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Faculty of Graduate Studies

Epidemiology of Cutaneous Leishmaniasis in the Northern West Bank, Palestine

By

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Dedication

For

My family, who offered me unconditional love and support throughout the course of this thesis. To my friends and colleagues.

Acknowledgment

Thanks and gratitude to my supervisor, Dr. Ayman Hussein for his guidance, encouragement and help through this study.

My special thanks to all those who helped me in my study, deepest respect and appreciation to D.G of primary health care and public health in the Palestinian ministry of health DR. .Asad Ramlawi and all of my friends and colleagues ,Directors of health issues in the primary health care department and the preventive medicine department of all districts , for their cooperation . Special thanks to my dear colleague head of vectors environmental department Samir Sawalha . My special and deepest thanks, respect and appreciation to my dear mother, father, sisters and my brothers for their patience and encouragement Lastly, I offer my regards and blessings to all of those who supported me in any respect during the completion of the thesis. and everyone wanted me to succeed progress and develop and shared me with their emotions.

الاقرار

انا الموقع ادناه مقدم الرسالة التي يحمل العنوان

Epidemiology of cutaneous leishmaniasis in the northern west bank ,Palestine

وبـائية داء الليشمانيا الجلـدية في شمـال الضفـة الـغربـيـة-فـلسـطين

اقر بأن ما اشتملت عليه هذه الرسالة إنما هي نتاج جهدي الخاص، باستثناء ما تمت الإشارة إليه حيثما ورد، وإن هذه الرسالة ككل، أو أي جزء منها لم يقدم من قبل لنيل أية درجة علمية أو بحث علمي أو بحثي لدى أية مؤسسة تعليمية أو بحثية أخرى .

Declaration

The work provided in this thesis, unless otherwise referenced, is the researcher's own work, and has not been submitted elsewhere for any other degree or qualification.

Student's Name: **اسم الطالب :**

Signature : **التوقيع :**

Date : **التاريخ :**

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Abbreviations

AIDS	Acquired Immune Deficiency Syndrome
CDC	Centre o Disease Control and Prevention
CL	Cutaneous Leishmaniasis
DDT	Dichlorodiphenyltrichloroethane
EMR	Estern Mediterian Region
HIV	Human Immunodeficiency Virus
IRB	Internal Review Board
MCL	Mucocutaneous Leishmaniasis
MOH	Ministry of Health
NW	New World
OW	Old World
PCR	Polymerase Chain Reaction
SPSS	Statistical Package for the Social Sciences
VL	Visceral leishmaniasis
WHO	World Health Organization

Epidemiology of cutaneous leishmaniasis in the northern west bank, Palestine

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Abstract

BACKGROUND: Leishmaniasis has been an antique public health problem in south -West Asia and the Arab world reported from time immemorial as the pharaohs ruled in Egypt and Assyrians in Mesopotamia. The disease is caused by the genus Leishmania. There are several species of this parasite that cause leishmaniasis where three forms are confirmed: cutaneous (CL), mucco-cutaneous (MCL), and visceral (VL) leishmaniasis. North of Palestine is the centre of a region where simple CL is hyperendemic. *Leishmania* parasite is transmitted by the sand fly vector supported by a wide range of reservoirs distributed on all inhabited continents. In Palestine, two forms of leishmaniasis exist. One is the CL caused by *L. major* or *L. tropica* and the other is visceral caused by *L. infantum*. Leishmaniasis in general is reported in all Palestinian districts except Gaza strip with an official incidence rate in the West Bank of more than 10 per 100,000 in 2003. **AIM**: The epidemiology of CL in Palestine and neighbouring countries appears to be undergoing a transition. From our observation as worker in MOH clinic for infectious diseases, we noticed rise in number of patients with CL in the area of north West Bank. Therefore, this study was designed to study the incidence of CL over 10 years period as well as studying the ecological, epidemiological and social

factors that might lead to this rise. **Methodology**: This study is retrospective cross-sectional study. 1150 files of patients were reviewed in order to fill a questionnaire designed by the authors. The questionnaire includes demographic, clinical, diagnostic, and epidemiological questions. Age, residence, sex and personal information as well as information about domestic and wild animal living around patients were collected. Other information about houses and protective measures taken by respondents to avoid bite of the sand fly vector were also seeked. **RESULTS**: The most striking results found in this study was that the study confirms that the area understudy is hyperendemic with CL. Tubas and Jenin districts were found to have more incidence by at least 5-10 than other districts in this study. No difference was found between male and female in infection with CL. However, children found to be the most affected age group. Site of infection among patients showed that limbs and legs are predominantly affected. Rat and dogs were reported by patients around their houses. Those animals are known to act as reservoirs for Sand fly vector. More than 70% of CL patients were found resident of suburban areas, although patients from different geographical sites were found.

Chapter One

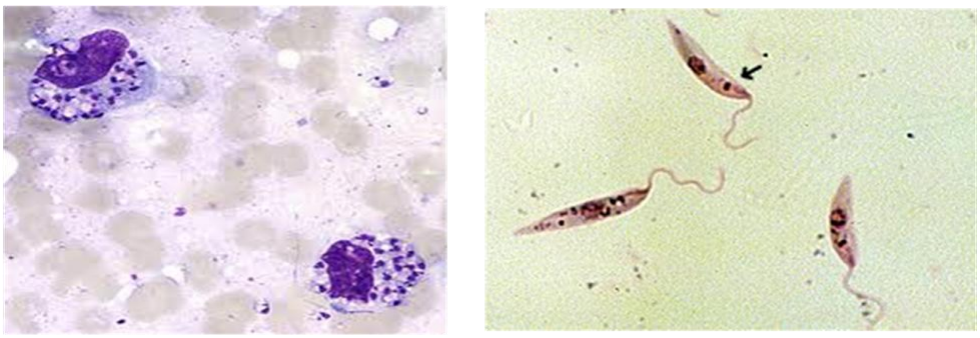
Introduction

Introduction

1.1. Background

1.1.1. Parasite

Leishmania parasite is a protozoa belonging to the order *Kinetoplastida* and the family of *Trypanosomatidae*. The genus *Leishmania* includes more than 20 species. The parasite exists in two morphological forms: the non-flagellated amastigote (3-5 mm in diameter) living intracellular in macrophages of the mammalian host (Figure 1A), and the flagellated promastigote, living extracellular in the intestinal tract of the sandfly-vector (figure 1B). In the macrophages the amastigotes are able to survive and multiply within the acidic phagolysosomes of the host cells **(reviewed by Alexander *et al*., 1999)**. After multiplication in the host cell the amastigotes are released. Subsequently other macrophages are infected and the infection spreads **(reviewed by Peters et al., 1990; Rittig and Bogdan, 2000)**. The parasite contains two prominent organelles, the nucleus and the kinetoplast. The kinetoplast is found in all protozoa of the order kinetoplastidae (eg. *Leishmania*, *Trypanosoma*, *Crithidia*).



A B

Figure 1. Forms of the parasite *Leishmania*: (A) and promastigote (B).

1.1.2 Life cycle:

The transmission cycle is maintained between the vector and the reservoir. Depending on the species of *Leishmania*, the transmission is either zoonotic or anthroponotic, involving either animals or humans as reservoir (Figure 2). The parasite is transmitted by the bite of female sandflies of the genus *Phlebotomus* and *Lutzomyia.* During the blood meal *Leishmania* infected macrophages are ingested by the vector. In the gut of the sandfly the intracellular amastigotes develop into flagellated promastigotes at an ambient temperature of 24-28◦C. During another blood meal the mature promastigotes are inoculated into a mammalian host. Macrophages ingest the parasites, which then transform into the amastigote form.

