

Prevalence of Cutaneous Leishmaniasis and Community Knowledge, Attitudes, and Practices in Dara Malo District, Southern Ethiopia: A Cross-Sectional Study

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Research Article

Keywords: Cutaneous leishmaniasis, KAP, LCL, Community survey, Dara Malo, Ethiopia

Posted Date: June 28th, 2026

DOI: <https://doi.org/10.21203/rs.3.rs-9791796/v1>

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Additional Declarations: No competing interests reported.

Abstract

Background

Cutaneous leishmaniasis (CL) remains a major public health challenge in Ethiopia, placing an estimated 30 million people at risk and causing an annual incidence of about 20,000 to 30,000 cases. Despite its considerable burden, there is limited evidence regarding community knowledge, attitudes, and practices (KAP) and their influence on disease prevalence. This study aimed to estimate the prevalence of CL and evaluate community KAP in Dara Malo district, Southern Ethiopia.

Methods

A community-based cross-sectional study was conducted in Dara Malo district. Five hundred sixteen households were selected using a two-stage sampling approach. Skin slit samples were collected for parasitological confirmation of CL and for the identification of the infecting *Leishmania* species using microscopy and Internal Transcribed Spacer 1 (ITS1)-based Polymerase Chain Reaction–Restriction Fragment Length Polymorphism (PCR-RFLP), respectively. Household-level prevalence was defined as the proportion of households with at least one member confirmed to have CL. Data on KAP were collected from household head using a pretested structured questionnaire in REDCap and analyzed using STATA (version 17.0).

Results

We collected data from 509 households, a response rate of 98.6%. The majority (316, 62.1%) of the households were headed by males with a mean age of 42.5 ($\pm$ 14.8 SD) years. The household-level prevalence of parasitologically confirmed CL was 5.11% (n = 26; 95% CI: 3.36%–7.39%). Among the CL cases, most (n = 24, 92.3%) had localized CL (LCL), single lesion (n = 20, 76.9%), and predominantly on their face (n = 20, 76.9%). The study revealed critical gaps, with substantial proportion of participants demonstrating poor knowledge (n = 253, 49.7%), poor attitude (n = 479, 94.1%), and poor preventive practices (n = 339, 66.6%). Large family size, being male, lack of formal education, lower household income, inadequate knowledge, and farming occupation showed a strong association with poor preventive practice.

Background

Cutaneous leishmaniasis (CL) is a neglected tropical disease caused by *Leishmania* species, transmitted by the bite of infected female sandflies. In Ethiopia, CL presents a (re)-emerging public health challenge, with an estimated 30 million people at risk and an annual incidence of about 20,000–30,000 cases. The most reported cause of CL in Ethiopia is *Leishmania aethiopica* (*L. aethiopica*) (1). However, access to diagnosis and treatment remains limited; only a fraction of these cases receive formal treatment due to

limited access to health services (2). CL is associated with chronic skin lesions, disfigurement, stigma, psychological distress, and economic loss, particularly in rural communities where access to care and awareness is low (3–7). During the past decades, Ethiopia witnessed a re-emergence of CL; outbreaks in Silti and Ankesha-Guagsa districts (8, 9) in the highlands, and Duunyar district in the lowland (10), highlighting the evolving epidemiology of the disease.

While the role of ecological and vector factors in driving CL transmission is well documented (11–14), community-level behavioral and socio-cultural determinants remain systematically understudied, particularly in southern Ethiopian highland-lowland interface zones. Knowledge, attitudes, and practices (KAP) related to CL play a critical role in shaping community responses to infection risk, health-seeking behavior, and uptake of preventive measures. A prior study conducted in endemic areas of Ethiopia reported gaps in community KAP about CL, which fosters risky behaviors and sustains transmission (15). For example, limited awareness of sand fly vectors and preventive measures, along with negative perceptions and low perceived preventability of CL, can increase vulnerability to infection and reduce community engagement in control efforts (16).

Evidence on KAP is limited and context-specific, rarely linking knowledge and attitudes to actual practices or parasitologically confirmed household-level prevalence, despite inconsistent associations reported across settings (16–18). Furthermore, prior KAP evidence is concentrated in northern/central Ethiopia and is absent from the Gamo Zone (11, 19). Therefore, integrated studies combining epidemiological data with community KAP are needed to inform targeted interventions and control strategies. This study aimed to determine the household-level prevalence of CL, assess community KAP toward CL, and identify factors associated with CL prevention practice in Dara Malo Woreda, southern Ethiopia.

Methods

Study area

Dara Malo district (Fig. 1) is located at 6°15'–6°28'N, and 37°14'E. It has 24 Kebeles (lowest administrative units): 17 in the highlands and 7 in the lowlands. The district spans between the Kolla (arid and semi-arid lowland) and the Weyna Dega (the temperate), to the Dega (cool and humid highland) agroecological zones at 1217 to 2700 meters above sea level. The population primarily practices subsistence rain-fed mixed farming. The district is located 27 km away from the nearest CL treatment center, Selam Ber Primary Hospital.

