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Meta analysis

Prevalence and associated risk factors of neglected tropical diseases in the Amhara region, Ethiopia

Mengesha W. Tegegne[1]*, Destaw Damtie[2]

[1]Department of Biology, College of Natural and Computational Science, Kebri Dehar University, Somali Region, Ethiopia
[2]Department of Biology, Bahir Dar University, Bahir Dar, Ethiopia

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***Correspondence:**
Mengesha W. Tegegne,
E-mail: mengeshawasie123@gmail.com

ABSTRACT

This systematic review analyzed the prevalence of neglected tropical diseases (NTDs) and associated risk factors in the Amhara region. Thirty-one articles from 2012 to 2022 were examined, and data analysis was conducted using STATA version 17. The overall NTD prevalence in Amhara was 29.9% (95% CI: 23.32–36.47). The highest prevalences were observed for soil-transmitted helminths (STHs) at 37.86% (95% CI=27.57–48.15), Schistosoma at 37.77% (95% CI=16.90–58.61), scabies at 24.28% (95% CI=6.42-42.15), and trachoma at 19.55% (95% CI=13.38–25.72). Prevalence varied across zones, ranging from 6.10% (95% CI=4.33–7.87) in Awi to 46.40% (95% CI=42.90–48.80) in Bahir Dar. Factors associated with NTDs included illiteracy and raw vegetable consumption for STHs; male gender, river swimming, and contact with river water for Schistosoma; ocular discharge and fly-eye contact for trachoma; and family size >6, clothes sharing, and sleeping with scabies-infected individuals for scabies. Improved sanitation, health education, and personal hygiene are vital for controlling NTDs in the study region.

Keywords: Amhara region, Disease, Neglected tropical diseases, Prevalence, Risk factors

INTRODUCTION

Neglected tropical diseases (NTDs) are a diverse group of 20 diseases primarily found in tropical regions, mainly in underdeveloped communities. They are caused by various pathogens, including viruses, bacteria, parasites, fungi, and poison.[1] Over a billion people, or one-sixth of the world's population, suffer from NTDs worldwide. People with NTDs frequently have multiple parasitic infections; additionally, every low-income country faces at least five NTDs at the same time. These diseases negatively impact physical and cognitive development, increase the risk of illness and mortality in mothers and children, impede agricultural and occupational activities, and feed the cycle of poverty and disease.[2] Over 500 million people in sub-Saharan Africa are affected by NTDs, which account for more than half of the region's cases of malaria and more than double the burden of tuberculosis. Anemia is caused by helminth infections, which impact millions of people and account for 85% of the illness burden. Disability is caused by schistosomiasis, lymphatic filariasis, and onchocerciasis. Limited data exists on non-helminth NTDs.[3] Ethiopia, which ranks third globally in total cases of NTDs after Nigeria and the Democratic Republic of the Congo, has serious challenges. The nation has sub-Saharan Africa's highest rates of trachoma, Podoconiosis, and cutaneous leishmaniasis.[4] NTDs put almost 75 million Ethiopians at risk of diminished ability to learn and work, pain, blindness, disability, and impaired physical and mental development. Ethiopia, a country disproportionately affected by trachoma, deals with these issues in filthy conditions with low housing, tainted water, poor hygiene, restricted access to treatment, and an increase in insect vectors. However, NTD control initiatives prioritize widespread drug use over water, sanitation, and hygiene (WASH) issues.[5] Numerous

NTDs, such as schistosomiasis (41.11%), visceral leishmaniasis (39.1%), trachoma (62.6%), and soil-transmitted helminths (33.84%), are prevalent in the Amhara region.[2,6-8] Because it focuses on studying NTDs in Ethiopia's Amhara region, this study is important from an academic standpoint. By means of an exacting systematic review and meta-analysis of studies published between 2012 and 2022, it offers policymakers and healthcare professionals the kind of subtle insights that are essential for focused interventions. The temporal scope guarantees applicability to current public health policies by ensuring relevance to recent epidemiological advances. The study's findings are highly regarded by academics and have the potential to guide evidence-based treatments and significantly enhance health outcomes in the Amhara region.

METHODS

Study area

This systematic review and meta-analysis include original studies (cross-sectional and case-control) on the prevalence and associated risk factors neglected tropical diseases in the Amhara region. The 2023 projected population of the region was 30,848,988.[9,10] The region's economy relies on agriculture, with crops like teff, barley, wheat, maize, sorghum and finger millet.[11]Amhara, home to historic sites and ancient churches, is important to Ethiopian history and tourism.[12] The Amhara people add to the region's rich cultural tapestry with their unique language (Amharic) and customs. Bahir Dar is the regional government's location. Amhara has 11 administrative zones covering 154,708.96 km^2. It features Lake Tana, a source of the Blue Nile, and Semien Mountains National Park with Ethiopia's highest peak. Borders include Sudan, Eritrea, Tigray, Afar, Benishangul-Gumuz, and Oromia.[13]

Search strategy

Medline, PubMed, ScienceDirect, Mesh Browser, and Google Scholar databases were systematically searched using Boolean operators (OR, AND) and relevant search terms for neglected tropical diseases in the Amhara region. The search included terms such as "neglected tropical disease AND soil-transmitted helminths OR Leishmaniasis OR scabies OR schistosomiasis OR trachoma AND Amhara region." Articles published in English between 2012 and 2022 were considered. Manual searching of references and related systematic reviews was performed to identify additional studies. The EndNote citation manager software (version X20 for Windows) was used to collect, organize, and remove duplicate articles.

