on surgery, antibiotics, facial cleanliness, and environmental improvement, to effectively prevent and control trachoma. Additionally, improving the overall living conditions of the community through coordinated efforts is essential in addressing the factors associated with the disease.

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Keywords

Associated Factor, Children Aged 1-9 Years, Kombolcha District, Prevalence, Trachoma

1. Introduction

Trachoma, a neglected tropical disease, is the world's leading infectious cause of blindness [1]. It is among the oldest diseases known to mankind [2]. Children generally have the highest prevalence of trachoma and are believed to be the main reservoirs of infection [3].

Based on reporting by the World Health Organization (WHO) in February 2018, trachoma remains endemic in 42 countries in which approximately 1.9 million people have visual impairment due to trachoma [4]. Globally, 200 million people are still at risk of trachoma, and 3.2 million people need surgery to avoid blindness because of trachoma [5]. In 2013 World Health Organization (WHO) estimated that 84 million people worldwide are affected by this disease, eight million of the people were suffer from visual impairment [6].

The primary trachoma-endemic countries were Africa, Asia, and Latin America. From Latin America, the disease was endemic in Brazil, Columbia, Guatemala, and Chiapas, Mexico [7]; whereas it is endemic in China, India, Myanmar, and Pakistan from Asia and in Ethiopia, Nigeria, Mali, and Sudan from Africa [8]. China, Sudan, and Ethiopia bear at least 50% of the burden of trachoma prevalence worldwide. Concerning to Africa, the overall trachoma prevalence in Algerian school health was 26% whereas the national prevalence in Burkina Faso was 26.9% (TF). In Ghana the overall prevalence and prevalence among children less than 10 years was 29.7% and 16.1% (TF/TI) respectively [9].

National prevalence of blindness in Ethiopia were estimated to be 1.25% [10]. More than 70% of blindness in Ethiopia is caused by trachoma and cataract. The prevalence of active trachoma was 45%, trachomatous conjunctival scar 80%, trachomatous trichiasis 3%, and corneal opacity 0.4% [11]. Over 693,000 people urgently need eyelid surgery to prevent blindness [12].

In Oromia region, trachoma is a public health problem, with both active and blinding trachoma prevalent in 218 districts. A study found that the prevalence of active trachoma among children aged 1-9 years was 25.2% [13].

The major cause of trachoma in many under privileged communities of developing countries were poor hygiene and inadequate sanitation; mainly due to lack of water, living with a trachoma case, overcrowded living conditions, practice of open defecation and poverty [14]. Similarly young age, infrequent face washing habit, not using soap during washing, poor practice of waste disposal and parent literacy were among the risk factors [15].

These inadequate hygiene and sanitation service provision

forced the WHO to recommends the new SAFE strategy as a way to eliminate blindness caused by trachoma until 2020 [16]. WHO in cooperation with other various NGO and national health services, through the Global Alliance for the Elimination of Trachoma by 2020, recommended that any individual with TT should be offered surgery [17, 18]. Mass drug administration to the entire community were also recommended on a regional or district basis when prevalence exceeds 5% in children aged 1-9 [19].

Infectious diseases have been the most important contributor to human morbidity and mortality until relatively recent times and still accounts for a large proportion of death and disability worldwide. In certain regions infectious diseases remains the most important cause of ill health and have been responsible for 22% of all deaths and 27% of disability-adjusted life years worldwide [11]. They have imposed a burden on the young, notably on children under 5 years. Eye problems are recognized as among one of the major public health challenges in many developing countries [21].

Trachoma is the leading infectious cause of blindness, and is caused by conjunctiva infection with the bacterium *Chlamydia trachomatis*. Early infection manifests as redness and irritation, with follicles on the tarsal conjunctiva; this may meet the definition of trachomatous inflammation-follicular (TF) of the WHO simplified trachoma grading system. Repeated infections may result in scarring of the conjunctivae and alteration in eyelid morphology and function such that in-turning of the eyelashes ensues; this condition is known as trachomatous trichiasis (TT). The in-turned eyelashes rub on the cornea and cause devastating pain at each [22].

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 [23]. The disease can be transmitted by the discharge from infected eyes of individuals and transferred by fingers, eye-seeking flies or by clothes to the eyes of non-infected ones. Trachoma is prevalent in areas where personal and community hygiene is poor, and it mainly affects deprived and marginalized classes of a community [24]. Ethiopia is one of the most severely affected trachoma endemic countries in the world with the highest prevalence in Amhara, Oromia and Southern Nations, Nationalities, and Peoples (SNNPR) regions [25]. According to the 2016 Global Health Observatory, there are more than 75 million people living in trachoma-endemic areas in Ethiopia, the largest number of any

country in the world.

Despite the efforts of multiple agencies to eliminate blindness caused by trachoma, using a series of prevention measures, prevalence of trachoma were still remains high in Ethiopia [20] in general and study area in particular. Therefore, Prevalence of trachoma and associated factors among children aged 1–9 years in rural communities of Kombolcha district, East Hararge, Oromia regional state, Ethiopia, 2020.

2. Methods and Materials

2.1. Study Design and Period

Community based cross sectional study design was employed, from October, 2021 to December, 2021.

2.2. Study Area

The study was conducted in Kombolcha district, located in the East Hararge Zone of eastern Ethiopia. The district is approximately 567 km from Addis Ababa, the capital of Ethiopia.

According to the 2007 population projection, the district had an estimated population of 201,376 in 2020, with 97,667 males and 103,709 females. Approximately 90% of the population resides in rural areas. The majority of the population (92.5%) speaks Afaan Oromo as their first language.