Study design and period

A community-based cross-sectional design was used to determine the prevalence of CL and to explore the KAP towards CL. The study was conducted from February to March 2025.

Study variables

Dependent variable

CL prevention practice

Independent variables

Knowledge about CL, attitude toward CL transmission and prevention method, gender, age, level of education, marital status, occupation, and the household annual income, family size, place of residence, and family history of CL

Study population

All households in Dara Malo district were our study population. Randomly selected household heads or members aged 18 years and above who had lived in Dara Malo district for six months or more were eligible for the KAP survey, while household members were assessed for CL.

Sample size determination and sampling procedure

The single population proportion formula, assuming a prevalence of 11% household level CL prevalence (11), 95% confidence level, 4% margin of error, a design effect of 2, finite population correction of 13,655 (estimated population of Dara Malo during the study), and 10% non-response rate, resulted in a sample size of 516 households.

Sampling techniques

A two-stage sampling technique was applied for the KAP survey. First, twelve kebeles (9 highland and 3 lowland) were selected using a lottery method. Proportional allocation was applied to determine the sample size per kebele. Finally, households were selected using a systematic random sampling technique (see Add file1_figure 1).

Data collection tools and procedures

Socio-epidemiological data were collected using a semi-structured, pre-tested questionnaire adapted from prior studies (11). Data collectors (nurses, health officers, and medical doctors) received study-specific training. Clinical evaluation was done by an experienced and trained medical doctor to identify CL cases. Trained laboratory technologists collected skin slit specimens from CL suspected cases.

Knowledge questionnaire included 11 items, covering symptoms, cause of CL, the mode of transmission, the vector type and activity, treatment, and prevention of CL. Attitude section comprised five items

addressing perceived community risk, the risk of CL between genders, treatability, preventability, and expected trend in CL. Prevention practice questionnaire included 11 items assessing preventive methods such as bed net use and spraying of insecticides, treatment preferences, and exposure to risk factors.

Operational definitions

Clinical CL

appearance of one or more lesions, typically on uncovered parts of the body. Lesions could be papular, nodular, or plaque.

Confirmed CL

a clinical CL with positive parasitology, diagnosed by slit skin smear microscopy and/or polymerase chain reaction.

Knowledge about CL: Knowledge about CL was classified according to modified Bloom's criteria: good if the score ranged from 80 to 100%, moderate if it was between 50 and 79%, and poor if it was below 49%, considering that the minimum acceptable level of knowledge was half (20).

Attitude: Participants' attitude was classified according to Bloom's criteria: good if the score ranged from 80 to 100%, moderate if it was between 60 and 79%, and poor if it was below 59% (21, 22).

Prevention Practice: Participants' practice was classified according to Bloom's criteria: good if the score ranged from 80 to 100%, moderate if it was between 60 and 79%, and poor if it was below 59% (21, 22)

Household Income

calculated by the 2025 World Bank Poverty & Inequality Platform report, which includes daily \$3 (equivalent to 245 ETB) for lower income, \$4.20 (equivalent to 344 ETB) for lower middle income, and \$8.30 (equivalent to 678 ETB) for upper middle income (23).

Laboratory confirmation and species typing

Active indurated edge of the lesion was cleaned with 70% alcohol and air-dried. Skin slit samples (SSS) were prepared, fixed with methanol, and stained with 10% Giemsa. Slides were examined independently by two microscopists for *Leishmania* amastigotes under oil immersion (100×). A slide was declared negative at least 100 fields were screened. After microscopy reading, the oil immersion was cleaned, and the slides were stored in pre-labeled boxes and transported to the AHRI laboratory at ambient temperature for Internal Transcribed Spacer 1 (ITS1) PCR-RFLP analysis.

DNA extraction and ITS1 PCR-RFLP assay

Slides were rehydrated with 150 µL 1x phosphate-buffered saline (PBS) (Thermo Fisher Scientific, Waltham, MA, USA) and scraped into labeled 1.5 mL Eppendorf tubes. A total of 180 µL ATL buffer

(QIAGEN) and proteinase K (20 mg/mL) were added and incubated at 56°C overnight. DNA was extracted following the QIAGEN DNeasy Tissue Kit (QIAGEN GmbH, Hilden, Germany) protocol and stored at -20°C. Amplicons of the ITS1 performed using L5.8S (5'-TGATACCACTTATCGCACTT-3') and LITSR (5'-CTGGATCATTTTCCGATG-3') primers (24). PCR products (7 µL) were digested with *HhaI* (New England *BioLabs*, Ipswich, MA, USA) and analyzed on 2% agarose gels (Invitrogen, USA) stained with SYBR Safe (Invitrogen, USA) alongside a 100 bp molecular marker (Invitrogen, Thermo Fisher Scientific, Baltics UAB, Lithuania). Reference strains (*L. aethiopica* L100, *L. donovani* HU3, and *L. tropica* K27) served as positive controls, and molecular-grade water a negative PCR control.