Criteria for inclusion and exclusion of studies

Articles collected were evaluated for inclusion in the meta-analysis based on specific criteria: English language, cross-sectional, and case-control studies conducted in the Amhara region. Included articles focused on neglected tropical disease prevalence, risk factors, study methods, and population. Excluded were duplicates, incomplete information, animal studies, and inaccessible articles.

Quality assessment

The quality of a meta-analysis depends on the quality of the included studies.[14] Authors assessed the risk of bias using the modified Newcastle–Ottawa scale (NOS) for cross-sectional studies.[15] Study quality was determined by the summed scores: low bias (≥7 points), moderate bias (3-6 points), high bias (≤3 points) (Table 1). Studies with low and moderate bias were included.[15]

Data extraction

Data were extracted using a standardized checklist, including author name, prevalence, publication year, study zone, setting, population, gender, design, sample size, neglected tropical diseases, and associated risk factors.

Data analysis

STATA version 17 was used for the analysis. A random-effects model was employed for pooled prevalence, and heterogeneity was assessed with Cochran's Q-test. The meta-analysis was conducted using the inverse-variance model. Subgroup analysis was performed based on zone, participants, diagnostic methods, study design, and disease types. Publication bias was assessed using Egger's test and forest plot symmetry. The forest plot was used for pooled prevalence, and odds ratios were used to determine the association between risk factors and diseases.

RESULTS

216 studies were found after a thorough literature search was carried out for this inquiry. Ninety duplicate records were found and removed from the dataset after an initial review. Another thirty studies were eliminated after further filtration by title review. Following that, a thorough assessment of the full-text papers was conducted, leading to the eligibility of 76 articles being evaluated. Thirty-one of these studies were included in the final evaluation and subsequent meta-analysis, while 45 other articles were discarded for lack of sufficient information. The robustness and integrity of the research that make up the final analytical framework are guaranteed by this stringent selection process (Figure 1).

Characteristics of eligible studies

The meta-analysis included 31 publications, consisting of 3 case-control studies and 28 cross-sectional studies. The temporal distribution of the selected studies spanned the years 2012–2022, as follows: 7 studies in 2022, accounting for 22.6% of the total; 5 studies in each of the years 2021 and 2020, making up 16.1% of the total; and 4 studies in 2016, representing 12.9% of the total. Remarkably, for the year 2018, no studies that met the inclusion criteria were discovered. The selected studies revealed the following prevalence of various neglected tropical diseases (NTDs): trachoma was identified in 9 studies (29%), scabies and Schistosoma in 6 studies each (19.4%), and soil-transmitted helminths (STHs) in 10 studies (32.3%). Furthermore, the study employed a variety of methodological techniques (Table 1).

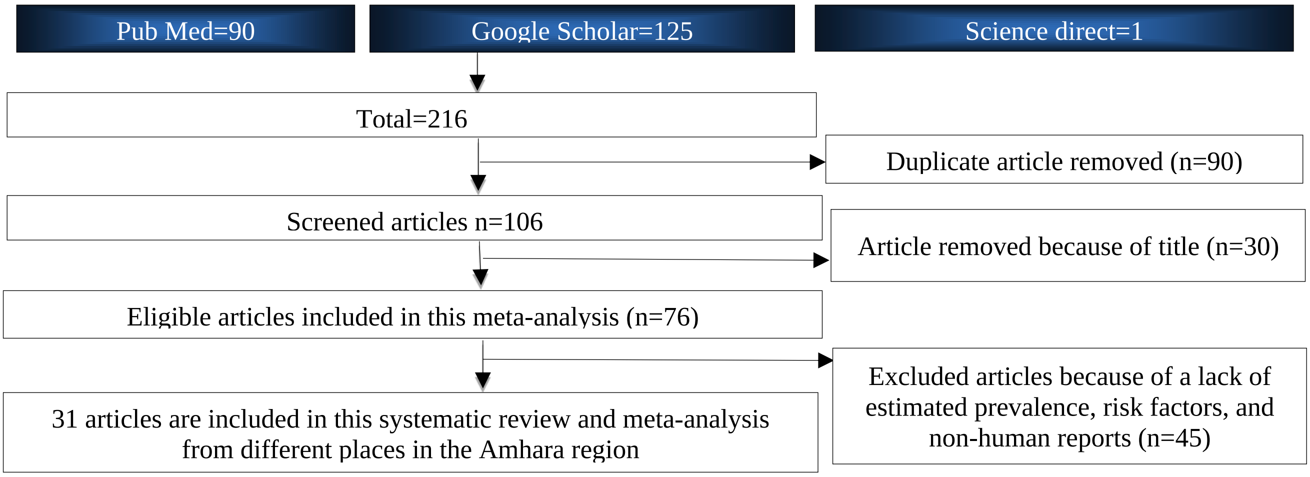

Figure 1: PRISMA flow diagram of articles considered for the review of NTDs among the Amhara regional population.