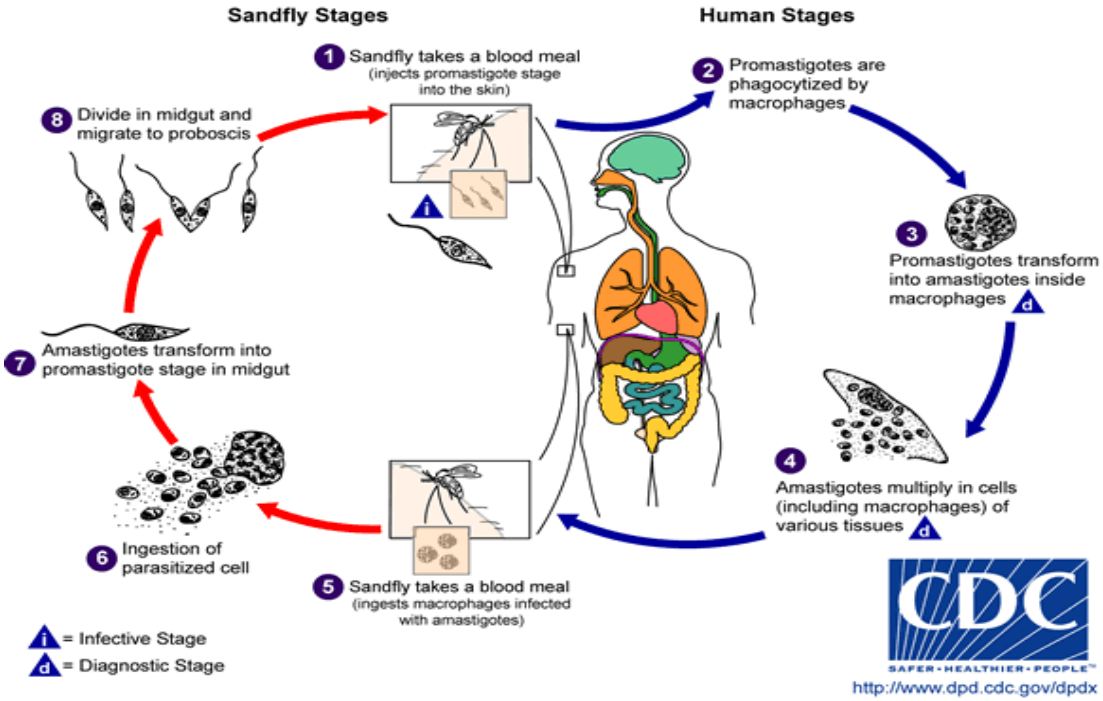


Figure 2. Life cycle of *Leishmania* parasite

1.1.3. Clinical forms of leishmaniasis.

In most patients, the skin lesion begins as a small erythematous papule about 2 to 6 weeks after inoculation (figure 3). Over the following month the papule slowly enlarges, and a crust develops in its centre. With time, the crust falls away, exposing a shallow ulcer (see figure 4). **(Klaus and Frankenburg, 1999; AL Jawabreh *et al*., 2004)**.

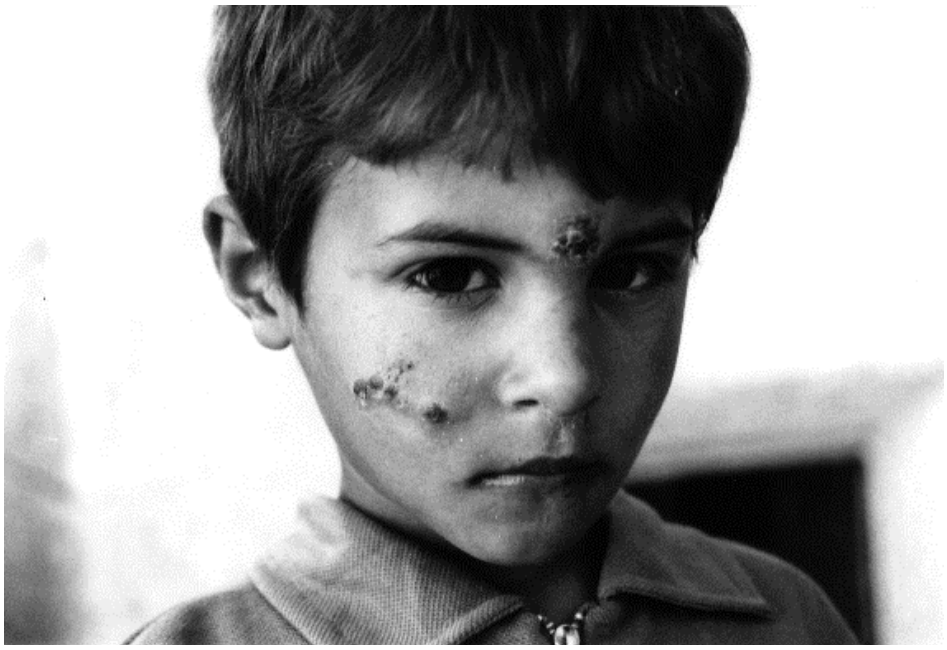


Figure 3. Picture showing nodules on face of patient with CL(Klaus and Frankenburg, 1999; AL Jawabreh *et al*., 2004).

If no treatment is given, the nodules ulcer remains stable for 6 to 12 months before undergoing spontaneous resolution. Usually a shallow depressed scar is left behind. CL caused by *L. tropica* and *L. major* are indistinguishable on clinical bases as both erupt in the same way, the size of the lesion ranging from a few millimeters to 4 centimeter or more. The site and number of lesions(s) are an indication of the type of cutaneous (CL). *L. major* usually presents as multiple lesions (≥3) and *L.tropica* is more often on the nose **(Klaus and Frankenburg, 1999; AL Jawabreh *et al*., 2004).**