Data quality assurance

Data tools were reviewed and pre-tested. Data collectors received two days of training. Routine debriefings were held weekly to ensure internal consistency and minimize bias.

Data management and analysis

Data were managed using REDCap and analyzed using STATA (version 17.0, Stata Corp., TX, USA). Descriptive statistics were summarized using tables and graphs. KAP was assessed using Bloom's cutoff points for the KAP study scoring system, adapted from previous studies (20–22). A score of one was given for each correct response and 0 for an incorrect response. Ordinal logistic regression was used to determine the presence of an association between CL prevention practice and independent variables. Adjusted odds ratios (AOR) with 95% confidence interval (CI) were reported. Statistical significance was declared at $p < 0.05$. The proportional odds assumption was checked using the omodel test, and the model fitness was also checked by the Likelihood ratio test (LR test), and the Pseudo R^2 statistics.

Ethical consideration

Ethical approval

was obtained from the AHRI/ALERT Ethics Review Committee (Re: PO/025/24). Support letters were obtained from the Gamo Zone health department (Re: 84/19) and Dara Malo district health office (Re: 25/650/13). Written informed consent was obtained from all adults; in addition, assent was sought from participants aged 8–17 years related to clinical examination of household members and for skin sampling if applicable, not for KAP participation.

Results

Socio-demographic characteristics

The response rate for the KAP survey was 98.6% (509/516); 316 (62.1%) were male, and the majority, 457 (90.5%), were rural residents. Nearly half of the participants (232; 45.6%) had never attended formal education. The mean age was 42.5 (± 14.8 SD) years. For most households (288; 56.6%), the typical family size ranged from four to six. Most households (360; 72.4%) had lower annual income (less than

645 USD (equivalent to 89,648 ETB), and farming was the main source of income for most (n = 415, 83.2%) households (Table 1).

Table 1
Sociodemographic characteristics of the study participants, Dara Malo Woreda, Gamo Zone, South Ethiopia, 2025 (n = 509).

Variable	Category	Frequency
Sex	Male	316 (62.1%)
	Female	193 (37.9%)
Age group (years) Mean = 42.5 (± 14.8 SD)	18–29	89 (17.5%)
	30–44	196 (38.5%)
	45–64	169 (33.2%)
	≥ 65	55 (10.8%)
Residence (n = 505)	Rural	457 (90.5%)
	Urban	48 (9.5%)
Educational status	Not attending formal	232 (45.6%)
	Primary	196 (38.5%)
	Secondary	54 (10.6%)
	College and above	27 (5.3%)
Family size	≤ 3	109 (21.4%)
	4–6	288 (56.6%)
	7–9	96 (18.9%)
	≥ 10	15 (2.9%)
Annual household income* (n = 497)	Lower income	360 (72.4%)
	Lower middle income	55 (11.1%)
	Upper middle income	82 (16.5%)
Occupation (n = 480)	Farmer	415 (83.2%)
	Merchant	36 (7.2%)
	Government employee	27 (5.4%)
	Others**	2 (0.4%)
*=Household income information was missing for 12 households, **= daily labourer 1 (0.2%), and driver 1 (0.2%)		

Household-level prevalence of cutaneous leishmaniasis

Thirty-seven suspected cases were identified, of whom 33 were volunteers for SSS, and 20 were microscopically positive, and an additional 6 cases were found PCR positive. The household level prevalence of parasitologically confirmed CL was 5.11% (n = 26, 95% CI: 3.36% – 7.39%). All samples were identified as *L. aethiopica* by ITS1-PCR RFLP. The positive households seem to cluster in a specific area (Fig. 1).

Demographic and clinical phenotypes of CL patients

Out of the 26 confirmed CL cases, 17 (65.4%) were male, and the median age was 18 years, with an interquartile age range of 10–30 years, and the mode was 10 years. The majority (n = 24, 92.3%) had localized cutaneous leishmaniasis (LCL); most (n = 9/26, 34.6%) with an indurated plaque-lesion. The reported duration of the lesion ranged from 3 months to 36 months, with an average of 14.72 ± 8.83 months. The majority (n = 20/26, 76.9%) had one lesion and on their face (n = 20/26, 76.9%) (Table 2).

Table 2
Socio-demographic and clinical characteristics of parasitological confirmed CL cases, Dara Malo district, Gamo Zone, south Ethiopia (n = 26)

Variables	Categories	Frequency
Sex	Male	17 (65.4%)
	Female	9 (34.6%)
Annual household income* (n = 24)	Lower income	18 (75%)
	Lower middle income	2 (8.3%)
	Upper middle income	4 (16.7%)
CL clinical forms	LCL	24 (92.3%)
	MCL	2 (7.7)
	DCL	0
Type of lesion (s)	Indurated plaque	9 (34.6%)
	Nodulo-ulcerative	8 (30.7%)
	Diffuse induration	2 (7.7%)
	Nodular	3 (11.5%)
	Nodulo-papular	3 (11.5%)
	Papular	1 (3.8%)
Number of lesion (s)	One	20 (76.9%)
	Two	5 (19.2%)
	Three and more	1 (3.9%)
Location of lesion (s)	Face	20 (76.9%)
	Upper limb	4 (15.4%)
	Neck	1 (3.8%)
	Multiple regions**	1 (3.8%)
Did the patient receive any treatment?	Yes	9 (34.6%)
	No	17 (65.4%)
*= Household income information was missing for two CL cases, **= face, and upper limb		