The district has a relatively high potential health service coverage, with 89% of the population having access to healthcare facilities. These facilities include:

1. 5 public health centers
2. 21 health posts
3. 28 private clinics

The study area was selected because:

1. No similar studies had been conducted in the district previously.
2. The community setting allowed for efficient data collection from children in the specified age group.
3. The majority of the population relies on government-owned health facilities for healthcare, making it easier to access participants.

The study provides valuable insights into the prevalence and risk factors of trachoma in a rural community in Ethiopia. The findings can inform public health interventions and contribute to the national goal of eliminating trachoma as a public health problem.

2.3. Source and Study Population

2.3.1. Source Population

The source population for this study consisted of all children aged one to nine years residing in rural communities of Kombolcha district.

2.3.2. Study Population

The study included children between the ages of one to nine years who were living in households selected through a systematic sampling technique. This sampling method involves selecting a random starting point and then selecting every k th household from a list of all households in the study area.

Households were selected from randomly selected rural kebeles within Kombolcha district. Kebeles are the smallest administrative units in Ethiopia, typically consisting of several villages or neighborhoods. By selecting households from randomly selected kebeles, the researchers aimed to obtain a representative sample of the district's rural population.

Inclusion criteria: The study population included all children aged 1-9 years living in the rural community of Kombolcha district in 2021. This age range was selected because trachoma is most prevalent among children, and the study aimed to assess the prevalence and risk factors of trachoma in this population.

Children were eligible for inclusion in the study if they:

1. Were between the ages of 1 and 9 years
2. Lived in the rural community of Kombolcha district
3. Were present in their household at the time of the survey

Exclusion: - In addition to the exclusion criteria previously mentioned, children who were unable to undergo physical examination due to serious medical illness during the study period were also excluded from the study. This exclusion criterion was implemented to ensure the accuracy and reliability of the data collected.

2.4. Sample Size and Sampling Procedures

2.4.1. Sample Size Determination

Based on the information provided, it appears that the sample size for the study was calculated using the single population proportion formula for the first objective and the double population proportion formula for the second objective. The prevalence of trachoma among children aged 1-9 years old was reported to be 25.2%, based on a similar study conducted in Kersa District, Jimma Zone, Southwest Ethiopia in 2013 [26].

For the first objective, which involved calculating the prevalence of trachoma with a margin of error of 5% and a 95% confidence interval, the single population proportion formula was used. A design effect of 1.5 and a 10% non-response rate were considered in the calculation. The sample size calculated using this formula was 622 children.

The double population proportion formula was used for the second objective, which involved comparing the prevalence of trachoma between two groups. The prevalence of trachoma in the comparison group was assumed to be 15%, based on a previous study. A power of 80% and a significance level of 0.05 were used in the calculation. The sample size calculated using this formula was larger than the sample size calculated for the first objective.

It is important to note that the largest sample size calculated between the two objectives was selected to ensure adequate power and precision in the study results. In this case, the sample size calculated for the second objective was likely larger than the sample size calculated for the first objective, leading to the selection of 622 children as the final sample size for the study.

The sample size of 622 children was calculated using appropriate statistical formulas and assumptions. This sample size is sufficient to achieve the study's objectives with the desired level of precision and power.

Objective 1: The sample size for objective one was calculated using single population proportion formula, by taking the following assumption. Study conducted in Kersa District, Jimma Zone, Southwest Ethiopia in 2013 revealed that Prevalence of trachoma among children aged 1-9 years old, were 25.2 [26].

$$n = \frac{Z_{\alpha/2}^2 \times p(1-p)}{d^2}$$

Were,

n= the required sample size

P = 25.2% (Prevalence of trachoma taken from previous study)

$Z_{\alpha/2}$ = 95% (1.96) (Confidence level)

d = 5% (0.05) desired precision or margin of sampling error

$$n = \frac{Z_{\alpha/2}^2 \times P(1-P)}{d^2} = \frac{1.96^2 \times 0.252(1-0.252)}{0.05^2} = 294$$

Non-Response Rate (NRR) = 10%.

By taking 10% non-response rate and design effect 1.5, the total sample size was $(294+29) \times 1.5 = 484$. Sample respondents will be drawn from four rural kebeles randomly selected from 19 rural kebeles of the study district that is why design effect will be used.

Objective 2: Sample size is determined based on factors associated with Trachoma among children of rural community using double population proportion formula at 95% CI with $Z = 1.96$, 80% power of the study, 1:2 ratio, two population proportion formula used and calculate by Epi Info version 7 Stat Calculator computer software program used, which gives as 622.

Table 1. Sample size calculated for the prevalence of trachoma and Associated factors.

Factors considered	Proportion –value	Sample	OR	Calculated sample size	Reference
Unclean face	% of cases in children who have no unclean face =42%.	224	2.4	338	(27)
	% of cases in children who have unclean face =58%.				
Not have functional latrine	% of cases in children, HH who have not functional latrine=40%.	26	4.39	214	(28)
	% of cases in children, HH who have functional latrine =9.2%.				
Waste around house	% of cases where no waste around house =53.8%.	374	1.68	622	(6)
	% of case where have waste around house=68.5%.				

2.4.2. Sampling Procedure

The use of a multi-stage sampling technique in selecting children aged 1-9 years old for the study helps ensure a representative sample from the population of interest.

In the first stage, Kombolcha district was selected purposively due to its proximity to the researchers and its potential for trachoma cases. This initial selection helps focus the study on an area where trachoma prevalence may be higher, increasing the likelihood of capturing relevant data.

