Assessment on the Prevalence and Associated risk factors of Cutaneous leishmaniasis among patients visiting Boru Meda hospital, Dessie town, Northeast Ethiopia

By

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List of Acronyms

AIDS	Acquired immuno deficiency syndrome
BMH	Boru Meda Hospital
CDC	Centers for Disease Control and Prevention
CL	Cutaneous leishmaniasis
DCL	Diffused cutaneous leishmaniasis
DNA	Deoxyribo nucleic acid
HIV	Human Immunodeficiency Virus
L. *aethiopica*	*Leishmania aethiopica*
L. donovani	*Leishmania donovani*
L. major	*Leishmania major*
L. mexicana	*Leishmania mexicana*
L. tropica	*Leishmania tropica*
LCL	Localized cutaneous leishmaniasis
SNNPRE	Southern Nations, Nationalities and Peoples' Region of Ethiopia
SPSS	Statistical Package for Social Sciences
WHO	World Health Organization

Abstract

Cutaneous leishmaniasis is the most common form of leishmaniasis, but it is a neglected tropical disease that mainly affects the poorest populations of the world since they live in poorly constructed houses, migration to endemic areas of cutaneous leishmaniasis infection because of famine, have poor waste management system and the likes. This study aimed at determining the prevalence and associated risk factors of cutaneous leishmaniasis among the community who visited Boru Meda Hospital (BMH) skin treatment department, in Dessie town, northeastern Ethiopia. The study was conducted from November 1, 2017 to May 31, 2018. The study used a retrospective study design that employed descriptive quantitative study techniques to assess the prevalence of cutaneous leishmaniasis in the study area from January 1, 2012 to May 31, 2018. In addition to this primary data were collected from skin patients using a questionnaire. The study population was those individuals, who visited the hospital for cutaneous cases and data of cutaneous leishmaniasis positive individuals from which were recorded at the hospital. For primary data collection 354 individuals were included in the study by convenient sampling technique. Statistical analysis was carried out using the SPSS IBM version 20 software. The overall prevalence of cutaneous leishmaniasis from January 1, 2012 to May 31, 2018 was 1.5% and there was increasing trend with year of examination. All localized, diffused and mucosal cutaneous leishmaniasis were observed. Dessie town had the highest prevalence of cutaneous leishmaniasis infection with 291(32.8%) patients out of 888 cases. Cutaneous leishmaniasis positivity in males was 61.1%) and 38.9% in females. Lack of knowledge about cutaneous leishmaniasis (AOR=3.911,95% CI=1.344-11.383, p=0.012), living in houses constructed with mud and grass (AOR=4.199, CI=1.676-10.517, p=0.002), presence of cracks in walls of houses(AOR=3.154,CI=1.412-7.043,p=0.005,sleeping on the floor(AOR=9.882,CI=2.66016.709, p=0.000),lack of using bed net during sleeping(AOR=8.829,CI=3.824-8.689, p=0.000),presence of trees (AOR=5.210, CI=2.21112.277, p=0.000) and irrigation areas near houses(AOR=8.102, CI =1.879-12.436, p=0.000), presence of dogs, rats and other animals in the compound or living houses(AOR= 2.272, CI=1.003-5.140,p=0.049) and travel to cutaneous leishmaniasis endemic areas(AOR=13.969, CI=4,401-14.338, p=0.000) were significantly associated risk factors with cutaneous leishmaniasis.

Keywords: Leishmaniasis, prevalence, risk factors, sand fly.

1. Introduction

1.1 Background

Leishmaniasis is a group of diseases caused by obligatory and intracellular haemophlagellated protozoan parasites of the genus *Leishmania*. Human leishmaniasis is a complex disease with many clinical forms, which range from mild self-healing cutaneous sores to fatal visceral disease. Leishmaniasis is transmitted by the bite of female *phlebotomine* sand flies. Cutaneous leishmaniasis is a neglected tropical disease strongly associated with poverty with an adverse health effects over the poorest populations of the world. This is because poverty increases its burden as a result of increasing migration, regional climatic change and impaired community resulting from malnutrition and /or HIV/AIDS (Hunt et al., 2007).

Cutaneous leishmaniasis exists in 88 countries with 1.5 million new cases per year. The world Health Organization has announced leishmaniasis as the sixth most significant disease in tropical and sub-tropical areas. Almost all the cutaneous cases (90%) occur in only seven countries, that is, Iran, Afghanistan, Algeria, Brazil, Peru, Syria and Saudi Arabia (WHO,2017).

In Africa and in most developing countries of the world, there is a prevalence of a wide range of infectious and communicable diseases, opportunistic infections, as well as other vector borne diseases and zoonosis (Hattingh, 2006).

In Ethiopia both Cutaneous and Visceral leishmaniasis are endemic and becoming a major concern (Edessa *et al*., 2008). Cutaneous leishmaniasis occurs in highlands of Ethiopia. Transmission occurs in Kutaber woreda (South Wollo Zone), Aleku (Wollega) and Ochollo (Gemu Gofa). The disease produces chronic ulcerative lesion on the face, arms and legs. Apart from its determining health effect, the interaction of cutaneous leishmaniasis leaves a disfiguring scar on the patient's body, which permanently leads to a lifelong stigma and discrimination (Yanik *et al*., 2004). Similarly, (Kassi et al., 2008) stated that infection of cutaneous leishmaniasis may cause psychological disorder and restricts social participation. As a result, the disease creates very great psychosocial impacts on the patient's life when compared to other infectious diseases, which have the highest morbidity rate in Africa like malaria and HIV/AIDS (Cooke, 2009). The majority of cutaneous leishmaniasis cases in Ethiopia are caused by Leishmania aethiopica (Lemma *et al*.,
1969) and (Lindtjorn, 1981) with rare cases caused by *L. major and L. tropica* (Fuller *et al*., 1979).

Cutaneous leishmaniasis is known to exist in Ethiopian highlands. It causes a disfiguring nature. But, it is among neglected tropical disease affecting the poorest populations in Ethiopia as it is elsewhere. The objective of this study was to assess the status of cutaneous leishmaniasis among patients visiting Boru Meda hospital (BMH) in Dessie town, northeast Ethiopia.

1.2 Basic research questions

This study was aimed to answer the following questions

- How is the current prevalence of cutaneous leishmaniasis among individuals in the hospital?
- Which groups of people are at high risk of cutaneous leishmaniasis infection?
- What are the associated factors for the prevalence of cutaneous leishmaniasis in the study area?

1.3 Objectives of the study

1.3.1 General objective

The study was aimed to determine the prevalence and associated factors of cutaneous leishmaniasis among the community visiting BMH skin treatment department, in Dessie town, South Wollo zone, Amhara Region, Ethiopia.

1.3.2 Specific objectives

- To determine the prevalence of cutaneous leishmaniasis among individuals visiting BMH from January 1, 2012 to May 31, 2018.
- To identify people with a high risk of cutaneous leishmaniasis.
- To determine the associated factors for the prevalence of cutaneous leishmaniasis in the study area.

1.4 Significance of the study

The findings of the study will be very significant in understanding the status, knowledge, and related issues on cutaneous leishmaniasis disease within the community in the study area. It also raises awareness and sharing trends within the community about the prevalence and control strategies of cutaneous leishmaniasis infection. The study will also serve as a base line data for further research in the study area.

2. Literature review

2.1. Types of leishmaniasis

There are three different kinds of leishmaniasis infection, namely, cutaneous leishmaniasis, mucocutaneous leishmaniasis (MCL) and visceral leishmaniasis (VL). Cutaneous leishmaniasis is the most common form of leishmaniasis caused by the Old-World and New-World Leishmania species. The Old-World species are *Leishmania major, L. tropica* and *L. aethiopica*. In the New World *L. mexicana* is the most common one. It is most common in Afghanistan, Brazil, Iran, Peru, Saudi Arabia and Syria. MCL is the disease of the mucosa membrane and become fatal. It is caused by *L. braziliensis*. This infection is most common in Bolivia, Brazil and Peru. VL infections are often recognized by fever, swelling of the liver and spleen, and anemia. It is caused exclusively by species of *L. donovani* complex. This disease is found in tropical and subtropical areas of all continents except Australia and is most common in Bangladesh, Brazil, India, Nepal and Sudan (Wikipedia, 2018).

2.2. Epidemiology

2.2.1 Cutaneous leishmaniasis in the world

Cutaneous leishmaniasis is currently endemic in 88 countries world- wide. The disease is present in 20 countries in the new-world (South & Central America) and in 68 countries in the Old-world (Europe, Africa, Middle East, Central Asia and the Indian subcontinent). An estimated 500,000 to 1000000 new cases occur annually but only a small fraction of cases; 19%-37% are actually reported to health authorities (WHO, 2014). There are an estimated 12 million cases world-wide. Cutaneous leishmaniasis is the most common form of leishmaniasis and causes skin lesions mainly ulcers on exposed parts of the body, leaving life-long scars and serious disability. About 95% of cutaneous leishmaniasis cases occur in Americans, the Mediterranean basin, the middle east and central Asia. Over two thirds of new cutaneous leishmaniasis cases occur in six countries Afghanistan, Algeria, Brazil, Colombia, Islamic Republic of Iran and the Syrian Arab Republic (WHO, 2007).

