Original Article

Clinical Manifestations of Cutaneous Leishmaniasis (CL): Does Elevated Blood Sugar Level have Implications for Clinical Management of CL?

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Abstract

Background: Cutaneous Leishmaniasis (CL) is a disease caused by a protozoan parasite transmitted through the bites of female sandflies. In Ethiopia, the predominant causative agent of CL is *Leishmania aethiopica* (*L.aethiopica*). However, there may be contributions from other parasite strains through genomic sharing. This parasite has developed sophisticated mechanisms to survive within host cells, evading immune responses. The resulting lesions caused by *L. aethiopica* display unique characteristics. The primary objective of this study was to compile a comprehensive dataset on lesion features and additional clinical attributes and explore the potential relation between blood glucose levels and CL in North-west Ethiopia.

Method: A cross-sectional study was conducted at Lay Gayint District Nefas Mewcha Primary Hospital over four months, from September 2023 to December 2023. Skin slit samples were collected to check the presence of the amastigotes stage of *Leishmania* using 100× objective under microscope. Fasting blood glucose levels were measured using a glucometer. A blood sample was taken from the middle finger and applied to the strip. Blood glucose level reading was reported in mg/dl.

Result: In a study period involving 14,080 patients at the hospital, 75 cases of CL were identified. The primary clinical form of the disease was Localized CL (LCL) (68%), with the majority of lesions appearing on the face (90%). Elevated blood glucose levels (>120mg/dl) were found in 27% of CL patients, with 56.5% in those ≤ 45 years old. A significant number of CL cases (18.4%) were clustered within the same household. Lesions larger than 4mm^2 were seen in 75% of patients ($\chi2$:11; p<0.05), and nearly 78% lived with the lesion for over 6 months ($\chi2$: 20; P<0.05).

Conclusion: The findings indicate that a significant proportion of Cutaneous Leishmaniasis (CL) patients exhibit elevated glucose levels, potentially exacerbating disease progression and lesion severity. Nonetheless, additional research is necessary to establish a causal link. It is imperative for leishmaniasis treatment initiatives to prioritize the management of comorbidities, such as hyperglycemia, and enhance patient access to timely treatment through educational interventions aimed at reducing treatment delays. [*Ethiop. J. Health Dev.* 2023; 37(2): 00-00]

Keywords: Blood glucose, cutaneous leishmaniasis, Lesion size, North-west Ethiopia

Introduction

In Ethiopia, Cutaneous Leishmaniasis (CL) is primarily caused by *Leishmania* (*L) aethiopica*; *L. tropica* and *L. major* can also cause the disease (1). Approximately 19.5% of Ethiopian landmass is considered to be at risk for CL (2, 3). *L. aethiopica* has an incubation period of 1-9 months (4). Studies in Ethiopia have revealed that approximately 30% of the genomic composition of the parasite causing CL is derived from *L. donovani* through the fusion of genomic materials with *L. aethiopica* (5). Leishmaniasis can affect individuals of all ages, especially children and impoverished individuals who face malnutrition and those who have poor housing conditions and weakened immune systems (5, 6).

The complex interaction between the parasite and the host determines the clinical outcomes of CL (7). In leishmaniasis, cytokine production exacerbates ulcerative lesion formation (8, 9). CL lesions can either heal within a short period or persist for weeks, months, or even years, leaving behind noticeable scars (1). These scars can lead to stigma, discrimination, and psychosocial problems (10, 11). CL cases in Ethiopia have also been reported to exhibit regional lymphadenopathy and peripheral neuropathy (1). In certain instances, individuals with cutaneous leishmaniasis may experience internal organ dysfunction, particularly in those who are immune-compromised (1). The two main cytokines of pro-inflammatory role in CL infection are Interferon-gamma (IFN-γ) and Tumor necrosis factor alpha (TNF-α), which play both immune protection and immunopathology. Although these cytokines have essential roles in the control of intracellular pathogens, their increased production may lead to autoimmune diseases (12). Studies conducted in Brazil showed that atypical lesions were observed in patients who had comorbidity of CL and diabetic mellitus (DM) (13). This shows that high blood glucose aggravates the

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lesion feature and severity; conversely, it influences the outcome of patient management (13).