In the second stage, five kebeles were selected from the 19 rural kebeles of Kombolcha district using a lottery method of simple random sampling. This random selection of kebeles helps reduce bias and ensures that a variety of areas within the district are represented in the study.

In the third stage, households with children aged 1-9 years old were selected through a systematic sampling method using proportional to their size. This method helps ensure that households are selected in a structured and representative way based on their size and distribution within the selected kebeles.

If more than one child aged 1-9 years old was present in a selected household, one child was chosen through a lottery method of simple random sampling. This approach helps ensure fairness in selecting individual children within households and avoids potential biases.

Overall, the use of a multi-stage sampling technique with careful consideration of different levels of selection helps enhance the representativeness and validity of the study findings related to trachoma prevalence among children aged 1-9 years old in Kombolcha district.

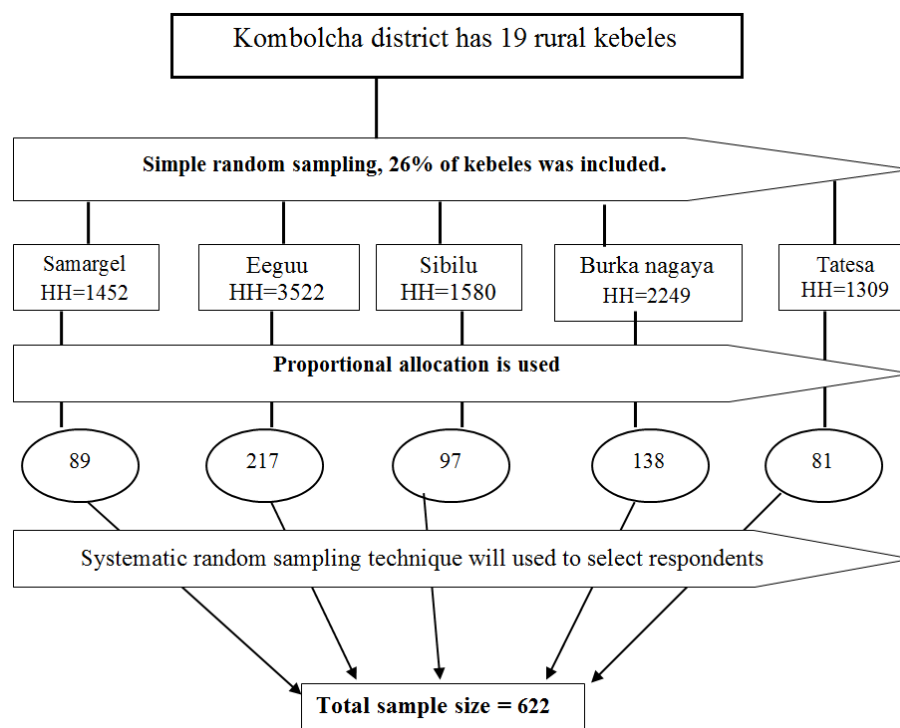


Figure 1. Schematic representation of the sampling method to assess prevalence of trachoma and associated factors among children aged 1–9 years in rural communities of komolcha district.

2.5. Variables of the Study

2.5.1. Dependent Variable

Active Trachoma.

2.5.2. Independent Variables

The socio-demographic characteristics of the respondents and their families play a crucial role in understanding the context and potential risk factors associated with trachoma prevalence among children aged 1-9 years old. These characteristics provide valuable insights into the social, economic, and environmental factors that may influence the occurrence of trachoma in the study population.

1. Family Background:

- 1) Educational Status: The educational level of parents or caregivers in the household can impact knowledge and practices related to hygiene and sanitation, including facial cleanliness.
- 2) Religious Affiliation: Religious beliefs and practices may influence behaviors related to hygiene and health-seeking behaviors.
- 3) Occupation: The type of occupation of family members can affect access to resources, healthcare services, and living conditions that may contribute to trachoma risk.
- 4) Eye Problems: Prevalence of eye problems within the family may indicate genetic predisposition or environmental factors contributing to eye health.

- 5) Marital Status: Family structure and dynamics, such as single-parent households or extended families, can influence caregiving practices and access to resources.

2. Child's Personal Factors:

- 1) Face Washing Frequency: Regular face washing is a key preventive measure against trachoma infection.
- 2) Use of Soap to Wash Face: Proper hygiene practices, including the use of soap, can reduce the transmission of trachoma.
- 3) Facial Cleanliness: The cleanliness of the child's face is directly related to trachoma prevention and control.
- 4) Education Level: The educational level of the child may influence their understanding of hygiene practices and disease prevention.
- 5) Cattle Ownership: Livestock ownership can impact environmental hygiene and sanitation practices within the household.

3. Household Environmental Factors:

- 1) Latrine Availability: Access to sanitation facilities is crucial for maintaining good hygiene and preventing trachoma transmission.
- 2) Latrine Distance from House: Proximity of latrines to living areas can affect hygiene practices and exposure to fecal contamination.
- 3) Housing Condition: Overcrowding, poor ventilation, and inadequate housing conditions can contribute to the spread of infectious diseases.
- 4) Availability of Waste Disposal Site: Proper waste

management is essential for preventing environmental contamination and disease transmission.

- 5) Availability of Water Source: Access to clean water for hygiene practices, such as face washing, is critical for trachoma prevention.

By examining these socio-demographic characteristics and environmental factors, researchers can identify potential risk factors for trachoma transmission and develop targeted interventions to reduce its prevalence among children in the study population.

2.6. Operational Definitions

Active trachoma: TF has been suggested by WHO as the key indicator for assessing the public health importance of active trachoma. Hence, it was defined as the presence of at least five or more follicles in the upper tarsal conjunctiva each at least 0.5 mm in size [29].