Table 1: NTDS data source articles in the Amhara region.

NTDs	Study setting	Sample size	Male	Fe-male	Study design	Method	Zone	Prevalence (%)	Quality assessment
T	Cb	704	337	367	CS	OB	Awi zone	6.1	6
STHs	Sc	778	397	381	CS	KK & FEC	Bahir Dar	46.4	8
STHs	Cb	641	406	235	CS	KK & FEC	East Gojjam	20.9	7
T	Sc	792	391	401	CS	OB	East Gojjam	24.1	8
Sb	Cb	1231	731	500	CC	FFI	East Shewa	1.6	8
STHs	Cb	401	183	218	CS	KK	M/Gondar	19.2	8
STHs	Sc	216	139	122	CS	KK	M/Gondar	66.7	7
STHs	Pw	416	-	416	CS	FEC	M/Gondar	27.6	6
T	Cb	681	365	365	CS	OB	M/Gondar	18	7
STHs	Sc	786	334	452	CS	KK	N/Gondar	32.3	6
STHs	Sc	400	213	187	CS	KK	N/Gondar	50.0	8
STHs	Cs	330	330	-	CS	FEC	N/Gondar	65.6	7
Sc	Cb	401	183	218	CS	KK	N/Gondar	11.2	8
Sc	Sc	384	186	198	CS	KK & SAF	N/Gondar	82.8	8
Sc	Cb	385	189	196	CS	KK	N/Gondar	36.6	6
Sc	Sc	579	293	286	CS	KK & WM	N/Gondar	50.3	8
T	Cb	586	285	301	CS	OB	N/Gondar	12.1	8
Sb	Cb	850	383	467	CS	HAPE	N/Gondar	10.82	6
Sb	Ib	494	284	210	CS	PE	N/Gondar	9.3	7
Sb	Cs	96	96	-	CC	FFI	N/Gondar	33.3	8
Sb	Cb	583	284	299	CS	PE	N/wollo	23.8	8
STHs	Cb	325	145	179	CS	KK	S/Gondar	36.0	8
STHs	Sc	340	194	146	CS	KK	S/Gondar	15	8
Sc	Sc	520	266	254	CS	KK, FEC & STS	S/Gondar	20.2	8
T	Cb	394	70	324	CS	OB	S/Gondar	9.9	8
T	Cb	671	351	320	CS	OB	S/Gondar	27.9	7
T	Cb	565	420	145	CS	OB	S/Gondar	36.1	8

Continued.

NTDs	Study setting	Sample size	Male	Fe-male	Study design	Method	Zone	Prevalence (%)	Quality assessment
Sb	Cb	4269	2254	2015	CC	OB	S/Gondar	52.8	6
T	Cb	596	301	295	CS	OB	S/Wollo	21.8	8
Sc	Sc	798	419	379	CS	KK & FEC	S/Wollo & S/Gondar	25.6	7
T	Cb	752	546	206	CS	OB	W/Gondar	11.8	6

Neglected tropical diseases (SB=scabies; SC=schistosoma; STHS=soil-transmitted helminths; T=trachoma). Study settings (CB=community-based; IB=institutional-based; CS=church student; PW=pregnant women; and SC=school children). Study design (CC=case-control and CS=cross-sectional). Method (FCE=formol ether concentration; FFI=face-to-face interview; HAPE=history and physical examination; KK=kato-katz; OB=observational; PH=physical examination; SAF=sodium acetate-acetic acid-formalin; STS=spontaneous tube sedimentation techniques; and WM=wet mount

Heterogeneity and risk of publication bias across studies included in the meta-analysis

Cochran's Q-test (df=30, p<0.001) and I^2-test (99.6%, 95% CI: 98.6–99.8) showed significant heterogeneity. Funnel plot (Figure 2) indicated no publication bias in the included studies.

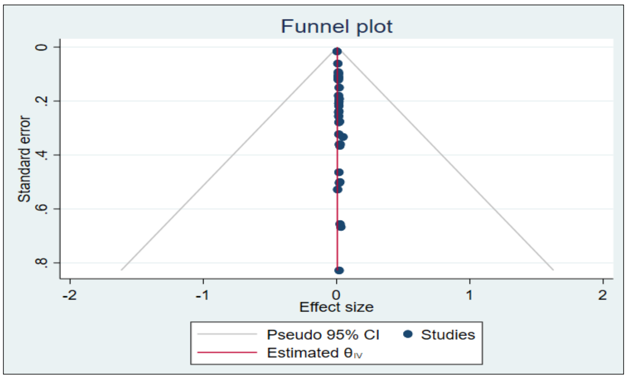

Figure 2: Funnel plot indicating no publication bias across studies in this meta-analysis.