Patients with high glucose levels had enhanced levels of Interleukin-1-beta (IL-1β), TNF, and IFN-γ experienced higher rates of therapeutic failure (14). It is also known that DM increases the susceptibility and severity of bacterial and fungus infections (14).

Although research has been conducted on *L.aethiopica* over the past 50 years, the knowledge gap remains high both in the community and academic spheres (5). The typical example is that although cytokines due to leishmaniasis proved to attack different organs of the body, there is limited research to show either the effect of leishmaniasis on blood sugar levels or vice versa. So it is quite important to understand the relationship between CL and glucose levels in the body for better management of the patients. This study aimed to investigate and generate thoughtful information on factors that are associated with CL lesion types and other clinical characteristics to understand the relationship between leishmaniasis and blood glucose levels.

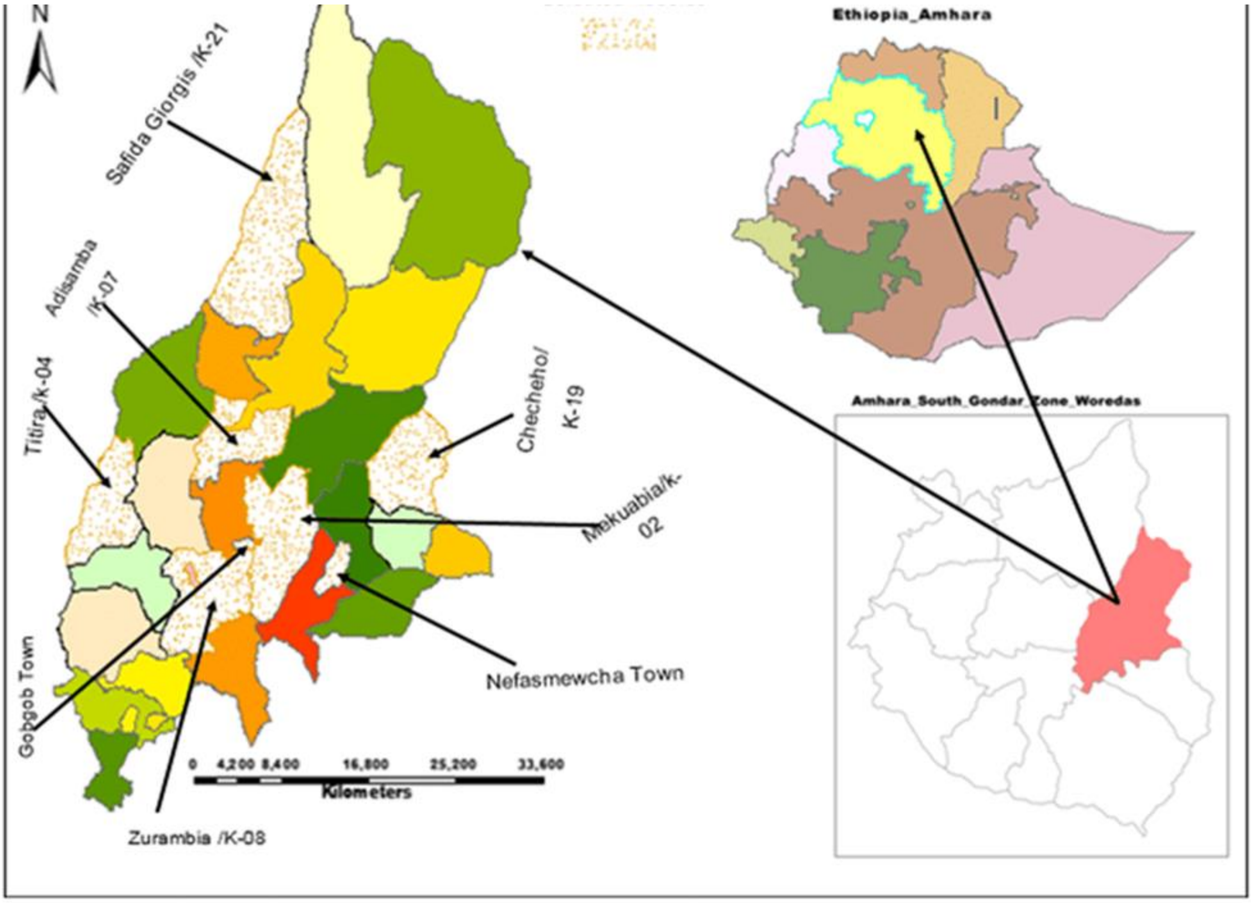
Materials and Method

Study design and period

The research method applied a cross-sectional study design, and it was conducted from September 2023 to December 2023.

Study area and setting

This study was conducted at Nefas Mewcha Hospital, Lay Gayint District. The district is 170 km away from the Regional Capital, Bahir Dar city. The population of the Woreda, according to the Regional Statistics Office report (2019), was 350,000, and its total area is 154 884.1 hectares. The hospital started its service in 2015in G C. It comprises medical, gynecological, inpatient, emergency, psychiatry, pharmacy, and laboratory services. Every day, 160-200 outpatients visit for general medical service. The Regional Health Bureau, in collaboration with WHO, started the Leishmaniasis Diagnosis and Treatment Center (LTC) for the surrounding community in 2019. On average, every year, 150-200 patients are looking for cutaneous leishmaniasis treatment. The location of Gayint District is 11° 50' 59" N latitude and 38° 22' 0" E longitude.



Shapefile: Central Statistical Agency, Ethiopia, 2013
Software: https://qgis.org/en/site/forusers/download.html

Figure 1. **Administrative boundary of Lay Gayint district.**

Source population

Patients who visited the selected hospital for medical care during the study periods were used as the study's source population.

Study population

The confirmed CL patients identified during the study period served as the primary focus of the research. Their demographic information, medical history, clinical manifestations, and treatment outcomes were meticulously documented and analyzed. The data collected from these patients formed the basis for drawing conclusions and generating insights regarding CL within the context of the study.