Clean face: a child who did not have an eye discharge or nasal discharge and fly on the face at the time of visit.

Corneal opacity (CO): Easily visible corneal opacity over the pupil.

Liquid waste around the house: Domestic waste waters come from a day-to-day living (generated from food preparation, washing, bathing and toilet usage).

Proper liquid waste disposal: Collecting the waste liquid into a closed place and dispersing it at the front of the main door of the house on a wide area at the night since the housefly is inactive at the night time.

Trachomatous conjunctival scar (TS): The presence of scarring in the tarsal conjunctiva [29].

Trachomatous inflammation-intense (TI): Pronounced inflammatory thickening of the tarsal conjunctiva that obscures more than half of the deep normal vessels [29].

Trachoma negative (TN): Children that do not have signs of active trachoma like a trachomatous conjunctival scar (TS), trachomatous trichiasis (TT) Trachomatous inflammation-intense (TI), Trachomatous inflammation-follicular (TF) and corneal opacity (CO).

Trachomatous trichiasis (TT): At least one lash rubs on the eyeball.

Unclean face: Having any discharge on eyes, nose and/or fly on the face at the time of visit.

Free from Trachoma – children that did not have signs or symptoms of active trachoma.

SAFE - a strategy developed to eliminate blindness caused by Trachoma through doing surgery, antibiotic treatment, facial cleanliness and improving the environment.

2.7. Data Collection Procedures (Instruments, Personnel, Measurements)

The data collection process for the study on trachoma prevalence among children aged 1-9 years involves a comprehensive approach that includes both questionnaire-based

interviews and clinical examinations. Here's a summary of the key components of the data collection process:

1. Data Collection Team:

Trained Ophthalmic Nurses and IECW: The data collection team consists of trained ophthalmic nurses and IECW (Information, Education, and Communication Workers) who are responsible for conducting face-to-face interviews with mothers or caregivers, as well as direct observations to assess socio-demographic characteristics, hygiene, and sanitation practices.

2. Interview Process:

Face-to-Face Interviews: The mothers or caregivers of children aged 1-9 years are interviewed using a structured and pretested questionnaire to gather information on socio-demographic characteristics, hygiene, and sanitation practices within the household.

3. Clinical Examination for Trachoma Status:

- 1) **Trained Data Collectors:** Trained data collectors, including BSC nurses and licensed ophthalmic nurses, conduct clinical examinations to assess the trachoma status of the children.

- 2) **Examination Procedure:** Using a binocular loupe and a hand flashlight, each eye of the children is examined separately in daylight conditions. The WHO simplified grading scheme is used to assess signs of trachoma.

- 3) **Hand Hygiene:** The examiners maintain hand hygiene by cleaning their hands with a disinfectant solution (alcohol) between each examination to minimize the risk of cross-infection.

4. Supervision and Expert Involvement:

- 1) **Ophthalmologists' Supervision:** The clinical examinations for trachoma are conducted under the supervision of ophthalmologists who have extensive experience in grading trachoma using the WHO grading scheme.

- 2) **Involvement of Health Workers:** Eight health workers, including five BSC nurses, two IECW, and one licensed ophthalmic nurse, are involved in the data collection process under the supervision of the investigator.

Overall, the data collection process integrates both qualitative and quantitative methods, ensuring a comprehensive assessment of socio-demographic characteristics, hygiene and sanitation practices, as well as accurate clinical examination for trachoma status among children. The involvement of trained professionals and expert supervision enhances the reliability and validity of the collected data.

2.8. Data Quality Assurance

The pretest conducted on 31 children from a rural community in a Kebele with similar socio-demographic characteristics as the selected Kebeles is a valuable step to assess the feasibility and appropriateness of the study tools and

procedures. Based on the pretest results, necessary revisions can be made to ensure the effectiveness and relevance of the data collection process.

The comprehensive training provided to the data collectors on various aspects, including study tools, objectives, respondent rights, confidentiality, and interview techniques, demonstrates a commitment to ensuring ethical and professional conduct during data collection. Additionally, the close supervision of the data collection process through daily checks of questionnaires further emphasizes the importance of data quality and accuracy.

The specialized training on eye examination, grading, and reporting provided to the data collectors by ophthalmic nurses from the Woreda's Health Center is crucial for ensuring standardized and accurate clinical assessments of trachoma status among the selected study children. The immediate deployment of trained health professionals to the sampled rural Kebeles for eye examinations reflects a proactive approach to initiating data collection promptly following the completion of training.

Overall, the emphasis on pretesting, thorough training, and close supervision highlights a robust and meticulous approach to data collection, which is essential for obtaining reliable and valid results for the study on trachoma prevalence among children aged 1-9 years.

2.9. Data Processing and Analysis

The systematic approach to data management and analysis outlined in your description is commendable. By checking the data for completeness, consistency, and missed values, you are ensuring the quality and integrity of the dataset before proceeding with analysis.

Utilizing Epi Info version 7.1 for data entry and SPSS version 23 for analysis is a common and reliable choice of software tools for epidemiological studies.

The use of descriptive statistics such as median, frequencies, and percentages will provide a clear summary of the data, allowing for a better understanding of the characteristics of the study population.

The decision to conduct binary logistic regression to identify candidate variables for the final model is appropriate for assessing the factors associated with trachoma prevalence. By setting a threshold of $P < 0.20$ in the bivariate analysis to determine which variables to include in the multivariate model, you are following a systematic approach to variable selection.