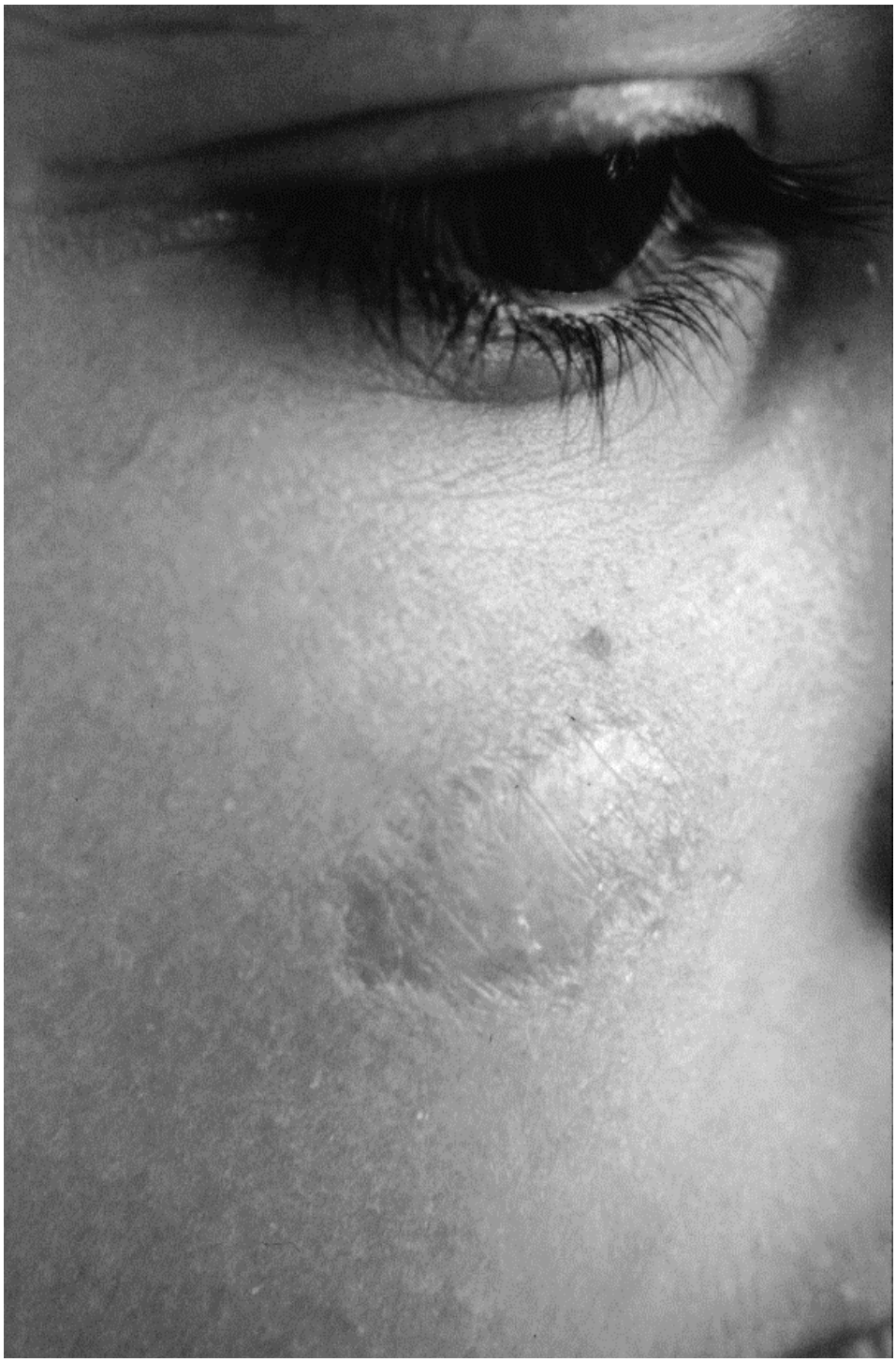


Figure 4. CL Patients with ulcer on the face**. (Al-Jawabreh *et al*., 2004).**

The preferred sites for *L. major* are cheeks, arms and legs which account for more than 70% of the cases, while the preferred sites for *L. tropica* are cheeks and arms forming over 50% **(Al-Jawabreh *et al*., 2004).** Abnormal manifestations for *L. major* are the enlargement of regional lymph nodes which is found in about 10% of patients. At times, the infection spreads deeply into subcutaneous tissue and muscle **(Al-Gindan *et al*., 1989; Vardy *et al*., 1993).** Hyperesthesia or anesthesia around the lesion was reported **(Satti *et al*., 1989).**

The three distinct forms,cutaneous Leishmaniasis(CL), visceral (VL) and mucocutaneous leishmaniasis (MCL) are classically caused by a spectrum of different *Leishmania* species. Even though there is a clear correlation between the causative species and the clinical presentation, many variations are seen. Depending on the specific characteristics of species/strains and also on the immunocompetence of the host the clinical manifestation may vary to a great extent. Species causing typically CL may visceralize and visceral species may show dermatotropism. In many endemic areas of the world a few *Leishmania* species are prevalent simultaneously so that a species specific diagnosis can not rely on clinical findings alone. Species specific diagnosis is necessary for adequate treatment. **(Schlein *et al*., 1982; 1984).**

1.1.4. Transmission:

The presence of leishmaniasis depends on a variety of ecological and biological factors. Since the various *Leishmania* species depend as much on

specific reservoir as on specific vector species, a *Leishmania* focus can only exist if suitable ecological conditions are present for both the host animal species and the sand fly species (fig. 5).

Figure 5. Sand fly vector of Leishmania spp.

CL occurs either as a zoonotic or an anthroponotic infection. Zoonotic CL is caused by *L.major*, with rodents serving as the reservoir. These rodents live usually in colonies and are commonly found in vast uninhabited areas. The rodent burrows provide excellent breeding places for the sandflies. Through the coexistence of rodents and sandflies in the same habitat the natural transmission cycle of *L.major* is maintained. In zoonotic leishmaniasis humans are only accidental hosts. New endemic foci of CL can emerge when developmental changes take place (eg. building, agriculture). In the Middle East and North Africa the fat sand rat (*Psammomys obesus*) is the main reservoir (Figure 6). Also jirds (*Meriones* sp.) (figure 7) were found to host the parasite **(Schlein *et al*., 1982; 1984).**

Figure 6. Fat sand rat**.**

Figure 7. Gerbil animal.

In Central Asia, Iran and Afghanistan the great gerbil (*Rhombomys opimus*) was identified as being the reservoir of *L.major* **(Strelkova, 1996; Yaghoobi-Ershadi and Javadian, 1996)**. This gerbil species also hosts nonpathogenic species of *Leishmania* (*L.gerbilli* and *L.turanica*). *L.major* is transmitted predominantly by sandflies of the species *Ph.papatasi*. Anthroponotic CL has been attributed to *L.tropica*. Major urban centers of the Middle East (Aleppo, Damascus, Baghdad, Tashkent, Teheran and Kabul) were known to be highly endemic for *L.tropica*. Humans are the only known reservoir. The infections were so numerous as to maintain the

transmission cycle. In recent years it became increasingly obvious that the classical transmission pattern of *L.tropica* infections has changed. Epidemics in densely populated areas became less common. A shift from an urban to a rural distribution took place. In some of the mentioned Middle Eastern cities, CL has been quite efficiently eradicated by systematic and repeated spraying of houses with insecticides and also as a result of spraying within anti-malaria campaigns. In the past decade the outskirts of cities and villages have been affected predominantly, and infections have occurred more sporadically. These characteristics suggest the existence of an animal reservoir and a zoonotic transmission of *L. tropica*. Until today the animal reservoir of *L. tropica* has not been identified, but several animal species are suspected to function as reservoir. *L. tropica* has been isolated from hyrax (*Procavia* ssp.) in Kenya **(Marlet et al., 2003)**, from dogs in Morocco **(Dereure, 1991)** and from rat x **(Aljeboori and Evans, 1980)**. Hyraxes are the proven reservoir of *L.aethiopica* in Ethiopia **(Ashford *et al.*, 1973; Bray et al., 1973).** In Jordan hyraxes (figure 8) are abundant in endemic areas of *L .tropica* and are therefore suspected to be the reservoir **(Saliba *et al*., 1997)**. This has been discussed also by Ashford, (2000). *L. tropica* is predominantly transmitted by sandflies of the species *Ph . sergenti.*

Figure 8. Hyrax animal.

1.1.5. **Public Health Surveillance**:

Leishmaniasis is a reportable infection in Palestine (Ministry of Health, 2004) and all neighboring countries like Jordan, Syria and Saudi Arabia. Ministries of Health collect data for various reasons like therapeutic and control strategies. Despite the law mandate, underreporting is still believed to prevail partly due to passive surveillance, including only cases coming from clinics and hospitals. Already before 1994 when the health authority was in the hands of the Israeli military rule, there were attempts to improve the reporting system in Palestine **(Awad et al., 2001)**. After 1994, the Palestinian Ministry of health continued the surveillance activity but suffered some disturbances between 2001 and 2005 due to the political turmoil in the area. The current situation depends on passive collection of data from health care providers in all Palestinian districts by the preventive medicine department in the Ministry of Health and presenting them either on the official website or distributing hardcopies to health stake-holders in the regions. The aim of surveillance is to control and prevent diseases, improve epidemiological knowledge and assist policy making. The tripod

of this activity is the laboratory, physicians/nurses and epidemiologist/statistician.

1.1.6. Clinical diagnosis and identification:

The conventional methods of clinical diagnosis of CL have ranged from clinical picture and epidemiological data, isolating the amastigotes by microscopy of stained smears from skin touch specimens or biopsies to *in-vitro* culturing of the parasite **(*Reed, 1996; Herwaldt, 1999*).** These conventional methods are, however, limited in sensitivity, need an experienced hand and do not distinguish between *Leishmania* species which differ in virulence and, subsequently, may require different therapeutic regimes and control measures. For all this and over the last decade diagnostic tests based on molecular biology techniques i.e, PCR, were introduced and proved to be more sensitive and specific **(Van Eys *et al*., 1992; Wilson, 1995; Osman *et al*., 1998)**.