Study participants

Confirmed CL patients who consented to participate and were able to give samples.

Inclusion and exclusion criteria

For the assessment of demographic and clinical variables, all patients confirmed to have CL (Cutaneous Leishmaniasis) were included in the study. However, certain groups, including children, CL patients with known comorbidities, and pregnant women, were excluded from the analysis of blood glucose levels. Furthermore, adult CL patients who had consumed a meal within the previous 8 hours were also excluded from the assessment of blood glucose levels.

Recruitment of CL patients

A nurse triaged patients according to the signs and symptoms to be assigned and to be looked after for their morbidity. Doctors who were working on the medical side of the outpatient department (OPD) were the ones who were responsible for screening and examining suspected CL patients. Those patients with clinical signs and symptoms of CL were sent to the laboratory for diagnostic confirmation. Laboratory confirmation was done by detecting amastigotes of the parasite through microscopy.

Study Variables

The dependent variable for this study was blood glucose measurement. Hence, the immune response mounted following *Leishmania* infection may disrupt the normal physiological function of beta cells, or the insulin circulating in the blood results in elevated blood glucose. The excess blood glucose again would provide a convenient environment for the multiplication and invasion of microbial growth that harm the patient and worsen wound healing. Also, it delays the healing time. So; in leishmaniasis patients, it is important to determine the blood glucose level to see the potential causal relationship to decide the protocol of CL patient management. The independent variables were demographic and clinical characteristics.

Sample size and sampling technique

A convenient sampling technique was used so that all CL patients in the study period were included.

Data collection and processing

In this study, a structured questionnaire was prepared and used for the collection of demographic and clinical data after being tested for convenience. The data elements were age, sex, CL in the family, occupation, lesion size, number of lesions, and duration of illness. Lesion size was measured by a caliper and reported in mm^2.

The skin scraping was taken from the border of the active lesion with a sterile scalpel. The skin scraping smear was stained with 10% Giemsa and examined for the amastigotes stage of the parasite under 100× microscopic objective.