It has been estimated that leishmaniasis may have been emerged 50 million years ago, during the Paleogene. The direct evidence that people suffered from this disease came from samples 4000 years old as DNA of *Leishmania donovani* was found in Egyptian mummies from a middle kingdom tomb. The presence of Leishmaniasis was also detected in the facial lesion on ancient skulls from the Atacama Desert in Chili (Tuon and Neto, 2008).

2.2.2 Cutaneous leishmaniasis in Africa

In Africa leishmaniasis is endemic to countries in the North, Central, Eastern and Horn of Africa. The disease is also endemic in West Africa. Since the first published work in Niger in 1911, other cases of leishmaniasis have been reported in West Africa mostly from Mali, Nigeria, Senegal and Cameroon (Wilson and Kweku, 2005).

Cutaneous leishmaniasis is endemic in many parts of Eastern Africa. It was described in Kenya in 1969, and caused by three parasites; *L. major, L. tropica, and L. aethiopica*. The disease occurs in a broad range of settings, ranging from river valleys and semi-arid lowlands to the hills and cliffs of highland plateaus. Cutaneous leishmaniasis is most endemic in the central part of the Rift Valley Province. In April 2009, an outbreak with at least fifty cutaneous leishmaniasis cases were reported from Gilgil district in Rift Valley Province (Njau, 2010). Cutaneous leishmaniasis in North Sudan is caused *by L. major and L. tropica* (Andersen *et al*., 1996). The first case of cutaneous leishmaniasis in North Sudan was described at the beginning of the twentieth century (Kirk and Drew, 1938). The majority of cutaneous leishmaniasis patients now come from Darfur and the central belt (Abdella *et al*., 1973*). Phlebotomine papatasi* has been considered as a possible vector of cutaneous leishmaniasis during the epidemics in central Sudan, where *P. orientalis* is absent (Abdella and Sherif, 1978). Zoonotic cutaneous leishmaniasis caused by *Leishmania major* and
Leishmania tropica are found in many parts of North Africa. Cutaneous leishmaniasis caused by *Leishmania major* is distributed in a belt from Marrakech and Casablanca in Morocco through Algiers in Algeria, Tripoli in Libya to Cairo, Alexandria and to the Sinai in Egypt. On the other hand, cutaneous leishmaniasis due to *Leishmania tropica* is also distributed in a similar belt across North Africa from Canary Islands to Egypt. It is widespread in the urban areas of these countries also *Leishmania tropica* is becoming more common in rural highland villages. Some countries of the region have endemic foci of zoonotic and anthroponotic cutaneous leishmaniasis, which could cause epidemic among non-immune populations if they are involved in the transmission cycle (Kumutai et al., 2009).

2.2.3 Cutaneous leishmaniasis in Ethiopia

Ethiopia is one of the endemic areas for leishmaniasis in the world. The health status in Ethiopia is poor and the population of the country faces high morbidity and mortality rates (Abyot *et al*., 2005). Both Cutaneous and Visceral leishmaniasis are growing health problems in Ethiopia, with endemic areas that are continually spreading. Cutaneous leishmaniasis was first described in Ethiopia by Italian

epidemiologist Martogiilo in 1913. The cutaneous leishmaniasis is endemic in most regions of Ethiopia, particularly in highland areas between 1400-2700m (Balzer *et* al., 1960). It is highly neglected disease. There are an estimated 50000 cases annually, but only 450 cases were reported in 2008.

There are two clinical forms of cutaneous leishmaniasis in Ethiopia: Localized Cutaneous leishmaniasis (LCL) and Diffused Cutaneous leishmaniasis (DCL) were reported in 1960. Currently the incidence of this form is in the highlands of Ethiopia. The LCL is the self- healing form of cutaneous leishmaniasis. The DCL is the non- self- healing form (Abraham, 2010).

Cutaneous leishmaniasis has different vernacular names in different localities of Ethiopia such as "Volvo" in Ochollo, "Finchottu" in central Shoa, "kunchir" in Gojam, Gondor, and parts of Wollo, "Giziwa" in Tigray, "Chewie" in Sodo, "Simbirahalkm" in wellega and "shahegne" in North Shoa (Negera et al. 2008).

Cutaneous leishmaniasis has been extensively studied in the western highlands and Lake Rift valley. The main areas of transmission include the Ochollo focus in the Rift valley escarpment above Lake Abaya, The Kutaber area in the North Eastern Ethiopia plateau near Dessie town, the Aleku area of Wollega zone, the Southwest highlands of Bale and Sidamo, and the Sebeta area near Addis Ababa. The Ochollo area is endemic for the disease with higher prevalence in younger age groups. An outbreak in Silti Woreda of SNNPRE was reported in 2005. A cutaneous leishmaniasis prevalence of 4.8% was recorded, which exceeds prevalence rates previously recorded from Ochollo (Ashford *et al*., 1973).

2.3 Parasitology

2.3.1 The parasite

Cutaneous leishmaniasis is caused by a single-celled protozoan parasite called *Leishmania*. Leishmania parasites exist as two forms: a small rounded form known as amastigotes living in the cells of vertebrate host, and an elongated form called promastigotes that moves with a flagellum and lives in the insect that transmit the disease. Promastigotes multiply freely in the gut of the sand fly and in culture medium (WHO, 2014). More than 20 different species of Leishmania can cause disease in humans. In Ethiopia *Leishmania aethiopica* is the most common species that causes the disease.

Leishmaniasis is a vector-borne disease that is transmitted by sand flies and caused by obligate intracellular protozoa of the genus *Leishmania*. Human infection is caused by about 21 of 30 species

that infect mammals. These include the *L. donovani* complex with 2 species (*L. donovani*, *L. infantum* [also known as *L. chagasi* in the New World]); the *L. mexicana* complex with 3 main species (*L. mexicana*, *L. amazonensis*, and *L. venezuelensis*); *L. tropica*; *L. major*; *L. aethiopica*; and the subgenus *Viannia* with 4 main species (*L. braziliensis*, *L. guyanensis*, *L. panamensis*, and *L. peruviana*). The different species are morphologically indistinguishable, but they can be differentiated by isoenzyme analysis, molecular methods, or monoclonal antibodies (CDC, 2013).

Life cycle of Leishmania

The life cycle of *Leishmania* involves two stages. In insect vector, the parasite takes a promastigote form which is characterized by elongated, motile and an extracellular stage, while in vertebrates the parasite is found in amastigote form. The amastigotes are ovoid, non-motile and intracellular stage. The insect vector injects promastigotes into the host's skin and soon after the parasite is taken up by skin macrophages where the promastigotes transform into amastigote form within 12 to 24 hours of inoculation. After transformation, the amastigotes multiply within the macrophage and ultimately the macrophage bursts releasing the amastigotes. This stage is chronic in nature and may continue for months to years and even for the life time without noticeable signs and symptoms, depending upon the host's susceptibility and its immune status. The infective macrophages may remain localized to the skin, as in case of cutaneous leishmaniasis leading to ulcer formation, or may disseminate to other organs, as in VL or to the mucosa as in MCL (Umakant and Sarman, 2008).