L. major and *L. tropica* are restricted to the Old World (OW), mainly in the Mediterranean basin, East Africa, Indian subcontinent, and West and Central Asia . *L. major* CL is found in low lying arid and semiarid deserts **(Klaus 1999).** *L. tropical* CL, by contrast, is more common in urban areas and in villages in hilly rural areas **(Klaus 1999).** Examples for *L. major* foci are Jericho in Palestine **(Al-Jawabreh *et al*., 2003 and 2004)** and Sidi-Bozaid in Tunisia **(*Ben Ismail et al., 1997*)**. As reviewed by Jacobson **(*Jacobson, 2003*),** examples for urban *L. tropica* foci are Baghdad in Iraq, Aleppo in Syria, Kabul in Afghanistan and Sanliurfa in South-east Turkey.

Within the past decade, the world's largest *L. tropica* focus was in Kabul **(WHO, 2002)**. Other smaller foci for *L. tropica* can be found in Shiraz in Iran, Mosul in Iraq, Ashkhabad in Turkmenistan, and Taza in Morocco.

1.1.7. Treatment.

Simple CL due to *L.major* is mostly left to self-cure. In endemic areas, it is even preferable not to treat, so that long-term immunity can be acquired. Treatment is necessary when cosmetically or functionally important sites are involved. *L.tropica* infections generally require treatment. For local treatment, intralesional Pentostam (sodiumstibogluconate), ketoconazol, cryotherapy with liquid nitrogen or heat can be applied. For systemic treatment, pentavalent antimonal compounds (Sb) eg. Pentostam and Glucantime are used **(Herwaldt, 1999; Norton *et. al*., 1992; Hepburn, 2000)**. Resistance against pentavalent antimonals has become a serious problem, especially in India. As an alternative drug Amphotericin-B has proved to be effective too. The combinations of Paromomycin (Aminosidine) with Sb and interferon-γ with Sb arealso efficient and may help to reduce side effects of Sb compounds (less Sb is required) **(reviewed by Berman, 1997)**.

1.2. Significance of the study.

Leishmainaisis disease is **on rise** in several countries in the World. Although, the disease is by law a reportable disease in Palestine, but nevertheless the disease seems to be greatly underreported. Therefore, it is

vital for understanding the epidemiological pattern of the disease distribution and for the prevention and control of the diseases to study distribution and factor affecting the diseases prevalence in Palestinian communities. Since Jenin district is known in literature to be the most affected area in the Palestinian territories, the study will focus on this district.

Chapter Two

Literature Review

2. Literature Review

2.1. Epidemiology and Environmental factors.

Cutaneous leishmaniasis is a vector borne disease caused by various members of the genus *Leishmania* parasite. Leishmaniasis is considered as a poverty-related disease. The endemic areas with leishmaniasis are usually identified by active or passive case reporting while the epidemic areas are usually identified by an early warning system. The distribution and epidemiology of both parasites is governed by several factors. The disease affects the poorest people and it is associated with conditions like malnutrition, displacement, poor housing, illiteracy, gender discrimination, weakness of the immune system and lack of resources. Environmental changes such as deforestation, building of dams, new irrigation schemes and urbanization, and the accompanying migration of non-immune people to endemic areas are linked to leishmaniasis **(Kroeger et al. 2002)**.

2.2. Incidence of leishmaniasis in the World and in the Eastern Mediterranean region .

The clinical presentation ranges from simple cutaneous lesions to life threatening visceral forms. Currently, leishmaniasis occurs in four continents and is considered to be endemic in 88 countries, 72 of which are developing countries (WHOhttp://www.who.int/leishmaniasis/burden/en/.). Leishmaniasis is not only widely distributed in warm countries, but it is also prevalent in very different topographic areas. The disease is endemic

with about 1.5 million cases occurring each year (Centre for diseases control and prevention (CDC). Diseases & conditions. Leishmania infection (Leishmaniasis). Fact sheet. [Cited 2007 Sep 11]. Available from: http://www.cdc.gov/ncidod/parasites/leishmanai/factsht_leishmania.htm. In most of the endemic countries leishmaniasis is not a reportable disease **(http://www.who.int/emc/diseases/ leish/leisdis1.html)**. New endemic foci have emerged over the past decades, epidemics are not controlled and endemic areas are spreading due to development and population shifts (Desjeux, 1999). In western countries the incidence is increasing due to HIV-*Leishmania* coinfection and tourism. In recent years coinfection with HIV became a serious threat in south-western Europe with 1.5-9.5% of AIDS patients being affected.

In the Eastern Mediterranean region (EMR), cutaneous and visceral Leishmaniasis are reported from 14 of the 22 countries of the region, namely Afghanistan, Egypt, Iran (Islamic Republic of), Iraq, Jordan, Libyan Arab Jamahiriya, Morocco, Pakistan, Saudi Arabia, Somalia, Sudan, Syrian Arab Republic, Tunisia and Yemen **(Postigo, 2010)**. In these countries, outbreaks of leishmaniasis are tend to occur every 10 years **(Postigo, 2010)**. In 2008, about 100,000 new cases of CL were reported from some of the EMR countries including Palestine. **(Postigo, 2010)**. The estimated number of cases of CL caused by *L. tropica* in Middle East and North Africa countries is reported to be 40,000 **(Hotez et al., 2012)**.

2.3. Leishmaniasis in Palestine

CL has been first reported in Jericho since the area was used to be free of leishmaniasis as reported by residents until the 1967 War. This was due to be a result of spraying against malaria by DDT. However, reports from Israeli soldiers post 1967 War revealed that the area is hyperendemic. *Leishmania major* accounts for the

majority of infections with *Leishmania* in the country. It is endemic in the Jordan Valley, the Jericho area, along the Dead Sea, in the Arava and the Negev. CL caused by *L.major* has been thoroughly studied over many years, and the reservoir animal species (*P.obesus, M.crassus*) as well as the vector species (*Ph.papatasi*) have been identified **(Schlein *et al.*, 1982; 1984).**

Leishmania tropica is endemic in a number of semiarid hilly areas in central and northern Israel as well as in the northern West Bank (Samaria), the Jenin district being a major endemic area **(Abdeen *et al*., 2002)**. The species has never been finally confirmed, but the hillyenvironment was highly suggestive of a focus of *L.tropica*.

The epidemiology of leishmaniasis has been also studied in Palestine and two forms of leishmaniasis have been reported. One is the CL caused by *L. major* or *L. tropica* and the other is VL caused by *L. infantum*. Leishmaniasis in general is reported in all Palestinian districts except Gaza strip with an official incidence rate in the West Bank of more than 10 per

100,000 in 2003 (**Klaus *et al*., 1994; Baneth et al., 1998; Abdeen *et al*., 2002; Anders *et al*., 2002; Al-Jawabreh *et al.*, 2004, Jaffe *et al.*, 2004, Schoenian 2003; Ministry of Health, 2004)**. The annual incidence of CL was studied in Jerusalem and its neighboring areas and it has been reported that the annual incidence of CL increased from 0.13 in 1999-2003 to 9.7 per 100,000 in 2004-2005 **(Singer et al. 2008)**. The highest incidence was reported from district of Tiberias and found to be 62.5 per 100,000 **(Vinitsky et al. 2010).**

The epidemiology of CL in the Jericho district has been profoundly studied by Al-Jawabreh (2000). In this context, Al-Jawabreh et al. (2004) reported the emergence of L. tropica in Jericho (A'riha) in the period between 1997-2002. Of the 107 dermal samples tested, around 50% were infected with *L. tropica* and the rest by *L. major* as revealed PCR technique. *L. tropica* is endemic in a number of areas in the northern West Bank, the Jenin district being a major endemic area **(Abdeen *et al*., 2002)**. According to Sawalha (2001) more than700 cases of CL have been reported from many single foci in the northern West Bank over the last decade. The causative species has not been identified, but the geographical area suggests *L. tropica.* CL caused by *L. tropical* is less prevalent than *L. major* **(see Schnur et al., 2004).**

L.d.infantum is an emerging disease in the northern West Bank. Several cases of VL has been reported from the area of northern West Bank **(Badr et al., 2005; Abdeen et al., 2002).** Most cases were reported in the Jenin

district, followed by Hebron, Tulkarem and Ramallah. Predominantly children between 1 and 6 years of age were affected **(Abdeen *et al*., 2002, Giladi *et al.*, 1985, Qubain *et al.*, 1997).** Other two reports of VL has been published from Bal'a village, 5 KM East of Tulkarm city (Qubain et al1997) and from Hebron district **(Amro et al., 2009).**