The fasting blood glucose level was measured using a glucometer. One drop of finger-prick blood was applied at the tip of the glucometer strip. Through lateral flow, the blood moved to the area where the glucose level reading was completed. The amount of blood glucose was measured using a unit of mg/dl.

Ethical Consideration

The study was conducted with the endorsement of Amhara Public Health Institute (RN. APHI-03/1691). Informed consent and assent were obtained from all study participants. Local language was used for the questionnaire, and consent was obtained to participate in the study. The data element was anonymous with patient identification. All CL patients were linked to physicians for treatment.

Data analysis

Data were analyzed by SPSS version 23. The Pearson chi-square was used to determine the association between the variables, and $p<0.05$ was considered statistically significant. Results were expressed in tables and graphs.

Operational definition

- Elevated Blood glucose patient: a patient who has a fasting blood glucose level >120mg/dl
- Normal Blood glucose: a patient who has a fasting blood glucose ≤120mg/dl

Result

Host-related factors of CL patients

Out of 14,080 medical cases, a total of 75 confirmed cases of Cutaneous Leishmaniasis (CL) were identified in outpatients of Nefas Mewcha Hospital. Among the total CL cases, 26 were children under the age of 18, and the mean age of these patients was 10.6 years old, while 49 cases were ≥18 years old and had a mean age of 33.6 years old. The youngest patient was 2 years old, while the oldest was 75 years old. The age group with the highest number (29; 38.7%) of cases was between 16-30 years old. The next highest risk group was children aged 1-15, with 25 cases or 33.3%. Both males and females were affected by the disease, but males accounted for a larger number, with 42 cases or 56% (Table 1).

From the 53 CL cases who responded to our questionnaire, the majority of these cases were engaged in farming, making up 52.8%. Students were the second largest group among the participants (Table 1). Our research revealed that approximately 19% of CL patients with (CL) conditions share the same household with other CL patients; suggestive of a cluster of cases that live in the same house (Table 1).

Table 1: **The host factors: CL distribution by sex, age, and occupation**

Variable		Frequency of CL	%	χ^2: (df):P-Value
Sex	F	33	44	1(1):0.29
	M	42	56	
	Total	75	100	
Age (year)	1-15	25	33.3	15(3):0.002
	16-30	29	38.7	
	31-45	12	16	
	46+	9	12	
	Total	75	100.0	
Occupation	Farmer	28	52.8	63.1(4):0.001
	Student	21	39.6	
	Retired	2	3.8	
	Teacher	1	1.9	
	Laborer	1	1.9	
	Total	53	100.0	
	Unclassified	22		
CL in the family	Yes	9	18.4	19.6(1):0.001
	No	40	81.6	
	Total	49	100.0	
	Unclassified	26		

The Pathology of CL

In this study, three clinical types of CL were recorded; LCL (Localized), MCL (Mucocutaneous), and DCL (Diffuse), with LCL being the most prevalent case ($\chi2$:48.5; $p<0.05$) 68% (51 out of 75 cases). However, all forms of the disease were predominantly found on the face, 65 (90.3%; $p<0.05$). The majority of patients (74.5%) had lesions greater than 4mm^2 ($\chi2$: 11.2; $p<0.05$). Our study revealed that only a small fraction of CL patients, around 22%, sought treatment at a hospital within six months (χ^2:20.2;$p<0.05$) (Table 2).

Table 2: **The pathology of CL: clinical presentations and other characteristics**

Variable		Frequency	%	χ^2: (df):P-Value
CL type	LCL	51	68	48.5(2):0.001
	MCL	22	29.3	
	DCL	2	2.7	
Lesion site	Face	65	90.3	163.7(3):0.001
	Multiple sites	3	4.2	
	Hand	3	4.2	
	Neck	1	1.4	
	Unclassified	3		
Lesion Number	1	33	61.1	19(2):0.001
	2	12	22.2	
	≥3	9	16.7	
	Unclassified	21		
Lesion Area	≤4mm^2	12	25	11.2(1):0.001
	>4mm^2	36	75	
	Unclassified	28		
Duration of lesion	≤6 month	14	21.9	20.2(1):0.001
	>6 month	50	78.1	
	Unclassified	11		

Blood glucose level and lymph node enlargement

In our study, we observed that 7.5% of CL patients exhibited lymph node enlargement, specifically in the neck area. Greater than 120mg/dl fasting blood glucose level measurement was recorded in 27% of CL patients, as revealed by the laboratory test (Table 3).