Prevalence of neglected tropical diseases in the Amhara region

The pooled prevalence of NTDs within the Amhara region was determined to be 29.9% (95% CI: 23.32%–36.47%), as illustrated in Figure 3. The observed range in prevalence across studies was notably wide, spanning from 6.10%, to 82.80%.[16,17] This substantial variability underscores the heterogeneous nature of NTD prevalence within the Amhara region, emphasizing the need for a nuanced understanding of the contributing factors and dynamics involved.

Sub-group prevalence of neglected tropical diseases in the Amhara region

The prevalence of NTDs within distinct sub-groups is detailed in Table 2. STHs had a prevalence of 37.86% (95% CI: 27.57–48.15%, I^2=98.4%, p<0.001), Schistosoma showed a prevalence of 24.28% (95% CI: 6.42–42.15%, I^2=99.5%, p<0.001), Trachoma exhibited a prevalence of 19.55% (95% CI: 13.38–25.72%, I^2=97.7%, p<0.001), and scabies had a prevalence of 19.55% (95% CI: 13.38–25.72%, I^2=99.7%, p<0.001). Concerning the study designs, case-control studies demonstrated a prevalence of 34.05% (95% CI: 5.20–62.89%, I^2=99.8%, p<0.001) and cross-sectional studies showed a prevalence of 29.44% (95% CI: 23.16–35.73%, I^2=99.1%, p<0.001).

Based on the demographic characteristics of the participants, the highest prevalence was observed among church students (49.70%, 95% CI: 18.05–81.36%; I^2=97.1%; p<0.001), followed by school-based studies (41.28%, 95% CI: 28.39–54.17%, I^2=99.2%, p<0.001), pregnant women (27.60%, 95% CI: 23.30–31.90%, I^2=0.0%, p<0.001), community-based studies (22.32%, 95% CI: 14.32–30.32%, I^2=99.3%, p<0.001), and institutional-based studies (9.30%, 95% CI: 6.74–11.86%, I^2=0.0%, p<0.001) in descending order.

Among the administrative zones in Amhara region, the prevalence of NTDs was as follows: Bahir Dar special zone (46.40%, 95% CI: 42.90–49.90%, I^2=0.0%, p<0.001), North Gondar (33.47%, 95% CI: 23.73–43.20%, I^2=99.3%, p<0.001), South Gondar (29.62%, 95% CI: 12.90–46.35, I^2=99.4%, p<0.001), South Wollo and South Gondar zones (25.60%, 95% CI: 22.57–28.63%, I^2=0.0%, p<0.001) (mixed study), East Gojjam zone (21.84%, 95% CI: 19.44–24.24%, I^2=41.4%, p<0.001), South Wollo zone (21.80%, 95% CI: 18.49–25.11%, I^2=0.0%, p<0.001), East Shewa zone (16.00%, 95% CI: 13.95–18.05%, I^2=0.0%, p<0.001), and Awi (6.10%, 95% CI: 1.33–1.87%, I^2=0.0%, p<0.001) in descending order.

Associated risk factors of NTDs in the Amhara region

Associated risk factors of STHs in the Amhara region

STH infection was associated with age, education, hand washing, residence, raw vegetable consumption, water source, and fingernail status (p<0.05). Notably, individuals categorized as illiterate exhibited elevated odds of STH infection (OR=1.30, 95% CI: 0.78–2.16, p<0.001), consistently consuming raw vegetables was associated with increased odds of STH infection (OR=1.16, 95% CI: 0.76–1.75, p=0.006), and individuals utilizing non-pipe water sources were found to have higher odds of STH infection (OR=1.24, 95% CI: 0.62–2.46, p<0.001) compared to their individuals utilizing pipe water sources (Table 3).