Knowledge about cutaneous leishmaniasis

Overall, there is an alarming low level of awareness in the endemic community; only few respondents (n = 29, 5.7%) demonstrated good knowledge of CL (Table 3/Fig. 2). While about half (n = 264; 51.9%) reported knowing CL symptoms, only 59 (11.6%) attributed the cause of CL as infection, and 61 (12.0%) claimed to differentiate CL from other skin diseases. Regarding transmission, the majority (n = 452, 88.8%) did not know how CL is transmitted. Where 42 (8.3%) mentioned insect bites as mode of transmission, 5 (1%) mentioned contact with a CL patient, 6 (1.2%) cited other routes, and 4 (0.8%) were unsure. The finding that only one respondent (0.2%) knew repellents were protective against sand fly bites was a critical knowledge gap (Table 3).

Table 3

Knowledge about CL among household heads, Dara Malo district, Gamo Zone, South Ethiopia, 2025 (n = 509)

Knowledge-related variables	Frequency (n)
Know the signs and symptoms of cutaneous leishmaniasis	
Yes	264 (51.9%)
No	151 (29.7%)
Do not know	94 (18.5%)
Differentiate cutaneous leishmaniasis from other skin diseases	
Yes	61 (12.0%)
No	264 (51.9%)
Do not know	184 (36.1%)
Know the cause of cutaneous leishmaniasis	
Infection	59 (11.6%)
Do not know	446 (88.5%)
Others	4 (0.8%)
Know about the mode of cutaneous leishmaniasis transmission	
Insect bite	42 (8.3%)
Contact with CL patient	5 (1%)
Unknown	4 (0.8%)
Others	6 (1.2%)
Do not know	452 (88.8%)
Know about the type of insect that causes CL	
Yes	40 (7.9%)
No	468 (91.6%)
Know about the time of day when the insect that transmits cutaneous leishmaniasis mostly bites	
Yes	53 (10.4%)
No	456 (89.6%)
Know about the breeding site of the insect that transmits cutaneous leishmaniasis	

Knowledge-related variables	Frequency (n)
Know the signs and symptoms of cutaneous leishmaniasis	
Yes	24 (4.7%)
No	485 (95.3%)
Know how to protect oneself and family from CL	
Yes	5 (1.0%)
No	504 (99%)
Know that sleeping under a bed net is protective	
Yes	18 (3.5%)
No	491 (96.5%)
Know repellent as protection against sand fly bites	
Yes	1 (0.2%)
No	508 (99.8%)
Knowledge (overall)	
Poor	253 (49.7%)
Moderate	227 (44.6%)
Good	29 (5.7%)

Attitude towards cutaneous leishmaniasis transmission and prevention

The study demonstrated that an extremely low level of good (positive) attitude (n = 4, 0.8%) towards CL control and prevention measures. While 158 (31.0%) believed it is treatable, few (n = 16, 3.1%) respondents believed that CL is preventable. Whereas 92 respondents (18.1%) believed that the risk of CL in the community is increasing when compared with the last five years (Table 4).

Table 4
Attitude towards CL control and prevention among household heads in Dara Malo district, Gamo Zone, 2025 (n = 509)

Variable	Frequency (n)
Believe that CL is treatable	
Yes	158 (31.0%)
No	351 (69%)
Believe that CL is preventable	
Yes	16 (3.1%)
No	493 (96.9%)
Compared to the last 5 years, risk of CL in the community	
Increased	92 (18.1%)
Decreased	135 (26.5%)
Remained the same	104 (20.4%)
Don't know	178 (35.0%)
Expected changes in the number of CL coming 5 years	
Will increase	92 (18.1%)
Will decrease	134 (26.3%)
Don't know	283 (55.6%)
Believe about risk of CL differs between males & females	
Yes	7 (1.4%)
No	197 (38.7%)
Don't know	305 (59.9%)
Attitude (overall)	
Poor	479 (94.1%)
Moderate	26 (5.1%)
Good	4 (0.8%)

Prevention practice of cutaneous leishmaniasis

The finding showed an extremely low (n = 29, 5.7%) level of “good” practice among participants; the majority used no prevention methods (n = 394, 77.4%). The study revealed severe treatment-prevention

paradox; while respondents were highly willing to seek medical help (n = 446, 87.6%), only (n = 21, 4.1%) participants reported spraying their homes or surrounding areas with insecticides for vector control. Similarly, a few participants (n = 67, 13.2%) reported having a bed net for use during sleep (Table 5).