Table 3: **Blood glucose level and status of lymph nodes in CL patients**

Variable		Frequency	%	χ^2: (df):P-Value
Blood glucose (mg/dl)	≤ 120	35	72.9	10:(1):0.001
	> 120	13	27.1	
	Total	48	100	
	Unclassified	27		
Lymph node enlargement	Yes	3	7.5	28.9:(1):0.001
	No	37	92.5	
	Total	40	100	
	Unclassified	35		

The practice and use of traditional medicine

Approximately 43.5% of the total CL cases opted for traditional medicine to heal from the disease. The study patients commonly applied either the juice or specific parts of these remedies directly to the wound. Traditional medicine utilized for treatment encompassed a diverse range of sources and methods, including both animal—and plant-derived substances (Table 4).

Table 4: **Traditional medical practice of CL patients to resolve CL problem**

Variable		Frequency	(%)
Traditional medicine use	Yes	20	43.5
	No	26	56.5
	Total	46	100
	Unclassified	29	
The type of herb they use	Azoo	1	5.2
	Bat	1	5.2
	Cactus juice& honey	3	15.7
	Charcoal	1	5.2
	Herbal	13	68.4
	Total	19	100
	Unclassified	56	

When comparing the total positive cases of high blood glucose levels (> 120mg/dl), it was found that 54% were males. A higher glucose level in the blood was found in larger lesion size 9/13(69 %) of CL patients with (>4mm^2). However, it was not statistically significant (p>0.05). The duration of the lesion, which was greater than 6 months, 7/13(54%) had a fasting blood glucose >120mg/dl, and it was statistically significant. Out of the total high blood glucose level, 9/13(56.5%) of them were ≤45 years old, but p-value was >0.05(Table 5)

Table 5: Fasting blood glucose levels across demographic and clinical variables

Variables		Blood sugar measurement		p-value
Age (year)		≤120mg/dl: n (%)	>120mg/dl: n (%)	
	18-30	23 (85.2)	4 (14.8)	0.09
	31-45	7 (58.3)	5 (41.7)	
	>45	5 (55.6)	4 (44.4)	
Sex	Female	14 (70)	6 (30)	0.70
	Male	21(75)	7 (25)	
Occupation	Farmer	19 (67.9)	9 (32.1)	0.31
	Student	13(81.3)	3 (18.7)	
	Retired	2 (100)	0 (0)	
	Laborer	0 (0)	1(100)	
	Teacher	1 (100)	0 (0)	
CL type	LCL	22 (73.3)	8 (26.7)	0.64
	MCL	11 (68.8)	5 (31.2)	
	DCL	2 (100)	0 (0)	
Lesion site	Face	30 (69.8)	13 (30.2)	0.35
	Multiple	3 (100)	0(0)	
	Hand &leg	2 (100)	0(0)	
Lesion number	1	19 (65.5)	10 (34.5)	0.12
	2	7 (70)	3 (30)	
	≥3	9 (100)	0 (0)	
Lesion size	≤4	8 (66.7)	4 (33.3)	0.61
	>4	26 (72.3)	10 (27.7)	
Duration of lesion	≤6 month	7 (53.8)	6 (46.2)	0.04
	>6 month	28 (80)	7 (20)	

Discussion

Elevated fasting blood glucose (>120mg/dl) was observed in 27% of CL-studied patients, which is greater than the prevalence of 14.8% of people with diabetes, previously reported in Ethiopia (15). Previously, an institution-based finding in Ethiopia showed the rate of diabetics to be 1.3% (16) and 5% in those aged >35 years (17), although they were not CL patients. In Colombia, the prevalence of people with diabetes people with diabetes in CL patients was 19.3% (18). When we compare studies so far, the percentage of elevated blood glucose levels was much higher in our study participants than in other studies carried out elsewhere, suggesting that continuous inflammation due to leishmaniasis might induce high blood sugar. It was shown that at higher blood glucose levels (13) neutrophils could be superactivated and could result in adverse effects in interfering with the wound healing process as well as in immune function (19). Our findings implicate the effect of leishmaniasis on elevated blood glucose levels; for those aged ≤ 45 years old, blood glucose reading was higher than older people (56%), which is not very common in the general population.