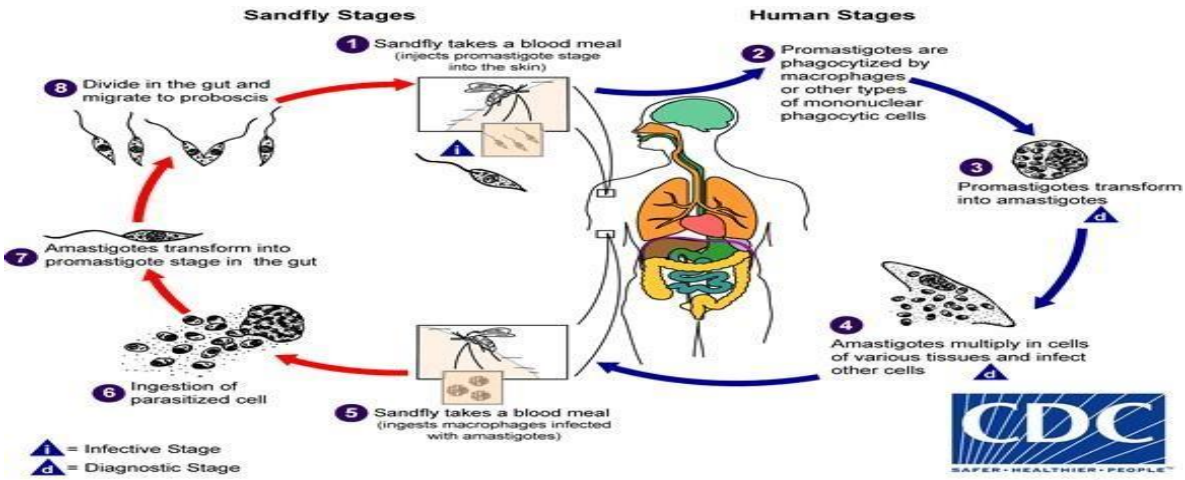

Figure 1. Life cycle of Leishmania

Leishmaniasis is transmitted by the bite of infected female phlebotomine sandflies. The sandflies inject the infective stage (i.e., promastigotes) from their proboscis during blood meals ❶. Promastigotes that

reach the puncture wound are phagocytized by macrophages ❷and other types of mononuclear phagocytic cells. Promastigotes transform in these cells into the tissue stage of the parasite (i.e., amastigotes) ❸, which multiply by simple division and proceed to infect other mononuclear phagocytic cells ❹. Parasite, host, and other factors affect whether the infection becomes symptomatic and whether cutaneous or visceral leishmaniasis results. Sand flies become infected by ingesting infected cells during blood meals (❺, ❻). In sandflies, amastigotes transform into promastigotes, develop in the gut ❼(in the hindgut for leishmanial organisms in the *Viannia* subgenus; in the midgut for organisms in the *Leishmania* subgenus), and migrate to the proboscis
❽.

2.3.2. The vector

Leishmania parasites are transmitted from a vertebrate host to another vertebrate host by a tiny insect vector, the phlebotomine sand fly. Only the female sand fly bites vertebrate animals and can therefore transmit the parasite (WHO, 2014). Over 90 sand fly species are known to transmit leishmania parasite. Sand flies usually are most active during the evening and nighttime hours (from dusk to dawn). Although sand flies are less active during the hottest time of the day; they may bite if they are disturbed. For example, if a person brushes up against the trunks of the tree or other sites where sand flies are resting (Aoun and Bouratbine, 2014).

2.3.3 Reservoir

A number of different vertebrates may be infected with Leishmania. The Leishmaniasis fall into two categories according to the role of human beings in the persistence of the parasite. In the first category, parasites are transmitted from human to human (anthroponotic cutaneous leishmaniasis). When there is no sand fly to assure transmission, parasites can persist for longer periods in humans, who are therefore the “reservoir” of Leishmania. In other situations, reservoir hosts are wild, mainly rodent species (Zoonotic cutaneous leishmaniasis). Cutaneous leishmaniasis in Ethiopia is zoonotic, with a hyrax acting as the main reservoir (Ashford *et al*., 1973).

Leishmaniasis is transmitted by the bite of female sand flies. When the sand fly bites infected skin it makes a pool. With mouth parts, which have cutting and saw-like edges, scratch the tissue of the dermis, which contains several mean phages full of amastigotes, and mix them with blood. By sucking the blood from these pools, they suck not only blood but also damaged tissue of the dermis containing macrophages with amastigotes.

In the mid gut of the sand fly, amastigotes change to promastigotes with flagella and multiply by binary fission. It takes about 5-7 days, depending on temperature of the environment, for promastigotes to almost fill the mid gut and change to their infective form (metacyclic), which migrate to the anterior part of the gut and proboscis. At this stage, the sand fly is infective and when it bites for feeding, it first injects some saliva (to prevent the blood from clotting) along with promastigotes in its mouthparts into the dermis of the new host. Promastigotes injected by this bite change to amastigotes, which are injected by the macrophage of the dermis, the cells in which they live and multiply. In Cutaneous leishmaniasis, it takes several weeks or months until lesion at the site of injection becomes apparent (WHO, 2014).

2.3.4 Parasitological diagnosis

The first steps are to check the symptoms or signs that might be from Leishmaniasis. Laboratory testing by taking tissue specimen from skin sores for cutaneous leishmaniasis or from bone marrow for VL can be examined for the parasite under a microscope, in special cultures (WHO, 2017). The clinical aspect of leisions can be highly suggestive but is not completely specific of the diagnosis of cutaneous leishmaniasis. Differential diagnosis must include infectious and noninfectious conditions. Therefore, it is mandatory to obtain a parasitological confirmation of the diagnosis before engaging in a systemic, potentially highly toxic anti leishmaniasis treatment. The same procedure is recommended before engaging in a local treatment (WHO, 2014).

2.3.5 The Biology and control of *Leishmania* vectors

Like all true flies, sand flies undergo complete metamorphosis and exhibit four complete life stages egg, larva, pupa and the adult. Unlike mosquitoes the immature stages do not require standing water to complete development also they do require relatively warm, moist environments. These requirements are often provided by animal burrows, so the sand flies are frequently found near rodent habitations. Sand fly eggs are laid in a suitable habitat by the female adults. Time to hatch is highly temperature dependent but average 6 to 17 days. The eggs are usually laid in a mass of high organic content and soil, provided the newly emerged larvae with shelter, moisture and nutrition. Adult sand flies are about one-third the length of a small mosquito, usually less than 3.5 millimeter in length. They are covered with dense hairs and hold their wings in a characteristics V-shape over their backs when at rest. Mouthparts are short, dagger-shaped and oriented downward. Both male and female sand fly adults obtain carbohydrate nutrition from plant juices; however, most females also require at least one blood meal in order to complete development of egg batches. Acquisition of disease agents is

therefore incidental to blood meal. Sand flies are very susceptible to dehydration, so most are nocturnal. They seek shelter in animal burrows, tree buttresses or holes, caves, rocks and other protective habitats, including human habitations. They may also occur in the earthen floors of human habitations (David M Claborn, 2010).

2.3.6 Risk factors associated with leishmaniasis

The increased leishmaniasis incidence is mainly attributed to several risk factors including environmental conditions, human behavior, socioeconomic status, immunogenic profile and genetic factors (Votýpka *et al*., 2014). Important environmental risk factors including living house with cracked mud or thatched plastered house walls, dump earth floors, sleeping on floor or outside and vegetation near house can facilitate sand fly survival and enhance vector abundance via providing diurnal resting places, breeding sites and humidity (Reithinger *et al*., 2010). Sand flies can hide in cracks and fissures in the un-plastered house walls, ceiling or floor (Coura Vital WI *et al*., 2013). Sleeping outside especially during summer months without bed nets can place people at risk of sand fly exposure.

Factors such as low educational level and socioeconomic concerns reflect the increased risk of leishmaniasis, for example it can increase sand fly access into poorly built houses, and human exposure to infected sand flies (Ghatee *et al*., 2013). Moreover, poor housing and sanitary conditions such as lack of waste management and open sewage can increase breeding of flies and their access to people (Dawit *et al*., 2013). Natural disasters like earthquakes can exert dramatic effects on creation of breeding places for sand flies, the abundances and proportion of the vectors, and transmission of the parasite (Sharifi *et al*., 2011). Presence of dogs and rodents are regarded as the most important risk factors for cutaneous leishmaniasis transmission (Belo *et al*., 2013). Presence of animals, mostly cows, can increase the prevalence of leishmaniasis cases via increasing the density of sand flies around houses, as their dung provides a rich environment for the sand flies, drawing the vectors into closer association with humans and increasing the risk of their being bitten (Bern *et al*., 2010).

2.3.7 Prevention

The lack of a vaccine or chemoprophylaxis limits the option for prevention of Leishmaniasis. The available tools include elimination of reservoir populations and some forms of vector control, including barriers to sand fly feeding. In order to reduce disease risk significantly, a reservoir population should be eliminated inside a 500-meter radius of a protected area (Kassi *et al*., 2008). Techniques used against mosquitoes are inappropriate for sand fly control because the aqueous habitat

of the mosquito larva is very different from the highly organic soil requirement of sand fly immature stages. One possible exception is the use of *Bacillus sphaericus* for sand fly larval control (Robert *et al*., 1997). In this innovative technique, bait-feed adults were used to carry the bacterial control agent to larval habitats in an animal burrows, resulting larval mortality in burrows up to 10 to 30 meters away from the baited solution.

2.3.8 Treatment

The treatment of leishmaniasis depends on several factors including type of disease, parasite species and geographical location. Leishmaniasis is a treatable and curable disease. All patients diagnosed as VL require prompt and complete treatment.