Table 5

Prevention and control practices towards CL among household heads in Dara Malo district, Gamo Zone, south Ethiopia, 2025 (n = 509)

Variables	Frequency (n)
Ever used prevention methods for CL	
Using a bed net	6 (1.2%)
Isolating an infected person	1 (0.2%)
Keeping personal hygiene	1 (0.2%)
Cleaning the dump, animal dung, and vegetation area	5 (1.0%)
Not used any prevention method	394 (77.4%)
Others	102 (20%)
Action when someone from the family gets CL	
Assist with home remedies	2 (0.4%)
Go to a traditional healer	31 (6.1%)
Go to nearby health facilities	446 (87.6%)
Others	3 (0.6%)
Have a bed net to be used while sleeping at home	
Yes	67 (13.2%)
Sleeping outside of the home	
Yes	1 (0.2%)
No	505 (99.5%)
Spend time around the gorge	
Yes	34 (6.7%)
No	475 (93.3%)
Travel in the forest area	
Yes	35 (6.9%)
No	474 (93.1%)
Sleep outdoors during the night	
Yes	15 (2.9%)
No	494 (97.1%)

Variables	Frequency (n)
Ever used prevention methods for CL	
Presence of animal dung at the dumping site near home	
Yes	202 (39.7%)
No	307 (60.3%)
Fumigate the house, and/or animal sheds, and/or the surroundings	
Yes	61 (12.0%)
No	448 (88%)
Presence of animal shades near the house or keeping an animal inside the house	
Yes	40 (7.9%)
No	469 (92.1%)
Household or surrounding sprayed with insecticides	
Yes	21 (4.1%)
No	488 (95.9%)
Practice (overall)	
Poor	339 (66.6%)
Moderate	141 (27.7%)
Good	29 (5.7%)

Factors associated with cutaneous leishmaniasis prevention practices

The partial proportional odds model using an ordered logit was used since few variables violated the proportional odds assumption ($\chi^2 = 32.72$, $p = 0.0011$) (12). Model fit was adequate, as supported by a significant likelihood ratio test (LR χ^2 (12) = 116.69, $p < 0.001$, and Pseudo $R^2 = 0.149$).

Sociodemographic and knowledge-related factors influenced prevention and control practices. Male household heads had 44% less likely to practice CL prevention measures compared with females (AOR = 0.56, 95% CI: 0.36, 0.87). Those who completed college or secondary school had 5.81 times higher odds of good practice (AOR = 5.81, 95% CI: 2.96–11.4). Participants with adequate knowledge about CL had 2.89 times higher odds of good practice (AOR = 2.89, 95% CI: 1.42–5.88). Participants with lower annual household income had 59% lower odds of good CL prevention practice compared to those with upper-middle income (AOR = 0.41, 95% CI: 0.21–0.81) (Table 6).

Table 6

Factors associated with the practice toward CL prevention among household heads in Dara Malo district, Gamo Zone, south Ethiopia, 2025 (n = 509).

Covariates	Practice toward CL prevention				
	Poor	Moderate	Good	AOR (95% C.I)	p-value
Age				1.01 (0.99–1.02)	0.35
Gender					
Female	107 (55.5%)	68 (35.2%)	18 (9.3%)	1	
Male	232 (73.4%)	73 (23.1%)	11 (3.5%)	0.56 (0.36, 0.87)	0.01
Educational status					
College or secondary	35 (43.2%)	42 (51.9%)	4 (4.9%)	5.81 (2.96–11.4)	< 0.001
Primary	110 (56.1%)	68 (34.7%)	18 (9.2%)	3.71 (2.23–6.19)	0.001
No formal education	194 (83.6%)	31 (13.4%)	7 (3.0%)	1	
Occupation					
Farmer	299 (72.1%)	93 (22.4%)	23 (5.5%)	1	
Others*	40 (42.6%)	48 (51.1%)	6 (6.4%)	2.18 (1.30–3.65)	0.003
Family size					
3 and below	192 (66.7%)	87 (30.2%)	9 (3.1%)	1.18 (0.59–2.37)	0.64
4 to 6	47 (49.0%)	37 (38.5%)	12 (12.5%)	2.25 (1.00– 5.05)	0.05
7 and above	99 (79.8%)	17 (13.7%)	8 (6.5%)	1	
Marital status					
Others* = government employee, merchant, daily labourer, and driver					
Adequate knowledge** = if the knowledge score ranged from 60 to 100%					
Favorable attitude*** = if the attitude score ranged from 60 to 100%					