The duration of illness in CL patients and blood glucose were analyzed and indicated that in ≤ 6 months, elevated blood glucose was higher compared to patients who came >6month time. This is probably due to the immune response at the initial time being rampant, affecting the insulin effect in the body. Still, later, as time goes on, the strength of the immune response may decline and may lead to an anergic phase. This phenomenon is supported by research that associated the number of amastigotes in a host cell and possibly a higher number of *Leishmania* per field in lesions of CL patients with DM (13, 20).

Our assumption that CL does hurt internal organs was supported by previous research findings (1). Moreover, it is crucial to incorporate treatment plans that take into account both CL and DM conditions. Studies in various regions have shown comorbidity between CL and diabetes. For example, in Colombia, a study conducted on CL patients revealed that out of 27 individuals, 5 (19.3%) had diabetes mellitus (21). Similarly, a study conducted in Sudan found that 3% of CL patients also had diabetes mellitus (22). In Sri Lanka, researchers showed that 22 patients (17.1%) had both CL and diabetes, indicating the occurrence of this comorbidity across different regions (23). Taken together, these research findings give a strong suggestion for considering the sugar level of CL patients while treating for anti-leishmaniasis because of the potential impact of the disease on the internal organs of the patients (1). Several studies have shown the existence of comorbidity between leishmaniasis and diabetes mellitus in different regions of the world. This emphasizes the importance of developing treatment plans that address both conditions, ensuring comprehensive care for affected individuals.

Among the different types of CL (LCL and MCL), the MCL cases had a higher percentage (31.2%) of elevated blood glucose levels compared to the LCL groups (26.7%). This difference in blood glucose levels could be attributed to the up-regulated immune response seen in MCL cases than in LCL, which is defined by the higher production of cytokines and chemokines (24, 25). This immune response to *Leishmania* infection potentially could harm insulin production and/or its mechanism of action in the end, possibly contributing to elevated blood glucose levels and later increasing the risk of developing diabetes. In Ethiopia, the clinical form, lesion characteristics, and morbidity of CL differ from those in other parts of the Old World (24, 25). Still, the specific reasons for this difference are not well understood. Our study gave one of the possible justifications by studying blood glucose levels about the pathological variation of CL.

The study involved 75 confirmed CL cases from different age groups and both sexes. We found that CL did not show a statistical difference between males and females (P>0.05). Both sexes were infected in comparable numbers, with 42 cases (56%) male and 44% female. However, a study in another area has shown a variation in the distribution of CL between females and males; females accounted for 38.9% of CL burden, whereas males accounted for 61.2% (26). Similarly, a review at the University of Gondar, Ethiopia, found that CL was significantly higher in men (65%) than in women (37%) (27). Quite different from the above studies, in Iraq, the rate of CL infection between males 50.9%) and females (49.1%) was not different (28). These variations could be attributed to differences in healthcare-seeking behavior, which may vary across different countries due to disparities in socioeconomic factors and health literacy. Another research finding reported that the prevalence rate of CL in males was 52%. In comparison, it was 48% in females out of 100 known cases (29), which is consistent between Iraq and our findings. Also a study report from Boru Meda Hospital, Ethiopia (30), the proportions of male (55.3%) and female patients (44.7%) were similar to our observations. In our study, to better understand the burden of leishmaniasis on sex, immunological evidence beyond epidemiological information is required.