The epidemiology of leishmaniasis in [Israel] has been reviewed by Giladi *et al.*, 1985). CL and VL forms are reported long time ago in [Israel], however, epidemiological studies showed that they are re-emerging as important public health problems in areas long believed to be disease free **(Jaffe et al., 2004).** For example several reports have indicated CL, caused by L. tropica, has become a significant problem in northern [Israel] and West Bank of Palestine **(Jaffe et al., 2004; Amro et al., 2009; Al-Jawabreh et al., 2003; Schnur et al., 2004)**. VL has been also reported from different parts of Palestine including Hebron **(Amro et al., 2009)** and Jenin districts **(Abdeen et al., 2002).**

Chapter Three

Material and Methods

3.1. Patients and study area.

All of north Palestinian districts (Jenin, Nablus, Tubas, Tulkarm, Salfeet and Nablus, extend over an area of more than 593 km^2, with a population density of 73 person per km^2 and a total population of more than 40,909 **(Palestinian Central Bureau of Statistics, 2005).** Jenin and Tubas districts are located in the northren part of the West Bank. There have 96 localities and covers an area of 592 km^2 with altitudes ranging between 90 and 750 meters above sea level **(palestinain central bureau of statistics, 2007).** Jericho, a strip of land extends from the Dead Sea and Jerusalem in the south to Nablus. Tubas and Jenin in the north and from the River Jordan in the east to the hills of Ramallah and Nablus in the west, is a low-lying (244-398 m below sea level) arid to semi-arid area located between 29°-33° north of the equator. The Palestinian population living in northern part of West Bank work as farmers, government employees and nomadic Bedouin shepherds who roam the area all the year round.

Figure 9. Map of the Palestinian governorates according to Palestinian classification.

3.2. Design of the study:

The research design of this study is cross-sectional descriptive retrospective design. This design was chosen to investigate the factors that lead to the increase of CL cases in the northern West Bank. Although the study is descriptive, it attempt to put the problem in prospective by showing the relative degree to which different districts are affected, how the patterns of the disease occurrence vary between different areas .

3.3. Sample collection:

Patient data sheets. Data of each referred patient has been collected from the dermatological private clinics and files from August 2000 to August 2010 in the preventive medicine departments in all of the districts. The tool used in this study is a questionnaire filled in by the author directly or by telephone interviewing the patients. Data are filled from the file. However, if there are certain information missing, then author has called the patient and filled missed information. In case some patients can not be contacted, then the file has been excluded. The questionnaire includes demographic, clinical, diagnostic, and epidemiological questions. The questionnaire has been designed by the author and thus it has been validated by a pilot study on 30 files. After analysis of data, the questionnaire was used to collected relevant data. It is worth mentioning that the files used in the pilot study have not been included in this study. It has been also designed to be used friendly with a computerized input interface and analysis by SPSS.

Inclusion criteria:

All files for patients who have a file in the preventive medicine departments within 10 years (2000-2010)

The exclusion criteria:

Files for patients in the period before 2000 and after 2010.

Ethical consideration:

Permission has been sought from the Internal Review Board (IRB) at An-Najah National University and from the Ministry of Health.

Statistical analysis

Collected data was analyzed using the statistical package for social sciences program (SPSS) version 16. Descriptive results were expressed as frequencies and percentages.

Chapter Four

Results

4.1. Distribution of study participants.

The total number of study sample was 1150 with mean age of 23.9 ± 19.1 yrs (min 1yr and max 90 yrs). Table 1 summarizes age distribution of the study participants. Of those 54.3% (624/1150) were males.

Table 1. Age categories of study participants.

Age (yrs)	Frequency	
	Number	%
<18	629	54.7
18-49	374	32.5
>49	147	12.8
Total	1150	100

They were distributed into 5 distinct districts as demonstrated by figure 10. More than 50% of samples were from Jenin district. The district incidence rate in Nablus was 532 per 100,000. Qaliqilia had the least rate

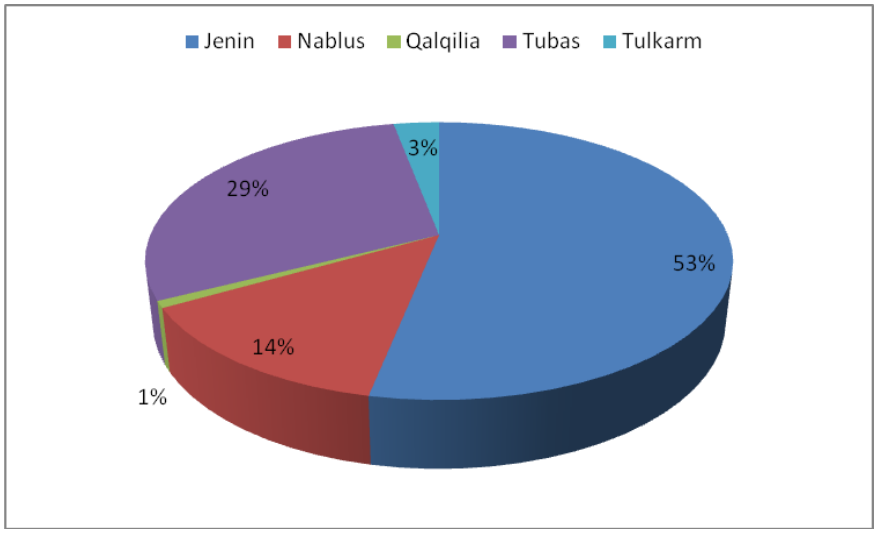


Figure 10. Distribution of study samples by residence (Total number of study samples is 1150).

4.2. Year of infection and districts.

Table 2. Number of patients with cutaneous leishmanisis distributed into districs of North west Bank.

District	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Total
Jenin	55	116	85	69	18	34	35	52	80	26	41	611(53%)
Nablus	14	12	10	11	4	9	8	20	37	14	17	156 (13.6)
Qaliq	0	0	1	0	0	1	0	5	2	0	0	9 (0.8%)
Tubas	13	22	26	32	4	14	16	19	65	66	61	339 (29.5%)
Tulkar	2	3	4	6	1	4	2	5	4	3	0	34 (3%)
Total												1150

4.3. Demographic and epidemiologic characteristics of CL patients in Northern West Bank, Palestine (2000-2010)

Figure 11 demonstrates the distribution of sex of patients enrolled in the study. About 54% of them were males.

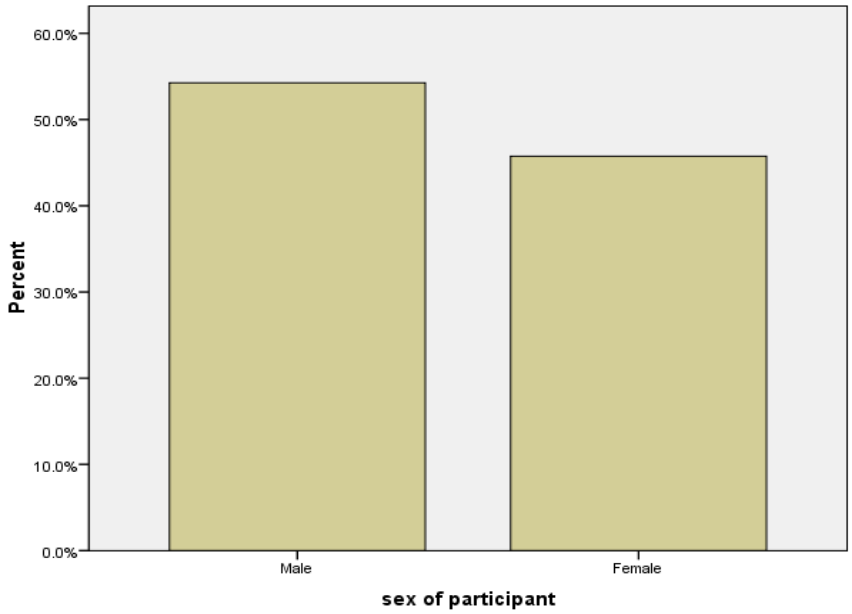


Figure 11. Distribution of sex of patients with cutaneous leishmaniasis**.**

4.4. Place of residence

Figure 12 demonstrates the distribution of patients with respect to area of residence. About 78.7% (902/1150) respondents are living in the village. Of those 73.3% (847/1150) are living in the peripheral of the village. In comparison, 16.7 (192/1150), about 2% (25/1150) and 2% (26/1145) were living in city, refugee camps and Badya, respectively (figure 12).