Using the stepwise method for variable selection in the multivariate binary logistic regression model helps in identifying the most significant predictors of trachoma prevalence while controlling for potential confounding factors. The reporting of adjusted odds ratios with corresponding confidence intervals at a significance level of $P < 0.05$ provides a robust measure of the strength and direction of associations between predictor variables and the outcome.

Overall, your planned data analysis strategy demonstrates a rigorous and methodical approach to investigating the factors associated with trachoma prevalence among children aged 1-9 years in the selected rural communities.

2.10. Ethical Considerations

It is commendable that you have obtained ethical clearance for your study and have put in place measures to ensure the protection of human subjects. The formal consent from Arsi University College of Health Sciences Department of Public Health and the official letter of cooperation from the concerned bodies of Kombolcha district administration offices and health office demonstrate a commitment to ethical research practices.

The explanation provided to the respondents about the purpose of the study, its procedures, and their right to refuse participation or withdraw at any time, along with obtaining verbal consent, shows a respectful and transparent approach to engaging with the study population. Additionally, assuring confidentiality and collecting data anonymously are important steps in protecting the privacy and rights of the participants.

It is also noteworthy that you have planned for the referral of respondents with trachoma positive findings to nearby health facilities for further investigation and treatment. This demonstrates a commitment to the well-being of the participants and reflects a responsible approach to addressing potential health concerns identified during the study.

Overall, your attention to ethical considerations in the planning and conduct of your research is vital for ensuring the integrity and credibility of your study.

3. Result

3.1. Socio Demographic Characteristics of the Respondents

A total of 622 children between the ages of 1 and 9 participated in the study, with a 100% response rate. Of these children, 44.2% (275) were male, and 55.8% (347) were female. The average age of the participants was 5.35 years, with a standard deviation of 2.2 years. The majority of the participants (64.3% or 400 children) were 5 years of age or older, while 35.7% (222 children) were 4 years of age or younger.

Among the children aged 1-9 years in the sample, 20.1% (125 children) were enrolled in school, while 79.9% (497 children) were not.

Regarding the education level of the children's parents, 52.6% (327 mothers) were unable to read or write, while only 16.7% (104 mothers) and 1.0% (6 mothers) had attended primary and secondary school, respectively. Of the 47 children who had trachoma, 68.1% (32 children) came from families where the mothers were unable to read or write.

The majority of household heads (85.7% or 533 individuals) were farmers by occupation. There was a statistically significant difference ($p < 0.01$) between respondents whose children had trachoma and those whose children did not, with the mean family size being 5.26 (SD ± 1.69) persons.

Most of the participants (96%) identified as Muslim, and

the largest ethnic groups represented were Oromo (95.5%) and Amhara (4%). The average reported monthly income of the households was 816.2 Ethiopian Birr (ETB), and 97.9% (46 cases) of the trachoma cases were reported from households with a monthly income of 2500 ETB or less. (Table 2)

Table 2. Socio Demographic characteristics of the study participants in in Kombolcha district, Southeast Ethiopia, December, 2021 (n =622).

characteristics	Categories	Frequency (n)	Percentage (%)
Sex of the children	Male	275	44.2
	Female	347	55.8
Age of the children	1-4 year	222	35.7
	≥ 5 year	400	64.3
	Amhara	25	4.0
Ethnicity	Oromo	594	95.5
	Others#	3	0.5
Religion	Muslim	602	96.8
	Orthodox	20	3.2
Educational status of the child	Enrolled at school	125	20.1
	Not enrolled at school	497	79.9

Variables	Category	NTR	TR	χ^2
		N (%)	N (%)	
Mother's Educational level	Unable to read and write	295 (51.3%)	32 (68.1%)	0.263
	Able to read and write	175 (30.4%)	9 (19.1%)	
	Primary education.	98 (17%)	6 (12.8%)	
	Secondary education	6 (1%)	0 (0%)	
	College and above	1 (0.2%)	0 (0%)	
	Total	575 (100%)	47 (100%)	
HH's Occupation	Farmer.	494 (85.9%)	39 (83%)	0.002***
	Merchant	23 (4%)	1 (2.1%)	
	Employed	5 (0.9%)	0 (0%)	
	Daily Lobar	9 (1.6%)	5 (10.6%)	
	Both farmers & merchant	44 (7.7%)	2 (4.3%)	
	Total	575 (100%)	47 (100%)	
HH's Monthly Income (Birr)	≤ 2500	566 (98.4%)	46 (97.9%)	0.768
	> 2500	9 (1.6%)	1 (2.1%)	
	Total	575 (100%)	47 (100%)	

Source: Own survey. 2021. ***= Significant at p-value of < 0.01 , # = Gurage, Somali and Harari

3.2. Environmental Health Related Factors of Participants

The majority (54.2%) of the study participants' families had to travel less than 30 minutes to fetch water, while 9.3% had to travel 1 hour or more, among which 22.4% had children infected with trachoma.