In our study, the number of LCL cases was high. In a similar hospital-based study, findings showed that out of 94 CL patients, LCL was 46 cases (48.9%), MCL was 36 cases (38.3%), and DCL was found in 12 cases (12.8%) (29). This suggests that the number of LCL, MCL, and DCL cases may vary in different locations and hospitals. The studies mentioned above were conducted in larger cities and in the hospitals that served as referrals for CL cases.

The occurrence of CL between younger and older age groups was significant (p<0.05). It is higher in age 1-30 years old than other groups. Our finding is in line with previous studies conducted in Iraq (28), where a higher percentage of CL cases were observed in individuals below the age of 40 compared to older age groups (29). Additionally, studies conducted in Boru Meda (30) found younger people being more affected. Similarly, in another study (17), more CL patients were reported from the age groups of 1-15 years. The overall concentration of CL cases was found in the productive age group (31), and this may be due to the increased job activity and proximity to the infection-causing pathogen.

Nine (19%) of reported cases of CL in Ethiopia were found to occur within the same households. In comparison, in Afghanistan, 2.1% of active CL cases and 13.4% of the patients had scars who resided in the same household (32). The clustering of infections within households may be attributed to infected human-to-healthy individuals (33, 34) or genetic susceptibility (35). These findings align with our result, showing the potential for CL to be transmitted through human-to-human transmission, but warrant further investigation to determine whether it is a bite from a newly infected sandfly from outside of houses to a human or a repeated bite from human-to-human transmission in the same household.

In our study, it was observed that farmers and students were significantly more affected by CL compared to individuals in other occupations. This finding is consistent with the results obtained from a study conducted at Boru Meda, which reported that 44.7% of infected individuals were farmers and 24.7% were students (30). Similarly, a study conducted in (36) demonstrated that a higher prevalence of the disease was among farmers (66.8%) and students (21.0%). However, it should be noted that a study conducted in (37) found a different pattern, where students were more affected by CL than in other occupations. The burden of CL in Iraq showed a distinct distribution, with housewives accounting for the highest percentage (23.6%) of cases, followed by students (18.5%), daily workers (9.9%), and farmers (2.7%) were the major ones. The differences observed in the distribution of CL among various occupations and geographical locations can be attributed to several factors. In our case, farmers residing in rural areas may have limited access to healthcare, and outside activity is mostly practiced, thereby increasing their risk of infection. In contrast, the higher prevalence of CL among housewives in Iraq could be explained by hormonal factors, potentially making females more susceptible to infection, but still, it needs clinical investigation.

According to our findings, the ratio of LCL is higher compared to other types of CL. Statistical analysis showed a significant difference between the LCL type and the other categories ($\chi 2$: 48.5; p<0.05). Similarly, other research on CL found that the number of LCL cases exceeded the other forms; LCL accounted for 76 cases, and MCL accounted for 24 cases (29). This difference between LCL and the other types requires further investigation to determine whether host factors contribute to the progression of LCL to MCL and DCL and/or if there are parasite factors that decide the CL type in the host.

In terms of the site of the lesion, our study revealed that 90.3% of the cases had lesions on the face. In a similar study on CL, the head and neck area were reported as the most affected part of the body, with 61 out of 94 cases being located in this region (31). A study conducted in South Ethiopia that aligned with our findings showed that the majority of lesions were found on the face (78%). In comparison, 10% were found on the hands and legs, and 12% were found in multiple sites (29). Similarly, our finding was in line with (37) which reported 78.6% of lesions being on the face (37). Unlike our finding in another study, it was reported that the lesion on the face was 29(34.1%), on the ear lobe 8(9.4%), on the extremities 27(32.7%), and on the neck 6(7.1%) (28). A retrospective study conducted in Sekota, Tefera Hailu Hospital, Ethiopia, also showed a preference for sand fly bites and lesion development in specific areas of the human body; cheek (37.6%), nose (24.8%), and lips (17.3%) (36). Likewise, similar findings also indicated that the lesion involvement is mainly seen on the face, particularly on the cheek and nose (29, 34, and 37). In general, there could be a scientific justification for this observation, as the face has smoother skin compared to other areas, making it more susceptible to damage. Additionally, sandflies may be attracted to the face a region where the nose and mouth exist for gas exchange, where breathing out of CO_2 is an ideal gas acting as a chemo-attractant to sandflies to the face area.