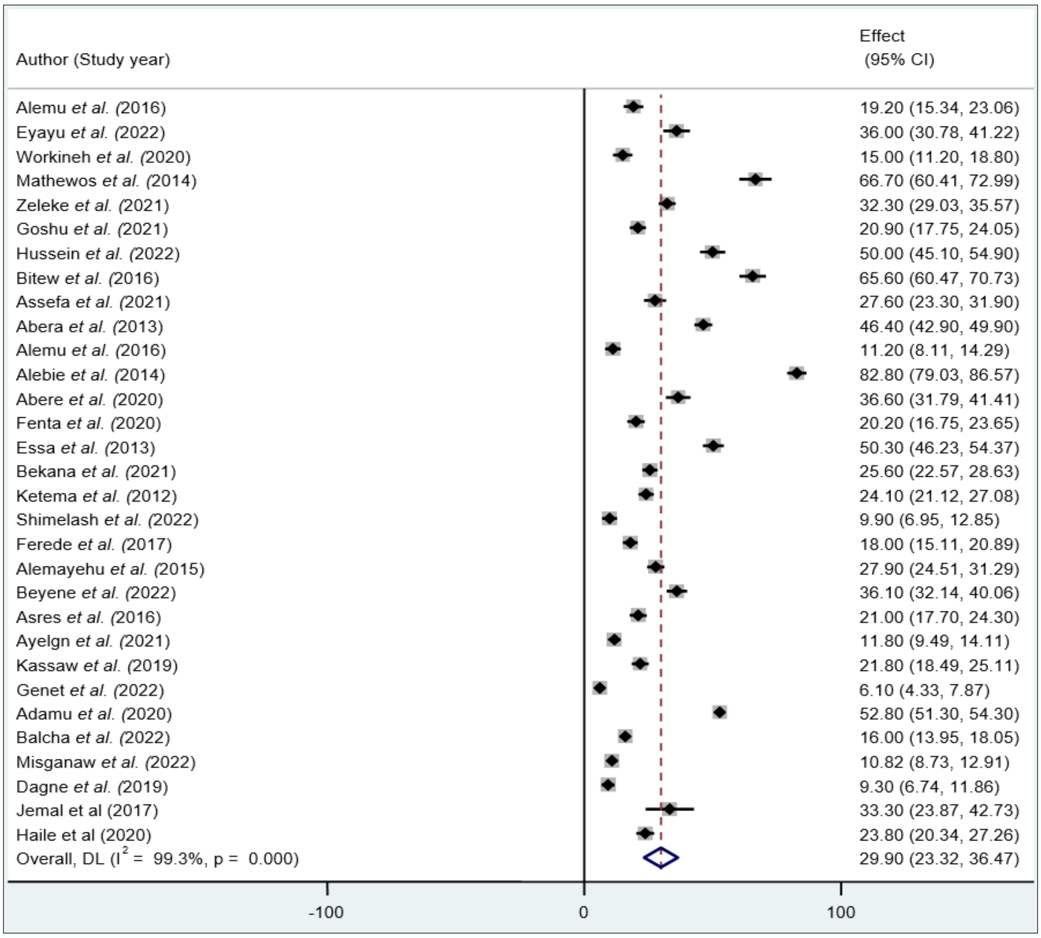

Figure 3: The overall prevalence of neglected tropical diseases in the Amhara region.

Table 2: Sub-group prevalence of neglected tropical diseases in Amhara region.

Variables	Characteristics	# Studies (%)	Sample size	Positives (N)	Prevalence (95% CI)	I^2, p value
Types of NTDs	STHs	10 (32.3)	4633	1762	37.86 (27.57, 48.15)	98.4%, p<0.001
	Schistosoma	6 (19.4)	3067	1158	37.77 (16.93, 58.61)	99.5%, p<0.001
	Trachoma	9 (29.03)	5741	1122	19.55 (13.38, 25.72)	97,7%, p<0.001
	Scabies	6 (19.4)	7523	1826	24.28 (6.42, 42.15)	99.7%, p<0.001
Study design	Cross-sectional	28 (90.3)	15368	4524	29.44 (23.16, 35.73)	99.1%, p<0.001
	Case–control	3 (9.7)	5596	1905	34.05 (5.20, 62.89)	99.8%, p<0.001
Study setting	Community	17 (54.8)	14035	3133	22.32 (14.32, 30.32)	99.3%, p<0.001
	School	10 (32.3)	5593	2309	41.28 (28.39, 54.17)	99.2%, p<0.001
	Church students	2 (6.5)	426	211	49.70 (18.05, 81.35)	97.1%, p<0.001
	Pregnant women	1 (3.23)	416	114	27.60 (23.30, 31.90)	0.0%, p<0.001
	Institutional	1 (3.23)	494	46	9.30 (6.74, 11.86)	0.0%, p<0.001
Zone	N/Gondar	17 (54.8)	8340	2791	33.47 (23.73, 43.20)	99.3%, p<0.001
	S/Gondar	6 (19.4)	6564	1944	29.62 (12.90, 46.35)	99.4%, p<0.001
	E/Gojjam	3 (9.7)	1953	427	21.84 (19.44, 24.24)	41.4%, p<0.001
	Bahir Dar	1 (3.23)	778	361	46.40 (42.90, 49.90)	0.0%, p<0.001
	S/Wollo & S/ Gondar	1 (3.23)	798	204	25.60 (22.57, 28.63)	0.0%, p<0.001
	S/Wollo	1 (3.23)	596	130	21.8 (18.49, 25.11)	0.0%, p<0.001
	E/Shewa	1 (3.23)	1231	197	16.00 (13.95, 18.05)	0.0%, p<0.001
	Awi	1 (3.23)	704	43	6.10 (4.33, 7.87)	0.0%, p<0.001

STHS=soil-transmitted helminths; N/Gondar=north Gondar; S/Gondar=south Gondar; E/Gojjam=east Gojjam; S/Wollo=south Wollo; E/Shewa=east Shewa

Table 3: Associated risk factors of STHS in the Amhara region.