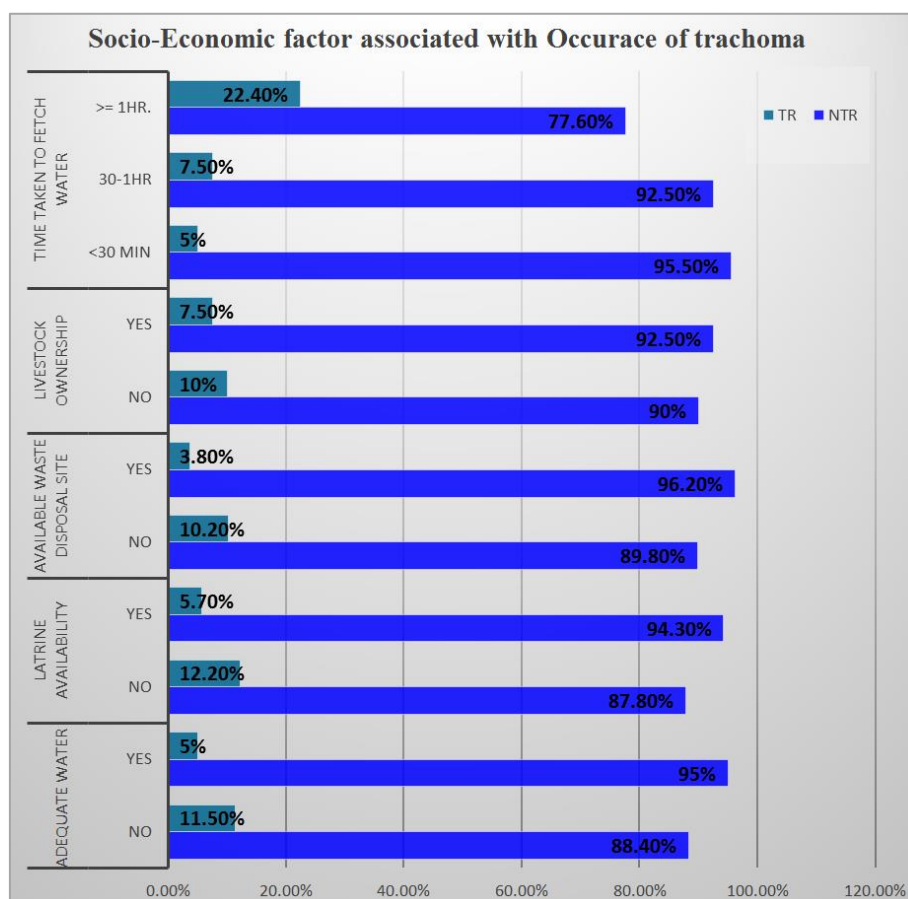


Figure 2. Socio-Economic factors associated with the occurrence of trachoma in Kombolcha district, Southeast Ethiopia, December 2021 (n =622).

Even though more than half of the participants (61.3%) had adequate water per capita per day, 38.7% who did not have adequate water and 28.9% who did not have a functional latrine accounted for 11.5% and 12.2% of trachoma cases, respectively.

On the other hand, more than half of the respondents (58%) did not have a designated pit for waste disposal (and practiced open dumping), which led to 10.2% of the children having trachoma.

There was a statistically significant difference ($p < 0.01$) between respondents with trachoma-positive children and those with trachoma-negative children in terms of adequacy of water for consumption, time taken to travel to fetch water, availability of a functional latrine, and waste disposal site. (Figure 2).

Of the 47 children with trachoma in the study area, the majority (39 or 83%) were at the stage of trachomatous follicular (TF) inflammation, while 5 (11%) were at the stage of trachomatous inflammation intense (TI), and 3 (6%) had both TF and TI. (Figure 3)

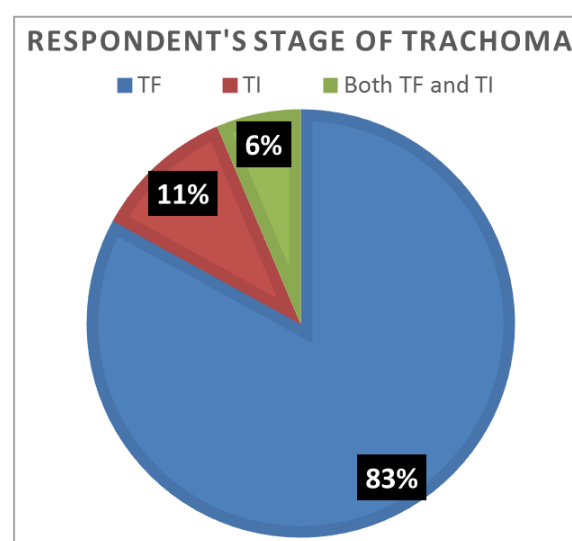


Figure 3. Respondent's Stage of trachoma in Kombolcha district, South east Ethiopia, December, 2021 (n=47).

During bivariate analysis, the following factors were significantly associated with active trachoma infection at a p-value < 0.01:

1. Using an unprotected water source
2. Sharing a common towel
3. Having an eye problem in the family

The following factors were significantly associated with active trachoma at a p-value < 0.05:

1. Child's age less than 5 years
2. Not washing face with soap

Being female was significantly associated with active trachoma at a p-value < 0.20.

Table 3. Bivariate analysis on factor associated with active trachoma among children of 1-9 years in rural communities of komolcha district, December, 2021 (n= 622).