For a cutaneous leishmaniasis, cryotherapy is available in most district level hospitals. In some major hospitals with functional dermatology units, topical therapy with sodium stibogluconate is provided (Herath, 2015). Many different therapeutic interventions, including local systemic and physical treatments (example cryotherapy, thermotherapy), have been used and tested in cutaneous leishmaniasis. The infecting species, geographical region and immune status of the patient affect the efficiency of treatments. Cutaneous leishmaniasis is not a life-threatening condition and sever complications are infrequent. However, as superficial secondary infections may complicate ulcerated cutaneous leishmaniasis, it is important to clean lesion. The recommended drug or treatment approach in cutaneous leishmaniasis should not induce life threatening complications; however, in severe cases; the risk benefit ratio is different. The treatment decision is based first on the risk benefit ratio of the intervention for each patient (for the recommended step-wise approach to choosing the most appropriate treatment decisions). To determine which treatment is most appropriate, it is important to collect the clinical information on the following five aspects:

- Size of lesion;
- Number of lesions;
- Location of lesion on the body;
- Evolution of the lesions: duration, aggravation (active lesion), improvement (self-healing);
- Immunological and general health status of the patient: immunocompromised or not diabetes, heart, liver or kidney trouble. In all patients, lesions should be washed with clean water and soap, then the lesion should be covered by a dressing (gauze and tape) and changed three or four times per week. This facilitates healing and prevents the creation of a sticky crust (WHO, 2014).

3. Materials and Methods

3.1. The study area and period

This study was conducted in Dessie Town at Boru Meda Hospital which is 10 km to the northeast direction of the center of the town and it is located in the northeastern part of Ethiopia about 411 kilometers away from Addis Ababa and 470 kilometers from Bahir Dar. It was established by Sudan interior mission in 1955 G.C. Boru Meda is located at $11^{0}07'21.33"N,39^{0}38'05.87"$ E with an elevation of 2706 meters (8878 ft.) above sea level. The hospital provides services in different departments; one of which is skin disease treatment including cutaneous leishmaniasis infection.

The study was conducted from November 1, 2017 to May 31, 2018 at BMD.

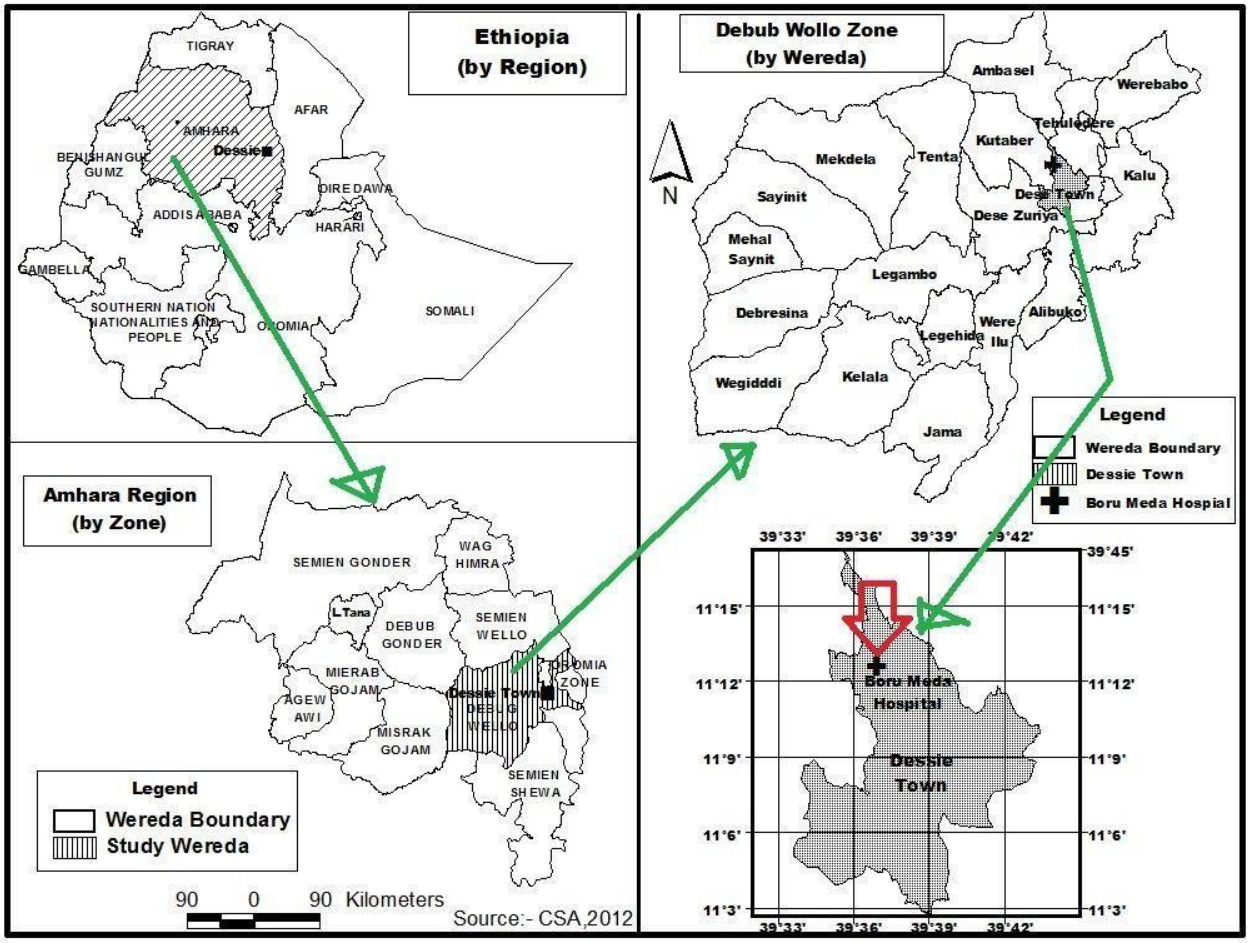

Figure 2. Map of the study area

3.2 Research design

This research focused on assessing the prevalence of cutaneous leishmaniasis and associated risk factors on this disease. In the study the researcher assessed the status of prevalence of cutaneous leishmaniasis and associated risk factors of the disease. The study used a retrospective study design that employed descriptive quantitative study techniques. In addition to secondary data primary data

were collected from skin patients using questionnaire. The retrospective study was used to assess the prevalence of cutaneous leishmaniasis in the study area from January 1, 2012 to May 31, 2018. The primary data that were obtained from questionnaires filled by skin patients have been used to assess associated risk factors for cutaneous leishmaniasis infection.

3.3 Sources of population

The sources of the study population were all groups of individuals that visited BMH of cutaneous medical treatment department.

3.4 Study population

The study population for the retrospective data was those individuals who visited the hospital for cutaneous cases and data of cutaneous leishmaniasis positive individuals that were recorded at the hospital from January 1, 2012-May 31, 2018. For the primary data collection, the study population was those individuals who visited the hospital for cutaneous cases from November 1, 2017 to May 31, 2018.

3.5 Inclusion and exclusion criteria

The retrospective data collection included all individuals who were examined in the hospital skin treatment department from January 1, 2012 to May 31, 2018. For primary data collection, 354 patients were included by convenient sampling technique. The researcher went to the hospital once in a week. Those skin patients that were present in that day were included and allowed to fill the questionnaire and the rest that were treated in the other days had been excluded from the study.

3.6 Methods of data collection

Leishmaniasis epidemiological data form the period of January 1, 2012 to May 31, 2018 were collected from BMH as BMH is recognized center for the treatment of leishmaniasis in the South Wollo. Data were generated from primary and secondary sources. Secondary data were collected from review of instructional records in the hospital from January 1, 2012 to May 31, 2018. For primary data collection questionnaires were adopted and modified from different literatures. The prepared questionnaire was translated first into Amharic and back translated into English to assure its consistency. Then it was administered to patients who came to the hospital for cutaneous leishmaniasis and other skin diseases treatment purposes. The collected data were checked for completeness, accuracy, clarity, and consistency. Before analysis was carried out the questionnaires were checked by reading. 354 individuals were included in the study by convenient sampling technique. The study was conducted from November 1, 2017 to May 31, 2018.

3.7 Sample size and sampling technique

It is impossible to get all individuals in the same area at the same time. Therefore, convenience sampling technique was used to collect data from the hospital. The retrospective data included all cutaneous leishmaniasis patients who were treated in the hospital from January 1, 2012 to May 31, 2018. 354 skin patients were included for primary data collection by convenience sampling technique.

3.8 Study variables

3.7.1 Dependent Variables: - CL prevalence status

3.7.2 Independent variables: - Socio-demographic variables such as age, sex, knowledge, environmental factors and human activities.

3.9 Data analysis and interpretation

Data obtained from various sources were analyzed using descriptive quantitative data analysis techniques. Univariate and multivariate logistic regression analysis techniques at 95% confidence intervals were used. Statistical significance was at P-value less than 0.05. All statistical analysis was carried out using the Statistical Package for Social Sciences (SPSS) IBM version 20 software. For analysis of the total prevalence of cutaneous leishmaniasis results were expressed in Tables, percentages, numbers and for description as appropriate.