Variables	OR (95% CI)	I-squared, p value
Sex		
Male	0.97 (0.85, 1.12)	0.0%, p<0.780
Female	1	
Age		
<30	0.83 (0.55, 1.26)	68.4%, p=0.023*
≥30	1	
Educational status		
Illiterate	1.30 (0.78, 2.16)	84.1%, p<0.001*
Literate	1	
Shoes wearing habits		
No	0.3 (0.22, 0.41)	19.1%, p=0.289
Always/ sometimes	1	
Hand washing habit after toilet		
Sometimes	0.37 (0.24, 0.58)	75.2%, p=0.001*
Always	1	
Hand washing habit before a meal		
Sometimes	0.55 (0.32,0.95)	59.4%, p=0.061
Always	1	
Residence		
Rural	0.48 (0.08, 2.99)	96.55, p<0.001*
Urban	1	
Habit of eating raw vegetables		
Always	1.16 (0.76, 1.75)	72.3%, p=0.006*
Sometimes	1	
Drinking water source		
Non-pipe	1.24 (0.62, 2.46)	89.2%, p<0.001*
Pipe	1	
Fingernail status		
Untrimmed	0.42 (0.25,0.73)	86.6%, p<0.001*
Trimmed	1	

*Significantly associated with STHS infection (p<0.05), or=odds ratio

Associated risk factors for Schistosoma in the Amhara region

Schistosoma infection was associated with sex, age, washing clothes in the river, swimming in the river, and river contact while crossing (p<0.05). The male sex (OR=1.14, 95% CI: 0.88–1.48, p<0.001), swimming in the rivers (OR=1.14, 95% CI: 0.79–2.54, p<0.001), and having contact with the river while crossing (OR=1.26, 95% CI: 0.84–1.89, p<0.001) were factors significantly associated with Schistosoma infection (Table 4).

Factors associated with trachoma in the Amhara region

Trachoma infection was associated with latrine use, ocular discharge, face washing with soap, waste disposal pit, water source, eye contact with flies, and face condition (p<0.05).

Table 4: Associated risk factors for schistosoma in the Amhara region.

Variables	OR (95% CI)	I-squared, p value
Sex		
Male	1.14 (0.88, 1.48)	77.8%, p<0.001*
Female	1	
Age		
≤40	0.74(0.61, 0.89)	63.7%, 0.026*
>40	1	
Habits of washing clothes in the river		
Yes	0.95 (0.55, 1.66)	92.4%, p<0.001*
No	1	
Habits of swimming in the river		
Yes	1.41 (0.79, 2.54)	90.8%, p<0.001*
No	1	
Habits of participating in irrigation farming		
Yes	1.41 (1.11, 1.78)	0.0%, p=0.918
No	1	
Habits of river water contact while crossing		
Yes	1.26 (0.84, 1.89)	80.4%, p=0.006*
No	1	

*Significantly associated with Schistosoma infection (p<0.05)

Table 5: Factors associated with trachoma in the Amhara region.

Variables	OR (95% CI)	I-squared, p value
Sex		
Male	0.99 (0.86, 1.14)	0.0%, p=0.853
Female	1	
Educational states		
Illiterate	2.17 (1.61, 2.93)	32.1%, p=0.208
Literate	1	
Use of latrine		
No	0.24(0.12, 0.48)	89.4%, p<0.001*
Yes	1	
Ocular discharge		
Presence	4.26 (2.23, 8.14	92.5%, p<0.001*
Absence	1	
Habits of washing face with soap		
No	0.35 (0.18, 0.70)	97.5%, p<0.001*
Yes	1	
Presence/absence of waste disposal pit		
Absence	0.90 (0.41, 1.99)	95.6%, p<0.001*
Presence	1	
Source of water		
Non-pipe	0.43 (0.15, 1.25)	96.8%, p<0.001*
Pipe	1	
Contact of eyes with flies		
Yes	1.85 (1.10, 3.10)	91.3%, p<0.001*
No	1	
Condition of face		
Unclean	0.26 (0.12, 0.57)	94.3%, p<0.001*
Clean	1	

*Significantly associated with trachoma infection (p<0.05)

The presence of ocular discharge (OR=4.26, 95% CI: 2.23–8.14, p<0.001) and eye contact with flies (OR=1.85, 95% CI: 1.10–3.10, p<0.001) were the two risk factors significantly associated with trachoma infection (Table 5).