Covariates	Practice toward CL prevention				
	Poor	Moderate	Good	AOR (95% C.I)	p-value
Married	326 (67.8%)	130 (27.0%)	25 (5.2%)	1	
Unmarried	13 (46.4%)	11 (39.3%)	4 (14.3%)	1.25 (0.54–2.89)	0.60
Annual household income					
Lower income	223 (62%)	111 (30.8%)	26 (7.2%)	0.41 (0.21–0.81)	0.01
Lower middle income	42 (76.4%)	11 (20%)	2 (3.6%)	0.55 (0.29–1.15)	0.11
Upper middle income	14 (17.1%)	67 (81.7%)	1 (1.2%)	1	
Knowledge about CL					
Adequate knowledge**	15 (44.1%)	18 (52.9%)	1 (2.9%)	2.89(1.42–5.88)	0.003
Inadequate knowledge	324 (68.2%)	123 (25.9%)	28 (5.9%)	1	
Attitude towards CL					
Favorable attitude***	22 (73.3%)	7 (23.3%)	1 (3.4%)	0.48(0.19–1.23)	0.61
Unfavorable attitude	317(66.2%)	134 (28%)	28 (5.9%)	1	
Others*= government employee, merchant, daily labourer, and driver					
Adequate knowledge**= if the knowledge score ranged from 60 to 100%					
Favorable attitude***= if the attitude score ranged from 60 to 100%					

Discussion

The sequelae of Cutaneous Leishmaniasis (**CL**) are identified by the term "**Bolbo, also spelled as Bolvo**" in South Ethiopia. The vernacular name(s) refers to the disfigurement as a result of the nodules, or ulcerative chronic lesions, and the caring up on cure (7, 25). The disease manifests as chronic skin lesions, most commonly affecting the face, with previous studies reporting facial involvement in approximately 69%–82% of cases (26–28). Similarly, in the present study, most lesions were located on the face (76.9%), underscoring the substantial psychosocial burden associated with visible disfigurement. This finding further substantiates the significance reflected in the vernacular terminology used by affected communities, which often embodies the psychosocial consequences of the disease,

including stigma, anxiety, and social isolation (7, 29, 30). Despite its substantial burden, community knowledge, attitudes, and practices regarding the disease remain inadequate.

This study shows that CL remains an important public health problem in the study area, with a household-level prevalence of 5.11%. This finding suggests ongoing community transmission and is consistent with reports from other endemic settings (27, 31). The household prevalence of CL observed in this study setting is higher than that reported from Bilala Shaye, South Ethiopia, (2.5%) (27), which may reflect the focal and heterogeneous nature of CL transmission, influenced by environmental factors such as vector density and proximity to reservoir hosts (14, 27). However, the prevalence is lower than the findings from Tigray (11.0%) (11), Kutaber District (14.02%) (32), Kambata (14.7%) (33), and the East Africa pooled estimate (22.57%) (34), possibly due to differences in ecological conditions, study populations, and transmission intensity across settings.

Molecular analysis identified *L. aethiopica* as the etiological agent among the samples collected in Dara Malo district. This finding is consistent with a recent community-based survey in Ethiopia's northeast highlands, which also identified *L. aethiopica* as the only causative agent (14). While *L. aethiopica* was the predominant species (93.1%), recent data from Northeast Ethiopia documented that 6.9% of clinical isolates from soldiers deployed at the Awash camp were identified as *L. tropica* (35), near a recent CL outbreak due to *L. tropica* (10); a finding that corroborates our results and previous reports documenting *L. aethiopica* as the predominant species in the Ethiopian highlands. The ecologically plausible given the study district's highland and mid-highland topography, where transmission in such environments is typically maintained by vectors such as *P. longipes* and *P. pedifer*, together with reservoir hosts including the Rock hyrax, all of which are well adapted to these ecological conditions (12, 36, 37). However, these should be considered with caution because genomic analyses of clinical isolated were identified as putative hybrids between *L. donovani* and *L. aethiopica*, showing 99.08%–99.69% sequence similarity with both parental species (10, 35); findings may indicate changing transmission dynamics of CL in Ethiopia.

The KAP assessment revealed major gaps in community awareness and preventive behaviour, with only 5.7% of participants demonstrating good knowledge, 0.8% good attitudes, and 5.7% good preventive practices regarding CL. These findings highlight persistent informational and behavioural barriers to effective disease control. Similar patterns of low knowledge have been documented elsewhere in Ethiopia, where reported knowledge levels ranged from 18.1% to 19%, although these remain higher than those observed in the present study (15, 18, 19, 33). Inadequate understanding of disease transmission and vector involvement may hinder the adoption of preventive interventions (38). However, the findings contrast with community-based studies from Southern Ethiopia and broader meta-analyses that reported higher knowledge level (54.5%-67.6%) (16, 39) (40). These discrepancies may be attributed to differences in public health infrastructure, health education access, and socio-cultural factors influencing information dissemination (40).

Although most respondents expressed a willingness to seek care from health facilities when a family member develops CL, a high proportion (66.6%) exhibited poor preventive practices, suggesting a disconnect between care-seeking intentions and preventive behaviours. This finding contrasts with reports from the endemic rural communities of northern Ethiopia, where about 90% of respondents preferred traditional healers for treatment (15). Preventive practices in the present study were significantly associated with family size, gender, income, literacy, and knowledge, while attitude showed no association. This finding aligns with a study conducted in South Ethiopia, which also reported a significant association between knowledge and practice (16). Similarly, evidence from Iran and Pakistan also indicated that poor preventive practices are closely linked to inadequate knowledge (41, 42).