In our study, 35 (74.5%) of CL cases had a lesion size of >4mm^2, which is different from the finding in Sir Lanka, where 82.3% of study participants had a lesion size of size <4cm (25). The study in the Ochollo area, Southern Ethiopia, showed the following lesion size of CL among patients: 17(17%) with lesion size of <1 cm, 78(78%) with lesion size of 1–5 cm, and 5(5%) with lesion size of >5 cm (29). This indicates that in our case, patients are presented with a serious form of the lesion, and they present with larger lesion sizes, bigger than lesions among CL patients in Ochollo and other related findings. This could be the difference in *Leishmania* parasite between Ochollo and Nefas Mewcha, and/or the presence or absence of RNA virus within *Leishmania*. However, additional research that focuses on lesion size is important.

In our study, we observed that 61% of the cases had one lesion, while 16.7% had more than two lesions. This finding aligns with a previous study conducted by (30), and (37), the lesion number having one was 61%, 19.5% had two lesions, and 16.2% had more than two lesions. In comparison with our findings, a study by (29) showed that 77% of patients had one lesion, and 23% had two or more lesions. At Boru Meda Hospital, 59.6% of CL patients had one lesion, 31.2% had two lesions, and 9.2% had three lesions. On the other hand, a study by (28) reported that 67.1% of CL patients had one lesion, 19.3% had two lesions, and 13.6% had three and above lesion numbers. Generally, the number of lesions plays a role in determining the success of treatment (28).

In our work, lymph node enlargement was seen in 3 (7.5%) CL patients. However, a study conducted in Sudan reported 11% of the patients as having lymph node involvement (22).

According to our research, the use of traditional medicine in the treatment of CL was observed in 20 patients (43.5%); this is higher than the findings reported by (37), where (28.6%) commonly used traditional medicine. Nevertheless, at Boru Meda Hospital about 61 patients (73.5%) sought treatment from traditional healers (30). Moreover, only 9% of the patients got modern treatment (29). Across all these studies, including ours, it is evident that a large majority of Ethiopians predominantly rely on traditional practices for treating CL. This practice challenges the prevention and control of the disease. Deviation from appropriate treatment methods can lead to disease progression, resulting in a decline in patient-related quality of life. It is crucial to address these challenges and promote the use of modern treatment approaches to manage and control CL effectively.

Conclusion

The study revealed that more than one-fourth of CL patients had elevated glucose levels, which might worsen the disease's pathology and increase lesion severity. A substantial proportion of CL patients used traditional medicine and delayed seeking treatment for anti-leishmaniasis.

Furthermore, an in-depth study is required to understand the cause-and-effect relationship between CL and DM. This particular aspect should be thoroughly covered to gain a comprehensive understanding of the condition and to organize effective and tailored treatment plans accordingly. Proper documentation regarding the physiological and systemic changes caused by leishmaniasis is equally important.

Limitations of the study

The study used a small sample size, which limits its definitive and general conclusion about CL and its relationship with blood glucose levels, traditional self-medication, and other clinical characteristics of CL patients. Further study with a large sample size needs to be done at multiple sites with case and control design types for the study of cause and effect relationships.

Abbreviations

CL: Cutaneous Leishmaniasis
DM: Diabetic Mellitus
L: Leishmania
RNA: Ribonucleic Acid
LCL: Localized cutaneous leishmaniasis
MCL: Mucosal cutaneous leishmaniasis
DCL: Diffuse cutaneous leishmaniasis
WHO: World Health Organization

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Consent and Ethical Considerations: Every patient asked to be part of the study. The researcher read in the local language what would be done and asked for their agreement in written form. To conduct this research, ethical clearance, and a support letter were given from Amhara Public Health Institute. The study hospital management, medical service head, and different staff who were part of the management were informed about the research the protocol was presented to them. Patient-related information was kept anonymous and never passed to another party.

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