Characteristics		NTR N. (%)	TR N. (%)	COR (95% CI)	P-Value
Child's Sex	Male	257 (93.5)	18 (6.5)	1	
	Female	318 (91.6)	29 (8.4)	1.8 (0.84 - 3.83)	0.135
Child's Age	1-4 year	216 (97.35)	6 (27)	1	
	≥ 5 years	359 (89.8)	41 (10.3)	2.6 (1.0 - 6.62)	0.049
Water source	Protected	493 (95.4)	24 (4.6)	1	
	Unprotected	82 (78.1)	23 (21.9)	2.8 (1.32 - 6.1)	0.008
Hygienic condition of the child's face	Clean	467 (95.3)	23 (4.7)	1	
	Unclean	108 (81.8)	24 (18.2)	1.55 (0.71 - 3.4)	0.28
Towel usage	Common	5 (26.3.)	14 (73.7)	1	
	None	570 (94.5)	33 (5.5)	0.12 (0.03 - 0.47)	0.002
Washing face by soap	No	144 (80.9)	34 (19.1)	1	
	Yes	431 (97.1)	13 (2.9)	0.3 (0.12 - 0.81)	0.02
Eye problem in family	Present	65 (71.4)	26 (28.6)	1	
	Absent	510 (96)	21 (4)	0.24 (0.12 - 0.53)	0.000
Family Size	≤4	358 (93.7)	24 (6.3)	1	
	≥5	217 (90.4)	23 (9.6)	1.24 (0.59-2.59)	0.56
Face Washing frequency	≤ once a day	290 (87.6)	41 (12.4)		
	≥ once a day	285 (97.9)	6 (2.1)	0.66 (0.21-2.13)	0.49

COR=Crude Odds Ratio, CIs=Confidence Interval, NTR= No trachoma, TR= Trachoma *Significant at p-value of <0.20 **= Significant at p-value of <0.05, ***= Significant at p-value of <0.01

3.3. Factors Associated with Active Trachoma

1. Water Source:

Respondents using protected water sources were 68% less likely to have trachoma infection (AOR=0.32) compared to those using unprotected water sources.

2. Toiletry Practices:

- 1) Respondents who shared towels had an eight-fold increased risk of trachoma infection (AOR=8.03)

compared to those who did not use towels.

- 2) Respondents who did not use soap to wash their faces were almost five times more likely to have trachoma infection (AOR=4.53) compared to those who used soap.

3. Household Factors:

Individuals with family members who had eye problems had almost five times higher odds of having trachoma infection (AOR=4.76) compared to those whose family members did not have eye problems. (Table 4).

Table 4. Bivariate vs multivariate analysis of independent factor associated with active trachoma among children 1-9 years in rural communities of komolcha district, December, 2021 (n=622).

Characteristics		NTR (N. (%))	TR (N. (%))	COR (95% CI)	AOR (95% CI)
Child's Sex	Male	257 (93.5)	18 (6.5)	1	0.56 (0.26-1.18)
	Female	318 (91.6)	29 (8.4)	1.8 (0.84 -3.83)	1
Child's Age	1-4 year	216 (97.35)	6 (27)	1	0.39 (0.16-1.02)
	≥ 5 years	359 (89.8)	41 (10.3)	2.6 (1.0 - 6.62)	1
Water source	Protected	493 (95.4)	24 (4.6)	1	0.32 (0.15- 0.67) **
	Unprotected	82 (78.1)	23 (21.9)	2.8 (1.32 - 6.1)	1
Towel usage	Common	5 (26.3.)	14 (73.7)	1	8.03 (2.18-29.6)**
	None	570 (94.5)	33 (5.5)	0.12 (0.03 - 0.47)	1
wash face by soap	No	144 (80.9)	34 (19.1)	1	4.53 (2.13-9.63)***
	Yes	431 (97.1)	13 (2.9)	0.3 (0.12 - 0.81)	1
Eye problem in family	Present	65 (71.4)	26 (28.6)	1	4.76 (2.19-10.35)***
	Absent	510 (96)	21 (4)	0.24 (0.12 - 0.53)	1

AOR=Adjusted Odds Ratio, CIs=Confidence Interval, in multivariate analysis. **= Significant at p-value of <0.05, ***= Significant less than <0.01

4. Discussion

Despite efforts to prevent trachoma, it remains a neglected public health concern with limited advocacy for those affected by the condition [18]. Although the SAFE strategy (Surgery for trichiasis, Antibiotics for active disease, Facial cleanliness, and Environmental improvement) has been implemented in Ethiopia to reduce disease transmission, the prevalence of trachoma remains high in the region [30]. Therefore, the main objective of this study was to assess the current prevalence of active trachoma and identify associated factors among children aged 1–9 years in rural communities of the Kombolcha district.

The study found that the prevalence of active trachoma among children aged 1–9 in the study population was 7.55%. Of this, 6.27% were TF cases, 0.8% were TI cases, and 0.48% had both TF and TI [31]. This prevalence exceeds the World Health Organization's trachoma elimination target of having a prevalence of active trachoma (grade TF) in children aged 1–9 years below 5%.

The prevalence of trachomatous trichiasis (TF) in children aged 1–9 years in this study was significantly lower than the 25% prevalence reported by the Global Trachoma Mapping Project in the Haramaya, Kurfachele, and Kombolcha districts between 2012–2014 [18]. This discrepancy may be attributed to several factors. The mass distribution of azithromycin in the woredas, along with the implementation of the F and E components of the SAFE strategy in the Kombolcha district,

could have contributed to the observed lower prevalence. Additionally, the time gap and differences in sample size between the studies may play a role.

Furthermore, the overall prevalence of active trachoma in this study was lower than that observed in other studies conducted in Ethiopia. For instance, studies in Ankober, North Shewa (53.9%), Baso Liben, West Gojjam (24.1%), Kersa, Jimma Zone (25.2%) [2], Gazegibela district, Amhara region (52.4%), Dalocha district, central Ethiopia (51.5%), Oromia regional state (23.4%), and among children in Ethiopia in general (26.9%) [18, 32, 33] reported higher prevalence rates. Similarly, the prevalence was lower compared to other African countries like Cameroon (11.2%), Malawi (13.6%), Nigeria (37.7%), and Niger (23.4%) [9, 34].