Factors associated with scabies in the Amhara region

Scabies was associated with sex, age, family size, sharing clothes with infected patients, sleeping with infected patients, clothes washing frequency, showering with soap, and showering frequency (p<0.05) (Table 6). However, family size greater than six (OR=1.73; 95% CI: 0.41–7.27) and sharing clothes with infected patients (OR=1.58; 95% CI: 0.81–3.08), and sleeping with infected patients (OR=1.54; 95% CI: 0.45–5.33) were the only factors significantly associated with Scabies infection.

Table 6: Factors associated with scabies in the Amhara region.

Variables	OR (95% CI)	I-squared, p value
Sex		
Male	0.97 (0.73, 1.27)	81.2%, p<0.001*
Female	1	
Age		
<20	0.95 (0.56, 1.61)	94.7%, p<0.001*
≥20	1	
Family size		
>6	1.73 (0.41, 7.27)	96.9%, p<0.001*
≤6	1	
Sharing clothes with scabies-infected individuals		
Yes	1.58 (0.81, 3.08)	94.2%, p<0.001*
No	1	
Sleeping with scabies-infected patients		
Yes	1.54 (0.45, 5.33)	97.6%, p<0.001*
No	1	
Frequency of washing clothes		
Monthly	0.49 (0.26, 0.92)	89.2%, p<0.001*
Weekly	1	
Knowledge about scabies		
No	0.96 (0.76, 1.21)	0.0%, p=0.411
Yes	1	
Habits of taking shower with soap		
No	0.85 (0.33, 2.21)	94.5%, p<0.001*
Yes	1	
Frequency of showering		
Monthly	0.32 (0.11, 0.93)	93.2%, p<0.001*
Weekly	1	

*Significantly associated with scabies infection (p<0.05), or=odds ratio

DISCUSSION

Cochran's Q-test and I^2-test reveal significant heterogeneity among the included studies, indicating variations in characteristics. The symmetry of the funnel plot suggests no publication bias, offering some confidence in the findings despite the observed heterogeneity.

The pooled prevalence of NTDs was found to be 29.9%, which is lower than that reported in Brazos County, Texas (91%).[18] The pooled prevalence of Soil-Transmitted Helminth (STH) parasitic infection was 37.86%, which is lower than reported rates in Southeast Asia (61.4%), Nigeria (54.8%), Kola Diba Primary School (50%), and Tach Gayint district (36%), as well as Northwest Ethiopia (32.3%).[19-23] This variation may be attributed to environmental factors, diagnostic methodologies, hygiene practices, sanitation conditions, and contamination.[24]

Schistosoma prevalence was 37.77% (95% CI: 16.93%–58.61%), which was lower than that in Brazil (42.9%), and sub-Saharan Africa (44.7%).[25,26] It was similar to the prevalence reported in SNNPR's (39.7%), but higher than the national prevalence estimate (18.0%).[27,28] Differences in prevalence could be attributed to geographical and ecological variations, participant behavior, sanitation, and snail distribution.[28]

Trachoma, a neglected disease, affects marginalized populations globally. Its pooled prevalence (19.55%) (95% CI: 13.38%–25.72%) was higher than that in Brazil (6.3%), and sub-Saharan Africa (10%), but lower than in the SNNPR (35.7%) and Oromia regions (20.2%) in Ethiopia.[29-31] Variations in occurrence and water access can be attributed to socioeconomic development, awareness, socio-cultural factors, education, and local conditions. Understanding the impact of water supply, sanitation, and facial hygiene is crucial for policy reform and provides insights for combating trachoma in affected areas.

Scabies is a neglected public health problem in developing countries like Ethiopia. Estimating scabies prevalence and identifying associated factors contribute to policymaking. This study represents the first systematic review in the Amhara region, revealing a pooled prevalence of 24.28% (95% CI: 6.42%–42.19%). This rate surpasses the global prevalence of 10%, but is lower than the prevalence in north Ethiopia (19.6%).[32,33] Various behavioral, methodological, educational, cultural, and attitudinal differences contribute to this variation. The findings emphasize the need for regional policymakers to address the health implications of scabies infestation.[34]

Soil-transmitted helminth infection is associated with age, exhibiting a higher prevalence below 30 years. In the rural area of Debre Tabor, infections were more prevalent among the age group of 10 to 14 years, indicating greater exposure among younger children who play in open fields.[35] Similarly, in North Sumatera, Indonesia, the highest infection rates were found in the age group of 6-12 years.[36] Conversely, at Sekela primary school in Western Ethiopia, lower infection rates were observed in children aged 7-8 years compared to those aged 9-12 years, suggesting a decline in infection rates with age.[37]

The odds of STH infection were 1.3 times higher among illiterates compared to literates (OR=1.3, 95% CI: 0.78, 2.16, I2=84.1, p<0.001). This finding aligns with a study conducted in Bibugn District, Northwest Ethiopia, as well as the national prevalence in Ethiopia, but is lower than the study conducted in Kafue district, Zambia.[38-40]

The odds of STH infection were 1.16 times higher in those who always consumed raw vegetables compared to those who sometimes ate unwashed vegetables (OR=1.16, 95% CI: 0.76–1.75, p=0.006). This figure was lower than the report in Ethiopia, but supported by studies in Shahrekord, Iran, and Poland.[39-42] Washing and cooking fruits and vegetables before consumption can reduce the risk of parasitic infections.