The strength of this study is the integration of identification of the causative species with comprehensive KAP surveys, enabling a more nuanced understanding of transmission dynamics and community-level perceptions. The limitations include, self-reported KAP responses may be subject to social desirability bias, and the use of household-level prevalence estimates may underestimate the true individual-level burden of disease.

Conclusion

The findings indicate that cutaneous leishmaniasis (CL) remains a significant public health concern in the study area, with considerable household-level prevalence and a predominance of lesions occurring on the facial region. The study further identified substantial gaps in knowledge, attitudes, and preventive practices related to the disease. These findings underscore the need for further in-depth social science research to better elucidate the underlying determinants of knowledge, attitudes, and practices (KAP), including fear, stigma, and culturally rooted interpretations of the disease to design culturally responsive and Tailored Social and Behavioral Change Communication (SBCC) strategies

Abbreviations

AHRI

Armauer Hansen Research Institute

AOR

Adjusted Odds Ratio

CI

Confidence Interval

CL

Cutaneous Leishmaniasis

DCL

Diffuse-cutaneous leishmaniasis

ETB

Ethiopian Birr

FMOH

Federal Ministry of Health
KAP
Knowledge, Attitude and Practice
LCL
Localized Cutaneous Leishmaniasis
MCL
Mucocutaneous leishmaniasis
PCR
Polymerase chain reaction
PCR
RFLP-Polymerase Chain Reaction-Restriction Fragment Length Polymorphism
PBS
Phosphate-Buffered Saline
REDCap
Research Electronic Data Capture
SD
Standard Deviation
SSSs
Skin Slit Samples
ITS1
Internal Transcribed Spacer 1
WHO
World Health Organization

Declarations

Open Science

Clinical trial number: not applicable

Ethics approval and consent to participate

Ethics

The protocol was reviewed and approved by AHRI/ALERT Ethics Review Committee (Re: PO/025/24), and support letters were obtained from the Gamo Zone health department (Re: 84/19) and Dara Malo district health office (Re: 25/650/13). This study was conducted in accordance with principles of the current revision of the Declaration of Helsinki 2013.

Consent for publication

Not applicable in this section.

Data Availability

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

Competing interests

The authors declare no competing financial or non-financial interests.

Funding

This project was not funded, while AHRI provided in-kind contributions.

Author's contribution

Conceptualization/study design- AAK*, AAA**, DEW and EG

Data curation / Investigation-AAK, AAA, AA, and DEW

Supervised -GS, TC, EM, FAK, DB, GM, SG and EG

Performed the laboratory activities- GS, ZBA, EFS, FJ, and JCS

Analysed and interpreted the data- AAK, GM, TN, and FG

Draft the manuscript-AAK

Review the manuscript- AAA, DEW, TC, AA, GS, EM, DB, GM, TN, SG, ZBA, EFS, FAK, FJ, JCS, and EG

AAK*= Adisu Asefa Kiyar, AAA**= Amanuel Albene Ayele

All authors read and approved the final manuscript.

Acknowledgement

We acknowledge the South Ethiopia Regional Health Bureau, the Gamo Zone Health Department, and the Dara Malo District for their collaboration. We further thank the Armauer Hansen Research Institute for providing in-kind contributions and conducting the laboratory activities. We sincerely thank all the study participants for their time and valuable contribution to this research.