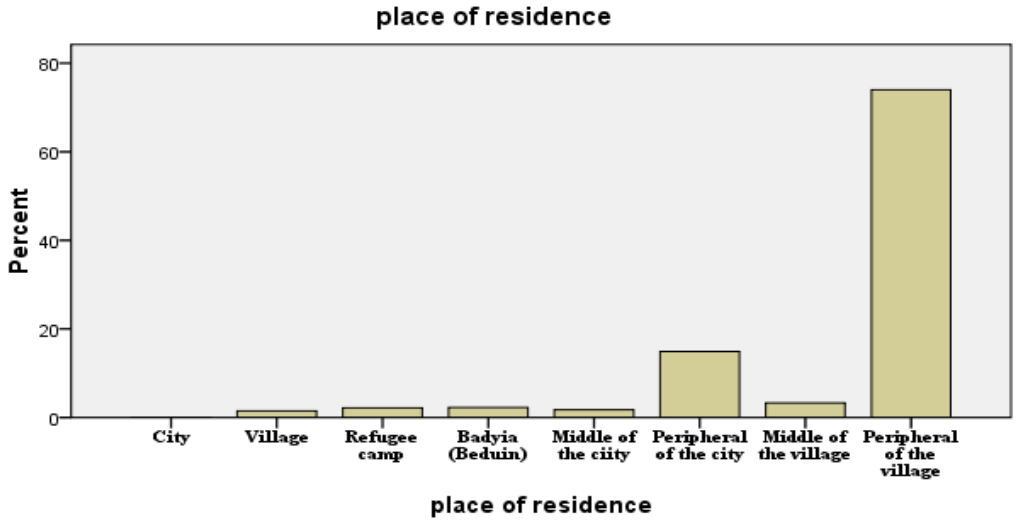


Figure 12. Place of living of patients with CL.

4.5. profession

The majority of patients were found to be students (39.5% (454/1150) (figure 13). Patients who are farmers constituted about 12% (144/1150) of the study samples. Housewives were 19.2% (221/1150) of study samples who contracted CL.

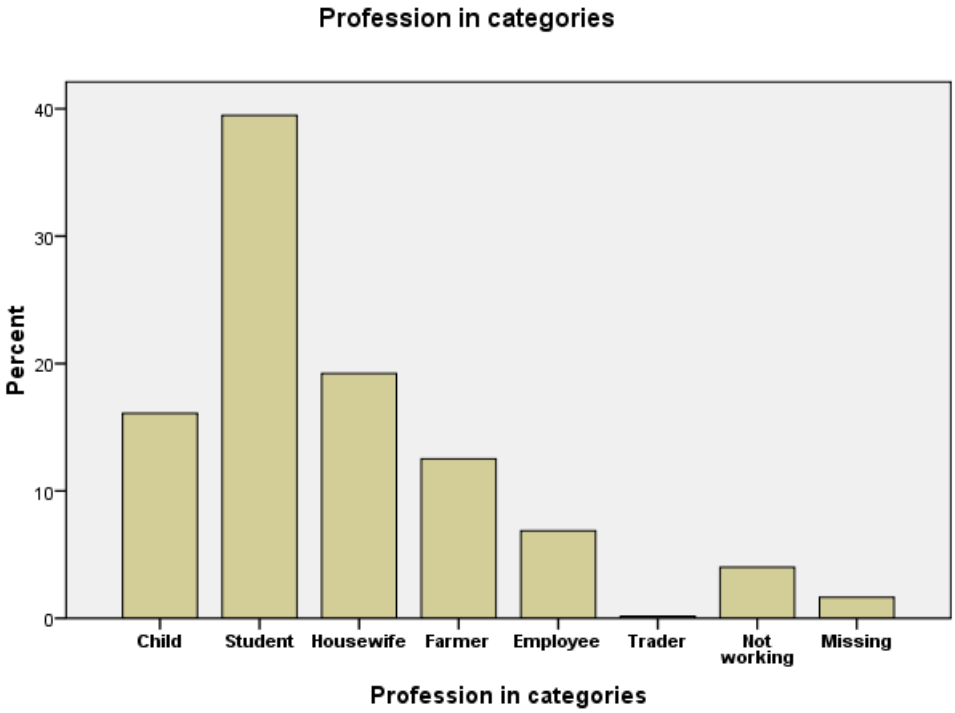


Figure 13. The profession of patients with CL in North West Bank.

4.6.Site of infection

Figure 14 demonstrates site of infection. About 74% (854/1150) of our participants have infections on the peripherals (exposed areas on hands, legs). The second site was found to be the face (24%).

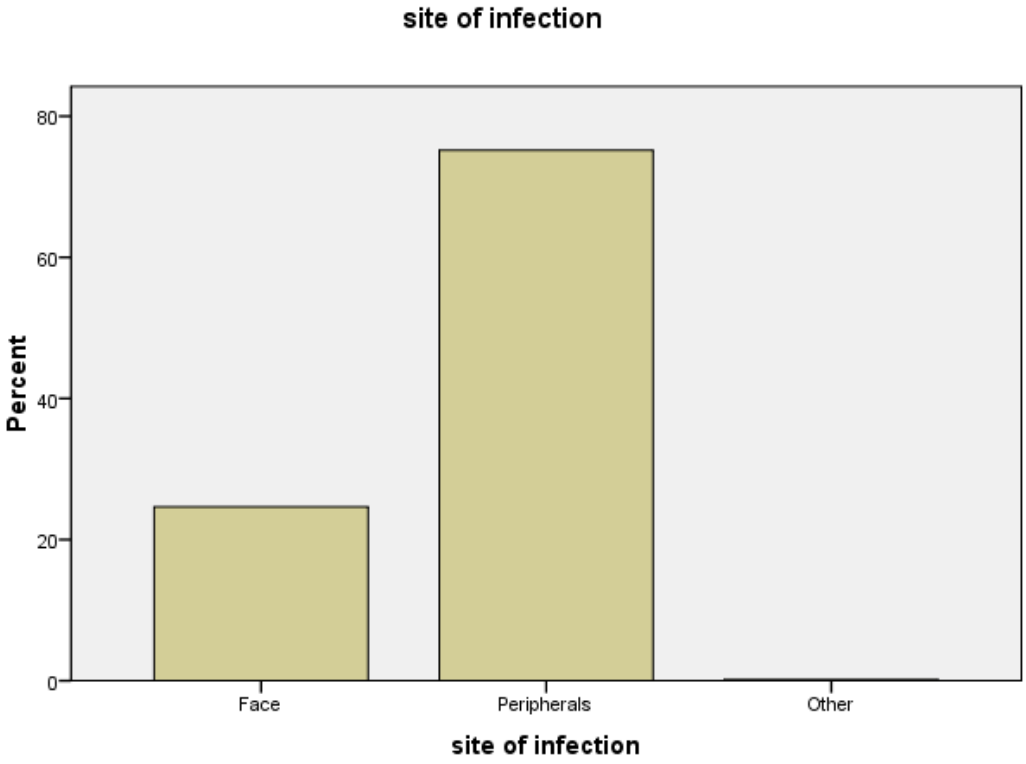


Figure 14. Site of infections of CL as found on study participants.

4.7. Number of nodules

Exploring number of nodules per patient was performed. Results as demonstrated by figure 15 showed that majority of patients have just one nodule (68.4% (787/1150). Only 3% (34/1150) had more than two nodules. The rest of patients (26.2%, 305/1150) had two nodules. There were missing data for 24 patients.