Individuals who consumed water from piped sources had 1.24 times lower odds of STH infection (95% CI: 0.62–2.46) compared to those using non-piped sources. This risk was lower than reported in Antiga village, Bali,[43] potentially attributed to treatment processes reducing contamination in piped water, whereas non-piped sources may contain higher STH levels due to fecal contamination without treatment.

The pooled result indicated that males had a 1.14 times (95% CI: 0.88-1.48) higher risk of Schistosoma infection compared to females, based on 5 studies. This finding aligns with the report from Côte d'Ivoire, suggesting that behavioral factors may contribute to the higher risk among males, as they engage in activities like swimming, fishing, and agricultural work.[44] Additionally, better access to healthcare facilities and services among females may contribute to their lower rate of Schistosoma infection.

Data from five studies identified the association between river swimming and Schistosoma infection in the Amhara region. River swimmers had a 1.41 times higher risk of Schistosoma infection (95% CI: 0.19–2.54) compared to non-swimmers. This risk was lower than reported in Nigeria, Burkina Faso, southern Ethiopia, and the Omusati region of Namibia.[45-48] The review indicated that frequenting open water or rivers increased the risk of *S. mansoni* infection in the study region, likely influenced by factors such as environmental sanitation, snail host availability, diagnostic methods, awareness levels, and water contact behavior of the population.

Crossing rivers was associated with a 1.26 times (95% CI: 0.84–1.88) higher likelihood of Schistosoma infection, according to a recent study. The pooled result showed a higher prevalence compared to reports from Nigeria, Ebonyi State, and southwest Ethiopia.[45,49,50] These findings underscore the significance of river crossing as a potential risk factor for Schistosoma infections, emphasizing the need for effective preventive strategies.

The presence of ocular discharge was associated with trachoma infection, as indicated by pooled results from 5 studies, increasing the likelihood by 4.26 times (95% CI: 2.23–8.14) compared to its absence. This finding was higher than the report in East Anglia, UK, possibly due to various factors such as differences in trachoma prevalence, environmental conditions, and demographics.[51] Further studies are needed to better understand these associations.

The association between fly-eye contact and trachoma infection in the Amhara region was extensively studied. Five studies revealed a significant increase in trachoma risk due to fly-eye contact.[17,21,23,52,53] The risk was 1.85 times higher (95% CI: 1.10-3.10) compared to individuals without fly-eye contact, consistent with a report from Yemen, but lower than in north-eastern Nigeria.[54,55] The presence of nasal and ocular secretions attracts flies, leading to increased fly-eye contact and trachoma transmission.[56] Effective control measures are crucial to reducing fly-human contact and preventing trachoma transmission.

Families with fewer than six members had a 1.73 times lower risk of scabies infection compared to larger families. This finding was consistent with a report from Malaysia, but lower than the report in Ethiopia.[33,57] Similar results were found in studies conducted in southeast Iran, Meta-Robi, and the western region of Cameroon.[58-60] The higher risk in larger families could be attributed to increased bed and clothing sharing habits.[33] Considering family size and shared habits is crucial for effective scabies prevention and control strategies.

In the Amhara region, the association between sleeping with a scabies patient and scabies infection was studied across five studies. Individuals who slept with a scabies patient had a higher likelihood of scabies infection (OR=1.54, 95% CI: 0.45–5.33) compared to those who did not. This finding was higher than reports from southern Ethiopia and the Raya Alamata district.[34,61] Methodological, educational, cultural, and attitudinal differences among the populations studied may explain these variations. Understanding context-specific factors is important for disease transmission and prevention efforts.

CONCLUSION

This review highlights the prevalence of NTDs in the Amhara region, including STHs, schistosomiasis, trachoma, and scabies. Factors associated with STH infection include being illiterate, a habit of eating raw vegetables, and drinking water from non-piped sources. Schistosomiasis is associated with being male, having a habit of swimming in rivers, and coming into contact with river water while crossing. Trachoma prevalence is linked to ocular discharge and fly-eye contact. Scabies prevalence is associated with having a family size greater than six, sharing clothes with scabies-infected individuals, and sleeping with scabies-infected patients. Efforts are needed to control and prevent these diseases. For STHs, focus on health education, hygiene practices, safe water, and sanitation. Target populations with low education and raw fruit/vegetable consumption. For schistosomiasis, promote safe water and sanitation; discourage river contact, swimming, and washing clothes. For trachoma, promote latrine use, waste disposal, safe water, and face hygiene. For scabies, promote hygiene, clothes washing, showers, and discourage sharing clothes. Health education and awareness campaigns are crucial. Empower communities, provide access to healthcare, and continue research and monitoring.

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