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Figures

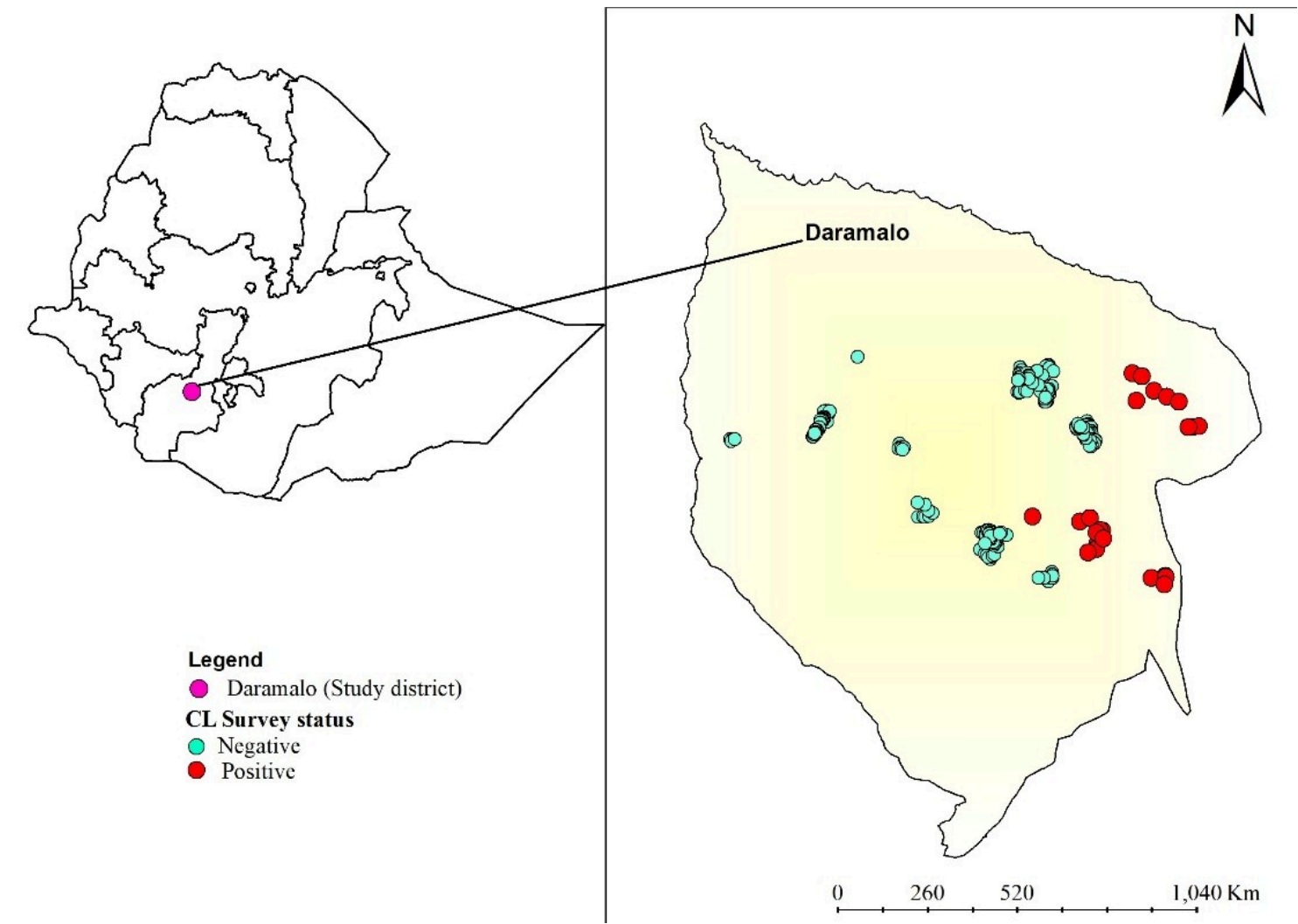


Figure 1

Map of Dara Malo district showing the distribution of confirmed CL cases.

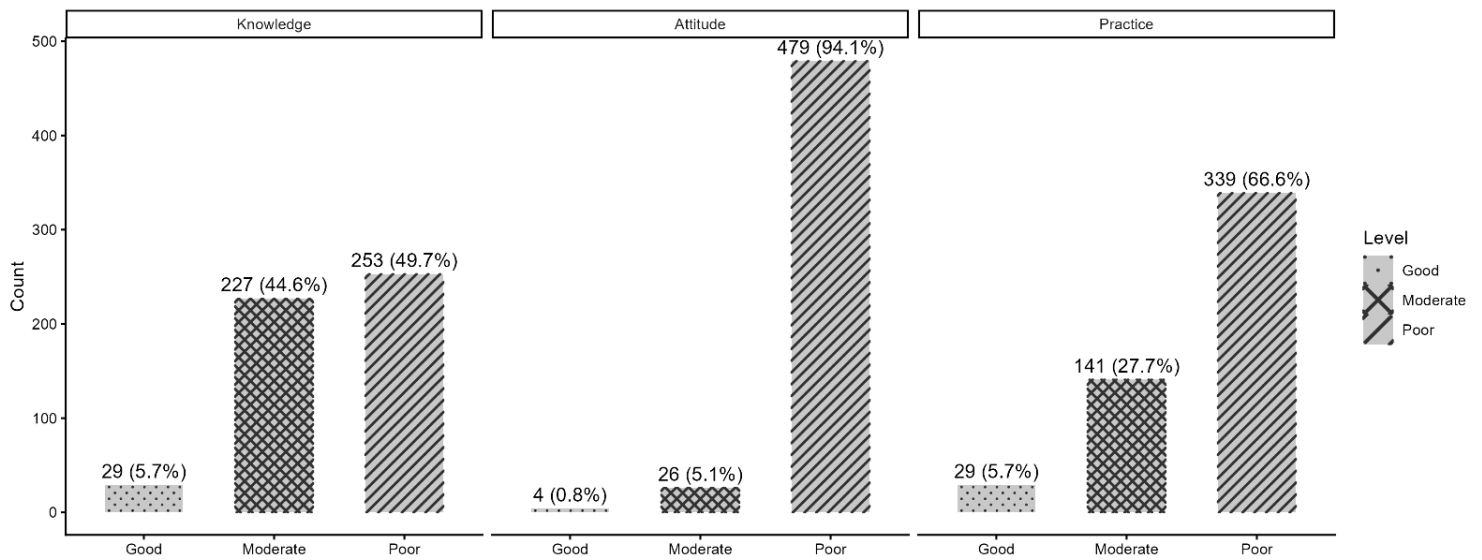


Figure 2

KAP about CL among household heads in Dara Malo district, Gamo Zone, South Ethiopia, 2025 (n=509)

Supplementary Files

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