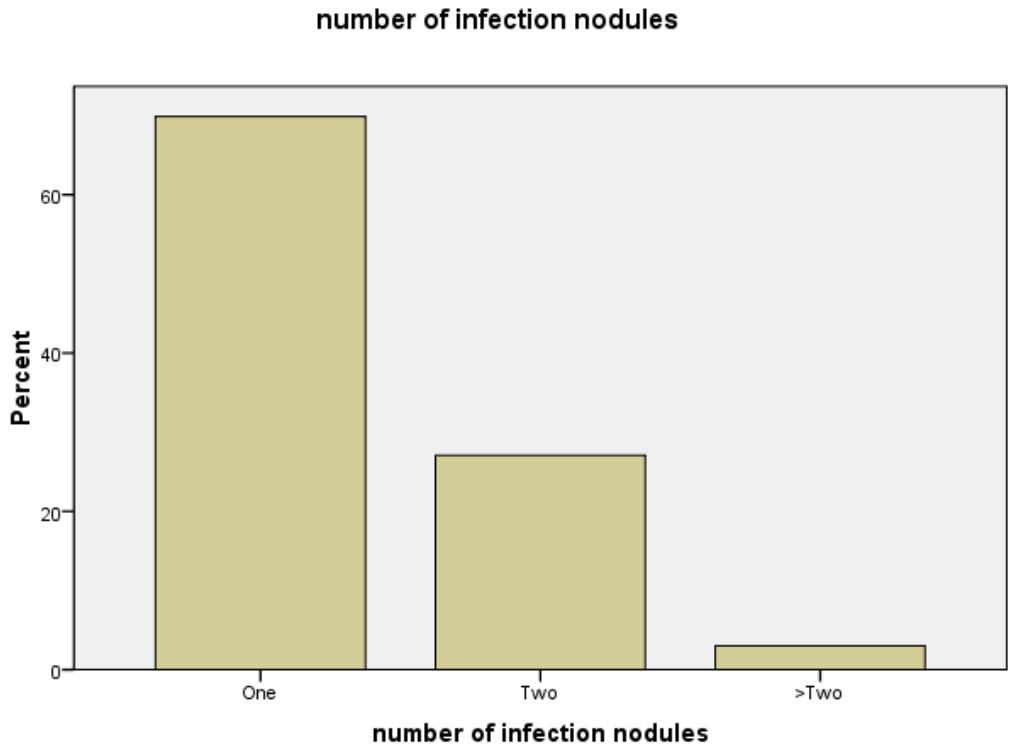


Figure 15. Distribution of nodules among patients with CL in North of west Bank

4.8. Type of animals living in contact with patients with CL

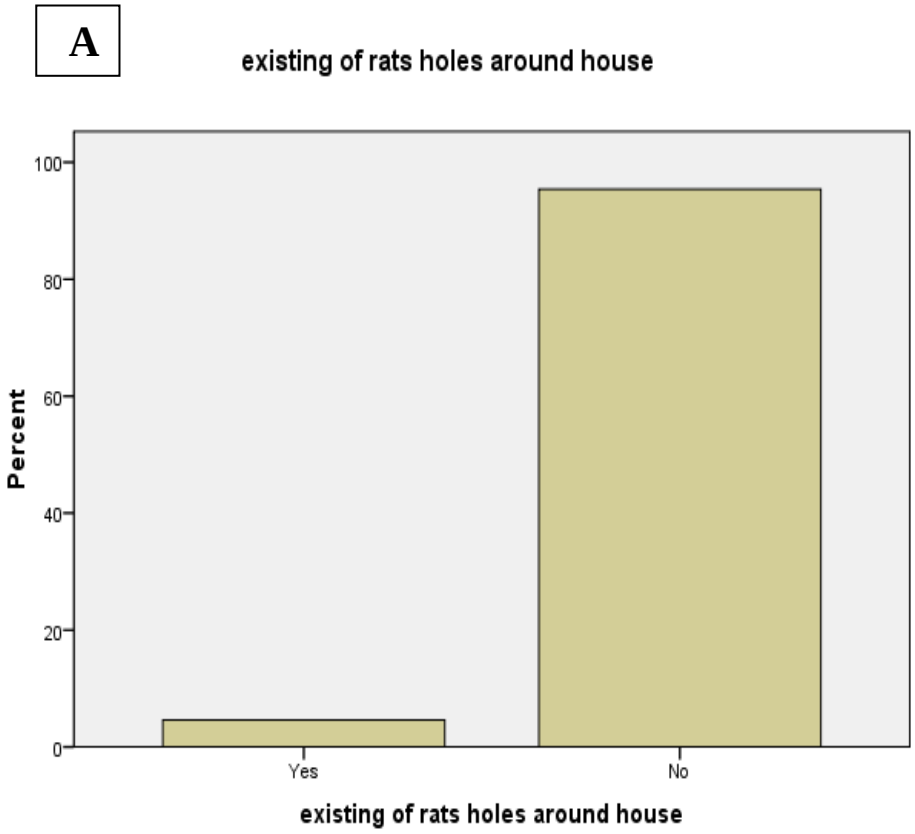
Table 3 summarizes the distribution of domestic animals which are in contact with CL patients.

Table 3. Distribution of domestic animals near patients with CL.

Animal	Frequency [No (%)]
Cows	29 (2.5)
Goats	101 (8.8)
Sheeps	249 (21.7)
Chickens	38 (3.3)
ND	733 (63.7)
Total	1150 (100)

4.9. Existing of dogs and rats around the area of patients with CL

Our data showed that 95% (1093/1150) of patients with CL reported no holes of rats in the area where they live (Fig. 16A). When respondents were asked whether they have seen rats around their houses, 6.6% (75/1150) have confirmed the presence of those non-domestic animals while the majority (76.4%;879/1150) reported no rats near their residence (fig. 16B)



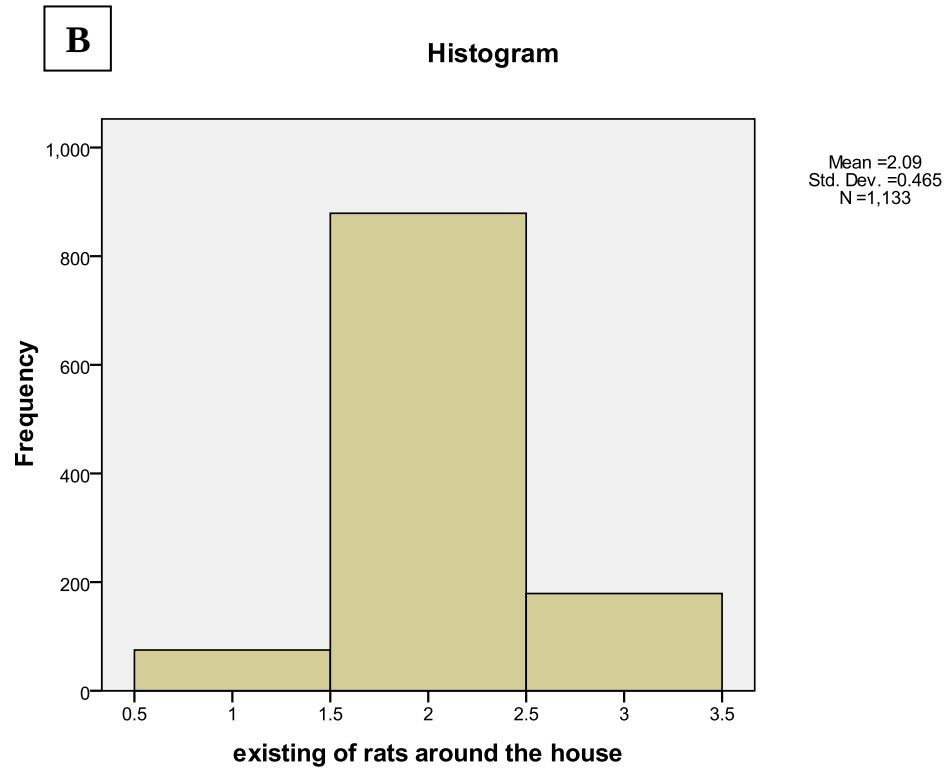


Figure 16. Existing of rats (A) or holes for rats (B) where patients with CL live.