3.10 Ethical considerations

Letter of permission to conduct the study was obtained from Addis Ababa University. Based on this letter additional permission was obtained from the administrators of BMH. Informal verbal consent was obtained from each study participants after the researcher clearly described the purpose, benefits and risks of the study. Any information concerning the participants was kept confidential and the data collected from the participants were only analyzed for the intended purposes.

4. Results

4.1 Cutaneous leishmaniasis prevalence by sex and age

In the past six and half years (January1, 2012 – May 31, 2018) a total of 58,163 people were examined in the skin treatment department of BMH. Of this, 29,704 were males and 28,459 females (male to female ratio is nearly 1:1). The total prevalence of cutaneous leishmaniasis was 1.5% with 543(1.8%) males and 345(1.2%) females (Table 1). The proportion of male cutaneous leishmaniasis positive patients was slightly higher than that of females. The rate of cutaneous leishmaniasis greatly increased from 0.94% in 2012 to 3.5% in 2018. Overall as well as throughout, more males were examined for skin problem except slightly higher females in the last two years (2016 and 2017) (Table 1). Among the positives (n=888), 543(61.1%) were males and 345(38.9%) females. This shows greater variation compared to the overall cutaneous leishmaniasis positivity in relation to sex as stated above. There was higher prevalence of cutaneous leishmaniasis positivity in males than in females in all years examined.

Table 1. Prevalence of cutaneous leishmaniasis among patients who visited BMH skin treatment department from January 1, 2012 to May 31, 2018

Year	Examined individuals			CL positive			Prevalence (%)		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
2012	2327	2016	4343	26	15	41	1.11	0.74	0.94
2013	3363	3129	6492	27	14	41	0.80	0.45	0.63
2014	3181	2644	5825	34	13	47	1.06	0.49	0.80
2015	4779	4102	8881	29	23	52	0.60	0.56	0.58
2016	4664	4683	9347	38	30	68	0.81	0.64	0.72
2017	7507	8014	15,521	221	149	370	2.96	1.86	2.40
2018*	3883	3871	7,754	168	101	269	4.30	2.60	3.50
Total	29,704	28,459	58,163	543	345	888	1.80	1.20	1.50

BMH: Boru Meda hospital; CL: Cutaneous leishmaniasis; *2018 data was only up to May.

The total percentage of cutaneous leishmaniasis positive individuals was different in each category of age groups. Among the positives males under age 5 were 5.5% age group 5-14 were 19% and 15 or greater than 15 were 75.5%. Females under age group less than 5 years were 7% age group514 were 24.4% and age group 15 & greater than 15 were 68.7% (Table 2). There was higher prevalence of

cutaneous leishmaniasis positivity in age groups of 15 years and above of both sexes, that is, from the positives (888) males were 75.5% and females=68.7%.

Table 2. Cutaneous leishmaniasis in different age and sex groups among patients who visited BMH skin treatment department between January 1, 2012 and May 31, 2018

Age (year)	Sex	Year							
		2012, n(%)	2013 n(%)	2014 n(%)	2015 n(%)	2016 n(%)	2017 n(%)	Up to May 2018, n(%)	Total n(%)
<5	Male	1	1	1	4	0	16	7	30
	Female	0	1	0	1	3	12	7	24
Total		1	2	1	5	3	28	14	54
5-14	Male	7	6	6	4	7	47	26	103
	Female	2	2	4	5	7	45	19	84
Total		9	8	10	9	14	92	45	187
>14	Male	18	20	27	21	31	159	134	410
	Female	13	11	9	17	20	92	75	237
Total		31	31	36	38	51	215	209	647
Overall	Male	26(1.11)	27(0.8)	34(1.06)	29(0.6)	38(0.81)	222(2.96)	167(4.3)	543(1.8)
	Female	15(0.74)	14(0.45)	13(0.49)	23(0.56)	30(0.64)	149(1.86)	101(2.6)	345(1.2)
Total		41(0.9)	41(0.6)	47(1.3)	52(0.6)	68(0.7)	370(2.4)	269(3.5)	888(1.5)

4.2 Patient residence

The cutaneous leishmaniasis cases recorded in the hospital were from 35 different localities/woredas including Dessie town. Most of the woredas (25) are found in South Wollo zone and second higher number of the patients were from (10) different woredas of North Wollo and North Shoa, Bati and Kemissie which share border with South Wollo. There is a significant variation of cutaneous leishmaniasis prevalence amongst the different woredas (p–value, Dessie=0.006, Kutaber=0.059, Tewlederie=0.233, Delanta=0.159, Dessie Zuria=0.625, Ambasel=0.132, Kalu=0.133 and other South Wollo areas=0.077). The proportion of cutaneous leishmaniasis cases from Dessie town was the highest (291(32.8%) from all the other areas (Table 3). Kutaber (183(20.6%) and Tewlederie 72(8.10%) woredas are the second and the third high burden areas respectively. Significantly high burden of cutaneous leishmaniasis infection was observed in Delanta, Dessie Zuria, Tenta, Borena, Kombolcha, Mekdella, Woldia, Kalu, Woreilu, Albuko and Legambo. The least cases were recorded in Bati, Wadella, Legehida, Meket, Alamata, Lalibella, Stayish, Wogdi, Efratanagdim, Dawnt, Gubalafto, Mehalsayint, Kelella, Wadella, Haik and Kobo (Table 3).

Table 3. Cutaneous leishmaniasis cases among patients who visited BMH skin treatment department from January 1, 2012 to May 31, 2018 in relation to their residence

Woreda Meket	**Frequency**	**Percent**
	1	0.1
Stayish	2	0.2
Bati	2	0.2
Legehida	2	0.2
Kobo	2	0.2
Alamata	3	0.3
Lalibella	3	0.3
Efratanagdim	4	0.5
Wogdi	4	0.5
Dawint	5	0.6
Wadella	5	0.6
Mehal saint	5	0.6
Gubalafto	6	0.7
Kelella	6	0.7
Kemissie	7	0.8
Haik	8	0.9
Antsokia	9	1.0
Jamma	9	1.0
Worebabo	9	1.0
Habru	9	1.0
Woldia	11	1.2
Mekdella	12	1.4
Woreilu	12	1.4
Albuko	12	1.4
Legambo	12	1.4
Tenta	15	1.7
Borena	16	1.8
Kombolcha	21	2.4
Kalu	23	2.6
Delanta	32	3.6
Ambasel	37	4.2
Dessie Zuria	38	4.3
Tewlederie	72	8.1
Kutaber	183	20.6
Dessie	291	32.8
Total	888	100.0

4.3 Repeated and new cutaneous leishmaniasis cases

Among patients of cutaneous leishmaniasis who were examined in the hospital most (521(58.7%) were new cases. Of these, 318(58.56%) were males and 203(58.84%) females. The rest were new

cases whereas 367(41.3%) were previously treated cases. That is, males and females who took treatment more than once in the hospital for cutaneous leishmaniasis were respectively 225(61.3%) and 142(38.7%).

The number and proportion of newly (once) and repeatedly treated individuals in the hospital had shown variation with year of examination. Specifically; 68.3, 75.61, 74.1, 71.5, 80.9, 54.9, 49.1% attended treatment once and 31.7, 24.4, 25.5, 28.9, 19.1, 45.1,50.9% of the patients came and got treatment more than once during the study period from 2012 to May 2018 respectively. The data showed that more repeat cases were observed in 2017 and 2018 up to May 31 than the rest years (Table 4).

Table 4. New and repeat cases of cutaneous leishmaniasis among patients who were treated at BMH skin treatment department from January 1,2012 to May 31, 2018

CL cases	**Year of examination**																
	2012		2013		2014		2015		2016		2017		2018		Total		Overall
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	
Repeat	8	5	7	3	9	3	10	5	7	6	90	77	94	43	225	142	367
New	18	10	20	11	25	10	19	18	31	24	131	72	74	58	318	203	521
Total	26	15	27	14	34	13	29	23	38	30	121	149	168	101	543	345	888

CL: cutaneous leishmaniasis; F: female; M: male

The data showed that the majority of the cutaneous leishmaniasis cases amongst the patients were localized, particularly at the nose and cheek of the body. Out of the 888 patients, 792(89.2%) were LCL, 35(3.9%) DCL and 61(6.9%) were MCL cases.

4.4 Socio-demographic risk factors for cutaneous leishmaniasis

The questionnaire data showed that out of 354 respondents, 216(61.0%) were males and 138(39.0%) females. Twenty-four (6.8%) of the respondents were the parents of under 5 children, 52(14.7%) 5-14 years and the rest 278(78.5%) of were 15 and above years. Most (141) of the respondents were secondary school students, 89 at primary school, 72 joined college and university education and the rest 52 were illiterates. Hundred seventy-nine of the respondents (50.6%) were cutaneous leishmaniasis positive (111 males and 68 females). Most (76 or 42.5%) of the cutaneous leishmaniasis positive individuals were secondary school students, 34(19.0%) illiterates, 45(25.14%) primary school attending and the rest 24(13.40%) had tertiary education (Tables 5 and 6).