These discrepancies in active trachoma prevalence may be attributed to various factors, including differences in infrastructure, health service coverage, sanitation practices, and access to clean water. For example, studies in Ankober (24% latrine access) and Kersa (10% latrine access) reported low latrine availability, and a significant portion of households in Kersa (89%) traveled more than 30 minutes to collect water. The impact of mass drug distribution and variations in personal and environmental factors may also contribute to the observed differences in prevalence.

Conversely, this study's findings were higher than those reported in previous studies conducted in the Harari region (1.3%) and Dire Dawa (4.3%) [35], as well as other African studies in the Gambia (3.8%) and Sierra Leone (5%). The lower prevalence reported in these studies might be explained by factors such as the low prevalence of facial and personal

hygiene in Sierra Leone, the high latrine access (98%) and improved water access (93% of households travelled less than 30 minutes to collect water) observed in the Gambia [36].

In the multivariable logistic regression analysis, we observed a significant association between the presence of active trachoma and several factors. These factors include the source of drinking water, common usage of towels, existence of eye problems in the family, and parent-reported use of soap when washing the face. These risk factors for the development of trachoma align with findings from other studies conducted in different parts of the country.

For example, our study revealed that children belonging to households that used protected water sources had a 68% lower likelihood of experiencing trachoma infection compared to those who used unprotected water sources (adjusted odds ratio AOR = 0.32, 95% confidence interval CI: 0.15-0.67). Similar findings have been documented in studies conducted in the Gazegibela district (northern Ethiopia) [32] and the Madda Walabu district (southeastern Ethiopia) [37], highlighting the importance of water sources in determining the prevalence of trachoma. These findings have also been consistent in the north and south Wollo Zones of the Amhara region [38]. This indicates that water sources play a significant role in the transmission of active trachoma in the study area compared to other factors.

Furthermore, our analysis found that the odds of children having active trachoma were more than eight times higher among households that used towels compared to their counterparts. These findings are consistent with previous studies. Additionally, individuals whose family members experienced eye problems had an almost five-fold higher odds of being infected with active trachoma compared to those whose family members did not have any eye problems.

The use of soap for face washing has been identified as a crucial factor in the prevalence of active trachoma. Our analysis revealed that the odds of having trachoma among children who did not use soap when washing their faces were almost five times higher compared to those who used soap. These findings are consistent with previous studies, including the one conducted in the Wereilu district [25] and other studies [37].

Therefore, it is essential to focus on improving community hygiene practices through awareness creation activities. By promoting the use of soap during face washing, we can potentially reduce the risk of trachoma transmission.

Furthermore, our study found that the risk of trachoma increases as the distance of the water source from home exceeds half an hour. Specifically, households located more than half an hour away from a water source had an almost twice higher risk of acquiring trachoma compared to nearby houses. This highlights the importance of having easy access to water sources in preventing trachoma.

The prevalence of active trachoma in children, as indicated by our study and previous research, is higher than 20%, suggesting a significant public health problem in rural Ethiopia.

This emphasizes the need for targeted interventions to address trachoma in these areas.

Additionally, our findings showed no significant difference in the magnitude of active trachoma between males and females under the age of 10 years. This aligns with study findings from other parts of the country and various countries worldwide, indicating that trachoma does not disproportionately affect one gender in this age group.

5. Conclusion

The study conducted in the Kombolcha district identified eye problems in the family, washing face with soap, towel usage, and water source as significant factors associated with active trachoma in children. The overall prevalence of active trachoma among children was found to be high in this study. However, it was observed that the prevalence of active trachoma among rural communities of children aged 1-9 years was below the World Health Organization (WHO) recommended threshold for initiating trachoma control measures (>10% prevalence). Despite this, active trachoma remains a major public health concern in the study area.

Therefore, it is recommended that efforts be coordinated to implement the WHO-endorsed SAFE strategy, with a particular focus on enhancing the overall living conditions of the community. This strategy includes Surgery for trichiasis, Antibiotics for treating infection, Facial cleanliness, and Environmental improvements to reduce transmission.

The accessibility of water plays a crucial role in the prevalence of trachoma. Areas where water is easily accessible tend to have lower rates of trachoma. Encouraging good face washing habits in children is also important as it helps to reduce the transmission of active trachoma.

By implementing the recommended strategies and improving living conditions, we can work towards reducing the burden of trachoma and improving the overall eye health of the community.

Abbreviations

AKT	Abdurehman Kelu Tololu
AOR	Adjusted Odds Ratio
AHT	Addis Hordofa Tekle
CI	Confidence Interval
MTA	Melese Tadesse Aredo
NGO	None Governmental Organization
SNNPR	Southern Nations, Nationalities, and Peoples
SPSS	Statistical Package for Social Sciences
TAM	Taha Adem Mume
TF	Trachomatous Inflammation Follicular
TI	Trachomatous Inflammation
TKB	Teresa Kissi Beyen
TT	Trachomatous Trichiasis
WHO	World Health Organization

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Author Contributions

Taha Adem Mume: Original draft preparation, Conceptualization, Methodology, Investigation, Data curation

Melese Tadesse Aredo: Conceptualization, Methodology, Analysis, Data curation

Abdurehman Kelu Tololu: Methodology, Review and editing

Teresa Kissi Beyen: Original draft preparation, Conceptualization, Methodology, Review and editing

Addis Hordofa Tekle: Review and editing

Dida Batu: Methodology, Review and editing

Ethics Approval and Consent to Participate

This research was approved by Institutional Review Board of Arsi University College of Health Sciences.

Consent for Publication

This section is not applicable because the research does not include individuals' image or videos.

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Data Availability Statement

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Conflicts of Interest

The authors declare no conflicts of interest.

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