Out of the respondents (354), 197(55.7%) were students, 54(15.3%) farmers, 52(14.7%) civil servants and 51(14.4%) merchants; cutaneous leishmaniasis positive individuals were 103(52.3%), 37(68.5%), 17(32.7%) and 22(43.1%) respectively. The data showed that cutaneous leishmaniasis cases were greatest in farmers and least in civil servants.

4.5 Cutaneous leishmaniasis risk factors

Only 83 respondents knew what cutaneous leishmaniasis meant and only 34 had knowledge about its transmission. Among the respondents 116(32.8%) said their living houses were built from muddy and grassy materials and 183(51.7%) were living in houses with cracked walls and only 53(14.9%) of the respondents lived in houses with moist floors. Concerning sleeping outside under a tree, only 36(10.2%) agreed that they sleep outside. The majority (318 (89.8%) sleep inside. Only 27(7.6%) of the respondents responded that they use bed nets. There were dogs and rats in the compounds or houses of 248(70.1%) of the respondents. While 238(67.2%) of the people had cows and other animals, 93(26.3%) were living near irrigation areas, 54(15.3%) were living near open sewage areas and 54(15.3%) had travelled to cutaneous leishmaniasis endemic areas.

Table 5. Univariate logistic regression analysis of associated risk factors in relation to CL positivity at BMH, Dessie town, Northeast of Ethiopia, from November 1, 2017 to May 31, 2018

Variable	Alternatives	N	Pos (%)	COR	95% CI	P-value
Gender	Male	216	111(51.4)	0.919	0.599-1.409	0.698
	Female	138	68(49.3)			
Age (year)	<5	24	3(12.5)			
	5-14	52		1.162	0.631-2.140	0.629
	≥15	278	16(30.8) 160(57.6) 80(58.4)	1.538	0.957-2.619	0.074
Residence	Dessie	137		3.860	1.170-12.734	0.027
	Kutaber	79	46(58.2)	3.833	1.122-13.097	0.032
	Tewlederie	34	17(50.0)	2.750	0.729-10.369	0.135
	Delanta	23	9(39.1)	1.768	0.428-7.299	0.431
	Dessie Zuria	19	5(26.3)	0.982	0.212-4.553	0.982
	Ambasel	18	7(38.9)	1.750	0.396-7.732	0.460
	Kalu	12	2(16.7)	0.550	0.082-3.682	0.538
	Other South Wollo areas	17	9(52.9)	3.094	0.698-13.711	0.137
	South Wollo border areas	15	4(26.7)	-	-	
Education	No formal schooling	52	34(65.4)	3.778	1.780-8.078	0.001
	Primary school education	89	45(50.6)	2.045	1.078-3.889	0.029
	Secondary school	141	76(53.9)	2.338	1.294-4.224	0.005
	Tertiary education	72	24(33.3)	-	-	
Occupation	Civil servant	52	17(32.7)	-	-	
	Farmer	54	37(68.5)	4.481	1.982-10.131	0.000
	Merchant	51	22(43.1)	1.562	0.701-3.482	0.276
	Student	197	103(52.3)	2.258	1.186-4.293	0.013
Know what CL is	Yes	83	27(32.5)	-	-	
	No	271	152(56.1)	2.649	1.578-4.448	0.000
Know CL transmission	Yes	34	5(14.7)	-	-	
	No	320	174(54.4)	6.912	2.609-18.312	0.000
Know factors related with CL	Yes	32	5(15.6)			
	No	322	174(54.0)	6.349	2.385-16.900	0.000
Muddy-grassy houses	Yes	116	85(73.3)	4.200	2.582-6.832	0.000
	No	238	94(39.5)			
Wall cracks	Yes	183	122(66.7)	3.899	2.508-6.061	0.000
	No	171	57(33.3)			
Moist Floor	Yes	53	36(67.9)	2.840	1.259-4.348	0.007
	No	301	143(47.5)			
On-floor sleeping	Yes	47	42(89.4)	10.423	4.014-7.064	0.000
	No	307	137(44.6)			
Bed net use	Yes	27	4(14.8)			
	No	327	175(53.5)	6.620	2.240-9.56	0.001
Trees near house	Yes	244	147(60.2)	3.694	2.275-5.998	0.000
	No	110	32(29.1)			
Sleeping outside under a tree	Yes	36	23(63.9)	1.837	.899-3.755	0.095
	No	318	156(49.1)			
Open sewage around house	Yes	54	37(67.5)	2.422	1.306-4.490	0.005
	No	300	142(47.3)			
Irrigation areas near house	Yes	93	84(90.3)	16.309	7.842-13.917	0.000
	No	261	95(36.4)			
Travelled to CL endemic areas	Yes	54	46(85.2)	7.220	3.295-15.822	0.000
	No	300	133(44.3)			
Dogs and rats inside house	Yes	248	137(55.4)	1.881	1.184-2.987	0.007
	No	106	42(39.6)			
Cows and other animals inside the house	Yes	238	142(59.7)	3.158	1.977-5.046	0.000
	No	116	37(31.9)			

Note: n: number, Pos: positive, COR: crude odds ratio, CI: confidence interval, significant at $p<0.05$, CL: Cutaneous leishmaniasis

Table 6. Multivariate logistic regression analysis result of risk factors for cutaneous leishmaniasis positivity at BMH, Dessie town, northeast Ethiopia, November 1, 2017 to May 31, 2018

Variable	Alternatives	n	Pos in %	AOR	95% CI	P-value
Residence	Dessie	137	80(58.4)	12.232	2.249-11.628	0.006
	Kutaber	79	46(58.2)	11.648	0.909-9.208	0.059
	Tewlederie	34	17(50)	5.141	0.348-7.882	0.233
	Delanta	23	9(39.1)	6.975	0.467-10.259	0.159
	Dessie Zuria	19	5(26.3)	2.150	0.099-6.544	0.626
	Ambasel	18	7(38.9)	10.188	0.498-8.470	0.132
	Kalu	12	2(16.7)	10.418	0.492-9.783	0.133
	Other South Wollo areas	17	9(52.9)	11.624	0.757-10.412	0.077
	South Wollo border areas	15	4(26.7)			
Educational	No formal schooling	52	34(65.4)	4.425	0.780-5.094	0.093
	Primary school	89	45(50.6)	0.869	0.896-3.504	0.844
	Secondary school	141	76(53.9)	1.159	0.216-3.504	0.826
	Tertiary	72	24(33.3)			
Occupation	Civil servant	52	17(32.7)			
	Farmer	54	37(68.5)	3.099	0.389-14.673	0.285
	Merchant	51	22(43.1)	2.478	0.393-15.644	0.334
	Student	179	103(52.3)	2.284	0.457-11.419	0.315
Know what CL is	Yes	83	27(32.5)			
	No	271	152(56.1)	3.911	1.344-11.383	0.012
Know CL transmission	Yes	34	5(14.7)			
	No	320	174(54.9)	3.430	0.858-13.720	0.081
Know factors related with CL	Yes	32	5(15.6)			
	No	322	174(54.0)	2.658	0.574-12.311	0.211
Muddy-grassy house	Yes	116	85(73.3)	4.199	1.676-10.517	0.002
	No	238	94(39.5)			
Wall cracks	Yes	183	122(66.7)	3.154	1.412-7.043	0.005
	No	171	57(33.3)			
On-floor sleeping	Yes	53	36(67.9)	1.692	0.691-4.445	0.323
	No	301	143(47.5)			
Bed net use	Yes	47	42(89.4)	9.882	2.660-16.709	0.000
	No	307	137(44.6)			
Trees near house	Yes	27	4(14.8)			
	No	327	175(53.5)	8.829	3.824-8.689	0.000
Sleeping under a tree	Yes	244	147(60.3)	5.210	2.211-12.277	0.000
	No	110	32(29.1)			
Open sewage around house	Yes	54	37(67.5)	2.543	0.943-6.860	0.065
	No	300	142(47.3)			
Irrigation areas near house	Yes	93	84(90.3)	8.102	1.879-12.436	0.000
	No	61	95(36.4)			
Travel to CL endemic areas	Yes	54	46(85.2)	13.969	4.401-14.338	0.000
	No	300	133(44.3)			
Dogs and rats inside house	Yes	248	137(55.2)	2.272	1.003-5.140	0.049
	No	106	42(39.6)			
Cows and other animals inside the house	Yes	238	142(59.7)	1.057	0.440-2.540	0.901
	No	116	37(31.2)			

Note: n: number, Pos: positive, AOR: adjusted odd ratio, CI: confidence interval, significant at p<.05.

5. Discussion

The overall prevalence of cutaneous leishmaniasis among patients who visited BMH skin treatment department from January 1, 2012 to May 31, 2018 was 1.5%. It is much lower than the prevalence that was recoded in Mekele city which was 5.6% (Tilahun *et al*., 2014) and Silti Woreda, 4.82% (Negera *et al*., 2008). The reason for the lower prevalence of cutaneous leishmaniasis at the study area might be due to a number of reasons. Previously, some people follow traditional medication options. Others used to go to the hospital, diagnosed but referred to other hospitals where leishmaniasis treatment service is available as the current hospital was not doing that. However, recently the hospital has started serving cutaneous leishmaniasis patients as any other skin disease cases (personal communication, hospital staff). During the time of study many people were attending the hospital for cutaneous leishmaniasis treatment from different nearby areas. The increased prevalence of cutaneous leishmaniasis cases in 2017 and up to May 2018 corroborates this explanation. The rate of cutaneous leishmaniasis prevalence greatly increased from 0.9% in 2012 to 3.5% in 2018 up to May 31 (Tables 1 and 2).

The overall percentage of cutaneous leishmaniasis positive males was 61.1% and 38.9% females agrees with a report Tigray in Ethiopia (Padovese et al. 2011). Our finding is also consistent with results from Iran (Babak *et al*., 2014) which showed 55.6% males, India males with 55 (Naushin *et al*., 2013) and in Jordan males 72.4% (Hattingh *et al*., 2006). In general, there is strong correlation between gender and incidence of leishmaniasis and the disease is seen more frequently in men than women (reviewed in Kassiri *et al*., 2013). Males appear to have a higher prevalence probably because of environmental exposure to the habitat of the sand fly through occupation and leisure activity, as there is no significant difference in gender attendance to health services. Cultural activities that mostly males are faced with outdoor activities including farming, keeping cattle, stayed around the gorge and/or farm for long period and the presence of endemic sites that mostly males could travel there for work. Other similar research showed that the occurrence of higher prevalence in men than women is logic, because the men work or sleep in populated and infected environments and are exposed to the infected vectors more than women (Moosa-Kazemi 2007). Furthermore, gender difference in cutaneous leishmaniasis incidence may be attributable to sex hormonal effects as it has been observed in some other parasitic diseases too (Bailey and Diana 2007, Rastogi and Nirwan 2007, Brieger 2009). To the contrary, a study conducted in America states that no significant difference was found between males and females, that is, males 52.0% and females 48.0% (Zaida *et al*., 2003) suggesting that they

are equally exposed to infection. This clearly demonstrates the variation in activities males and females are involved in industrialized countries like America in contrast to Ethiopia and other developing countries agriculture and the nature of the activities that exposes males for sand fly than females

The secondary data collected from the hospital records showed that the total percentage of cutaneous leishmaniasis positive individuals was different in each category of age groups. Out of 888 cutaneous leishmaniasis positive individuals, under age 5 were 6.1%, 5-14 were 20.1% and 15 or greater than 15 were 72.1%. The primary data of this study also showed almost similar pattern in relation to age. These results showed individuals from the age of 15 years and above were the most affected age groups in the study area by cutaneous leishmaniasis. This result is consistent with the study that was conducted in Tigray, where most of the cases (63.4%) were aged between 16 and 45 years (Tilahun *et al*., 2014). This might be due to the outdoor activities that can be performed by individuals of age groups of ≥15 in farms and the likes than individuals below this age as they are actively working groups.

The data showed that the majority (89.2%) of the cutaneous leishmaniasis cases were localized, particularly at the nose and face. Diffused and mucocutaneous accounted only for 3.9% and 6.9% respectively. It is known that sand fly vectors bite in the face which is exposed and cutaneous lesions appear in the site of promastigote inoculation following the bite. In other localities and countries, the face is noticed as the most infected organ by the leishmania (Aflatoonian and Sharifi 2006) although some other studies showed leishmaniasis lesions in the hands and feet as well (Ardahali *et al*., 2000). The current hospital data indicates that cutaneous leishmaniasis cases were observed in 35 different woredas including Dessie town. There was a greater variation of cutaneous leishmaniasis prevalence amongst the different woredas. The data showed that Dessie town had higher prevalence of cutaneous leishmaniasis from all other areas. The high prevalence of cutaneous leishmaniasis in Dessie town and Kutaber woreda could be as a result of their higher altitude which is about 2700 meters above sea level together with other possible factors. Cutaneous leishmaniasis disease is found mainly at high and mid altitudes ranging from 1400 to 2700 meters above sea level, which is most favorable for the proven vector sand fly species (Edessa *et al*., 2008). The results show the widespread endemicity of cutaneous leishmaniasis in Dessie town and its surroundings calling for future wider field-based epidemiological surveys. A previous report concerning the endemicity of cutaneous leishmaniasis in Kutaber, which

is some 20km from Dessie (Bugssa *et al*., 2014) exists but the current report is the first of its kind for cutaneous leishmaniasis from Dessie town.

The data showed that the cutaneous leishmaniasis prevalence was highest for farmers (68.5%) and least in among civil servants. Farming activity could put farmers at greater risk of cutaneous leishmaniasis than non-farmers such as government employees. In farm field and irrigation areas and possible travel to endemic areas and other seasonal activities farmers could be more exposed to sand fly bites. Students hold second place in cutaneous leishmaniasis prevalence because most students are families of farmers and engaged in similar activities as their parents.

The prevalence of cutaneous leishmaniasis in the study area is affected by other risk factors. Lack of knowledge about cutaneous leishmaniasis is, living in houses constructed with mud and grass, presence of cracks in walls of houses, sleeping on the floor, lack of using bed net during sleeping, presence of plants and irrigation areas near houses, presence of dogs, rats and other animals in the compound or living houses and travel of people to endemic areas of cutaneous leishmaniasis disease infection were found to be associated risk factors. The responses of the participants on knowledge-based questionnaires showed that the majority of the respondents were not aware of the meaning, transmission and associated risk factors of cutaneous leishmaniasis and this lack of knowledge was significantly associated cutaneous leishmaniasis. This result agrees with the researches of Ghatee *et al.,* 2103 and Dawit *et al.,* 2013. Factors such as low educational level and socioeconomic concerns reflect the increased risk of leishmaniasis, for example it can increase sand fly access into poorly built houses, and human exposure to infected sand flies (Ghatee *et al*., 2013). Moreover, poor housing and sanitary conditions such as lack of waste management and open sewage can increase breeding of flies and their access to people (Dawit *et al*., 2013).

Houses made of mud and grass were strongly associated with risk factor for cutaneous leishmaniasis. Houses having cracked walls were also associated with the risk of cutaneous leishmaniasis. Further, sleeping on floor is another cutaneous leishmaniasis risk factor. A similar report from Turkey suggested that living houses with cracked mud or thatched plastered walls and sleeping on the floor can facilitate sand fly survival and enhance vector abundance by providing diurnal resting places, breeding sites and humidity (Vital *et al*., 2013).

Over 90% of the respondents did not use bed nets while sleeping and among them 53.5% were cutaneous leishmaniasis positive indicating that sleeping without bed net in endemic areas could

increase the risk of being exposed to cutaneous leishmaniasis. Presence of plants near houses were other main associated risk factors in for cutaneous leishmaniasis infection where out of 244 participants who lived near areas of plants 60.2%) had cutaneous leishmaniasis. Sandflies use plants as a source of shelter and carbohydrates. They seek shelter in animal burrows, tree buttresses or holes, caves, rocks and other protective habitats (Claborn, 2010). Therefore, the presence of plants near households increases sand fly access and increased cutaneous leishmaniasis occurrence. Presence of irrigation areas near households similarly significantly associated with cutaneous leishmaniasis as sandflies need relatively warm, moist environments to complete metamorphosis (Claborn, 2010).

Among 54 participants who had travelled to cutaneous leishmaniasis endemic areas 46(85.2%) had cutaneous leishmaniasis demonstrating that movement of people from non-endemic to endemic places increases the prevalence of cutaneous leishmaniasis. Other authors also reported increasingly cutaneous leishmaniasis cases among travelers returning from tropical and subtropical regions where the disease is endemic (Oryan and Akbari, 2016).

The last associated risk factor for cutaneous leishmaniasis infection in the study area is the presence of dogs and rats in the compound or house of the participants. From the 248 respondents who had said confirmed the presence of dogs and rats in their compound or house 137(55.2%) developed cutaneous leishmaniasis. The presence of dogs and rodents is considered as the most important risk factor for cutaneous leishmaniasis transmission (Belo *et al*., 2013).

6. Conclusions and recommendations

The results of this study show that cutaneous leishmaniasis prevalence showed increment within the past six and half years in the study area. Males were more affected than females by cutaneous leishmaniasis. In relation to age individuals within the age of 15 and above years were highly infected cutaneous leishmaniasis. The study showed localized cutaneous leishmaniasis is the most common form of leishmaniasis in the study area. Moreover, the study demonstrated that cutaneous leishmaniasis is endemic in Dessie and its surroundings without being recognized in the literature. Common cutaneous leishmaniasis risk factors incriminated elsewhere are also prevalent in the study area.

The study revealed that the community lack of awareness about the meaning, transmission and associated risk factors of cutaneous leishmaniasis. Thus, in order to minimize infection of cutaneous leishmaniasis disease, awareness creation should be done by health professionals and other concerned bodies. The hospital lacked organized documentation system about cutaneous leishmaniasis patients and this needs to be improved. More comprehensive future study on the epidemiology and public health burden of the disease in the area is recommended.

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8. Annexes

Annex 1: -Retrospective data collection format

PREVALENCE OF CUTANEOUS LEISHMANIASIS Month: _____ Year: _____

SI No.	MRN No.	DATE (E.C)	WOREDA	AGE	GENDER	NEW	REPEAT	TYPE OF CL
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								

Annex 2: Questionnaire (English version)

Addis Ababa University

College of Natural and Computational Sciences

Department of Biology

Questionnaire: prepared for fulfillment of post- graduation (2018 G.C)

Dear respondents, this questionnaire is used to gather supportive information to the study for the prevalence and associated risk factors of Cutaneous leishmaniasis among patients admitted to Boru Meda hospital at Dessie town, South Wollo. It is aimed to understand the general awareness of the community on Cutaneous leishmaniasis and to assess the associated risk factors for infection of Cutaneous leishmaniasis disease in order to indicate appropriate solution on the prevention and controlling of the disease. Based on this objective, you are requested to fulfill the following questions accordingly. Please circle your response.

No need of writing your name.

Thank you very much for your cooperation.

General information

I. Sex 1. Male 2. Female Age---------- II.

Residence: woreda _____kebele _____

III. Educational states:

1. Informal education
2. primary school education
3. secondary school education
4. college and university

IV. Occupation /job

1. Civil servant
2. Farmer
3. Merchant
4. Student
5. Mention if there is another_____.

Questionnaire: prepared to assess your understanding about Cutaneous leishmaniasis disease.

1. Do you know what do we mean by Cutaneous leishmaniasis disease?

A. yes, I know B. No, I do not know

2. Do you know how Cutaneous leishmaniasis can be transmitted?

A. Yes, I know B. No, I do not know

3. Do you know the factors that influence cutaneous leishmaniasis infection?

A. Yes, I know B. No, I do not know

Questionnaire: prepared to know the factors that influence infection of Cutaneous leishmaniasis

1. Is your living house made of muddy and grassy materials?

A. Yes, it is B. No, it is not

2. Are there cracked walls in your house?

A. Yes, there are B. No, there are not 3. Is there moist on the floor of your house?

A. Yes, there is B. No, there is not

4. Do you sleep on the floor?

A. Yes, I do B. No, I do not

5. Do you use bed net while you are sleeping?

A. Yes, I do B. No, I do not

6. Are there trees around your house?

A. Yes, there are B. No, there are not 7. Do you sleep outside your house under the tree?

A. Yes, I do B. No, I do not sleep

8. Is there an open sewage around your house?

A. Yes, there is B. No, there are not 9.

Are there irrigation areas around your house?

A. Yes, there are B. No, there are not

10. Have you gone to endemic areas of Cutaneous leishmaniasis infection because of seasonal labor?

A. Yes, I have gone B. No, I have not gone 11. Are there dogs and rats in your compound or house?

A. Yes, there are B. No, there are not

12. Do you have cows and other animals?

A. Yes, I have B. No, I have not

Annex. 3: Questionnaire (Amharic version)

በአድስ አበባ ዩኒቨርስቲ የድህረ ምረቃ ትምህርት ቤት

ለሁለተኛ ድግሪ ትምህርት ማሟያ ጥናት የተዘጋጀ መጠይቅ (2010 ዓ.ም) የፁሁፍ መጠይቅ

ይህ የፁሁፍ መጠይቅ የተዘጋጀው የቁንጮር በሽታ ስርጭት መነሻ ምክንያቶችን ለማወቅ ለሚደረግ ጥናት አጋዥ መረጃ ለማግኘት ሲሆን በመጠይቁ ለበሽታው ስርጭት መነሻ ምክንያቶችን ማህበረሰብ ለበሽታው ያለውን ግንዛቤ መረዳት በሽታውን ለመቆጣጠርና ለመከላከል አመች መፍተሄ ለመጠቆም ይረዳ ዘንድ ነው፡ ፡ይህንን አላማ ተገንዝበው መጠይቁን በትክክል ይሞሉልን ዘንድ ትብብረዎን እንጠይቃለን፡፡ ስም መፃፍ አያስፈልግል፡፡

“መረጃውን በትክክል ስለሞሉ እናመሰግናለን!” ሀ.

አጠቃላይ መረጃ

i. ፆታ፡- 1. ወንድ 2. ሴት እድሜ--------9+--

ii. አድርሻ፡- ወረዳ----------ቀበሌ----------

iii. የትምህርት ሁኔታ፡

1. መደበኛ ትምህርት ያልተማሩ
2. የመጀመሪያ ድጃ ትምህርት የተማሩ
3. የሁለተኛ ደረጃ ትምህርት የተማሩ
4. ኮሌጅና ዩኒቨርስቲ የተማሩ

IV. የስራ ሁኔታ

1. የመንግስት ሰራተኛ
2. አርሶ አደር
3. ነጋዴ
4. ተማሪ
5. ሌላ ካለ ይገለፅ----------

ለ. ስለቁንጮር በሽታ ያለዎትን ግንዛቤ ለመዳሰስ የተዘጋጀ የፁሁፍ መጠይቅ

1. የቁንጮር በሽታ ምንነት ያውቃሉ? ሀ. አዎ አውቃለሁ ለ. አይ አላውቅም
2. የቁንጮር በሽታ እንዴት እንደሚተላለፍ ያውቃሉ? ሀ. አዎ አውቃለሁ ለ. አይ አላውቅም
3. የቁንጮር በሽታ መነሻ ምክንያቶችን ያውቃሉ? ሀ. አዎ አውቃለሁ ለ. አይ አላውቅም

ሐ. የቁንጮር በሽታ መነሻ ምክንያቶችን ለማወቅ የተዘጋጀ የፁሁፍ መጠይቅ

1. የሚኖሩበት ቤት ከጭቃና ከሳር የተሰራ ነው? ሀ. አዎ ነው ለ. አይ አይደለም
2. የሚኖሩበት ቤት ግድግዳ ስንጥቅ(ቀዳዳ) አለው? ሀ. አዎ አለው ለ. አይ የለውም
3. የቤትዎ ወለል እርጥበት አለው? ሀ. አዎ አለው ለ. አይ የለውም
4. የሚተኙት ወለል ላይ ነው? ሀ. አዎ ነው ለ. አይ አይደለም
5. ሲተኙ የአልጋ አጎበር ይጠቀማሉ? ሀ. አዎ እጠቀማለሁ ለ. አይ አልጠቀምም

6. በቤትዎ አቅራቢያ ዛፎች አሉ? ሀ. አዎ አለ ለ. አይ የለም
7. ከቤት ውጭ ከዛፍ ስር ይተኛሉ? ሀ. አዎ እተኛለሁ ለ. አይ አልተኛም
8. በቤትዎ አካባቢ ክፍት የሆነ ፈሳሽ ቆሻሻ አለ? ሀ. አዎ አለ ለ. አይ የለም
9. በቤትዎ አካባቢ የመስኖ እርሻ ቦታ አለ? ሀ. አዎ አለ ለ. አይ የለም
10. በወቅታዊ ስራዎች ምክንያት የቁንጮር በሽታ ወደአለባቸው አካባቢዎች ሄደው ያውቃሉ?
    ሀ. አዎ ሄጀ አውቃለሁ ለ. አይ ሄ አላውቅም
11. በግቢዎ ወይም በቤትዎ ውስጥ ውሻና አይጦች አሉ? ሀ. አዎ አሉ ለ. አይ የሉም
12. ላሞችና ሌሎች እንሰሳት አሉዎት? ሀ. አዎ አሉኝ ለ. አይ የሉኝም

9. Declaration

I, the undersigned, declare that this Thesis is my original work and all source materials used are duly acknowledged.

Name Belayneh Eshetu

Signature _____

Date _____

10. Statement of the supervisor

This Thesis has been approved for submission to the Department Zoological Sciences for public defense.

Name Hassen Mamo (PhD)

Signature _____

Date _____