There were 43.2% (497/1150) of respondents who saw dogs around their homes (Fig 7). However, 48% (553/1150) of respondents were not sure if they have seen dogs around.

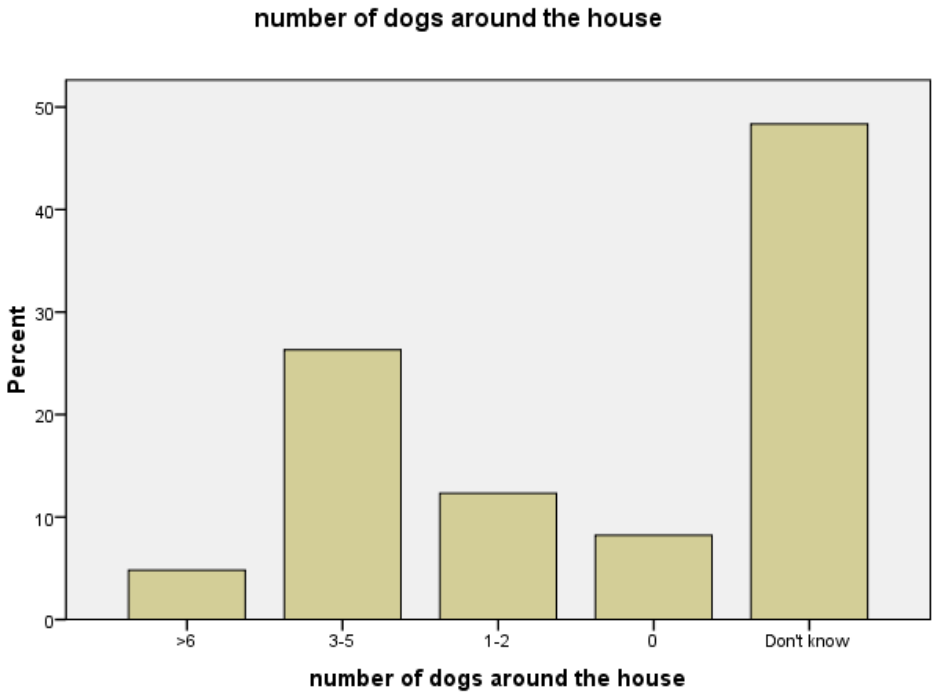


Figure 17. Existence of dogs around the patients with CL houses (numbers in the X-axis represents number of dogs).

4.10. Environmental hazards around where people live

In order to relate the presence of the leishmania vector in the area where patients with CL live, the study has been concerned with accumulation of waste in the area. Figure 18 shows clearly that around 85% of patients suffered from accumulation of waste near where they live.

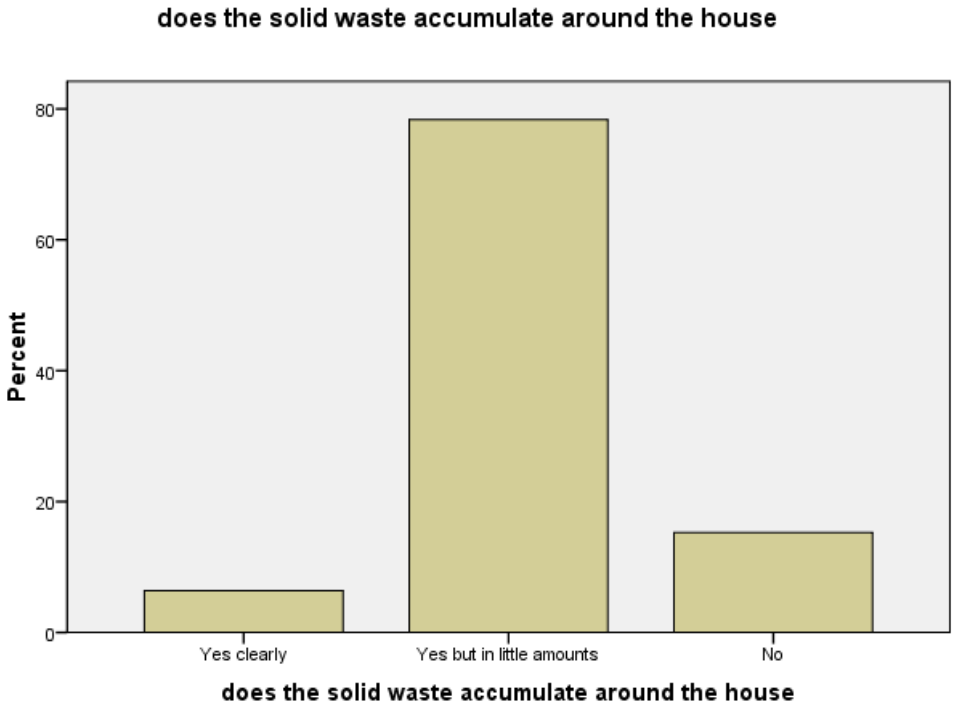


Figure 18. Accumulation of waste around the area where patients with CL are living.

4.11. Presence of screens on windows

The data in this study showed that around 87% of participants (1007/1150) had window screens (nets) in their houses (fig.19).

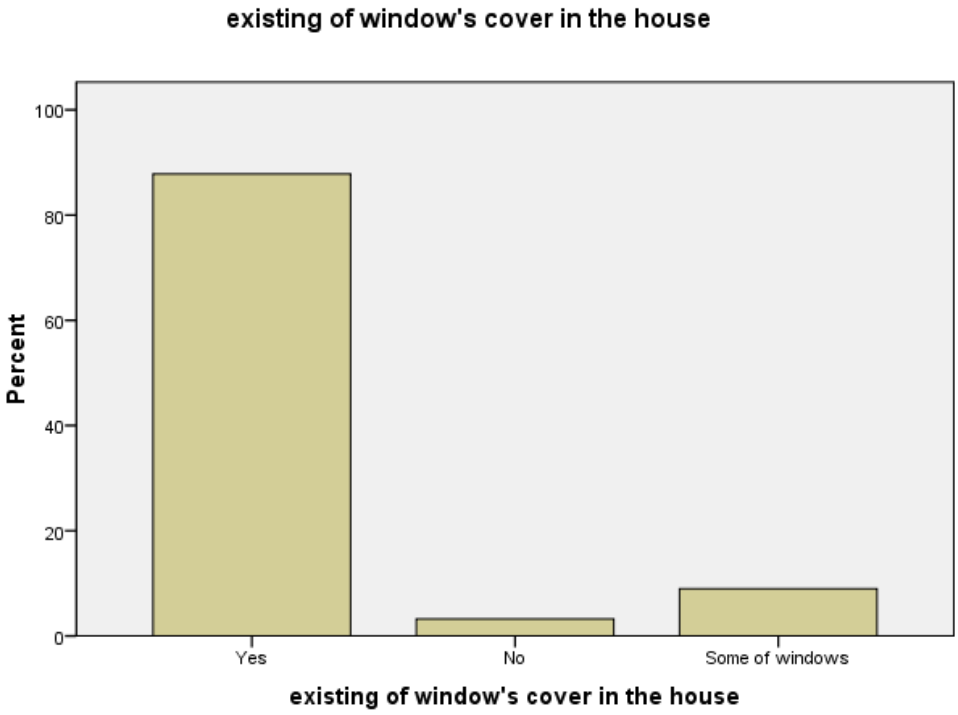


Figure 19. Presence of window screens (nets) in the houses of patients with CL

4.12. Use of insecticides inside homes of study participants

Participants have been asked about use of insecticides in their homes. Although 92 of participants were occasionally using insecticides, only 4% (55/1150) of those participants reported using insecticides all the time (fig20).

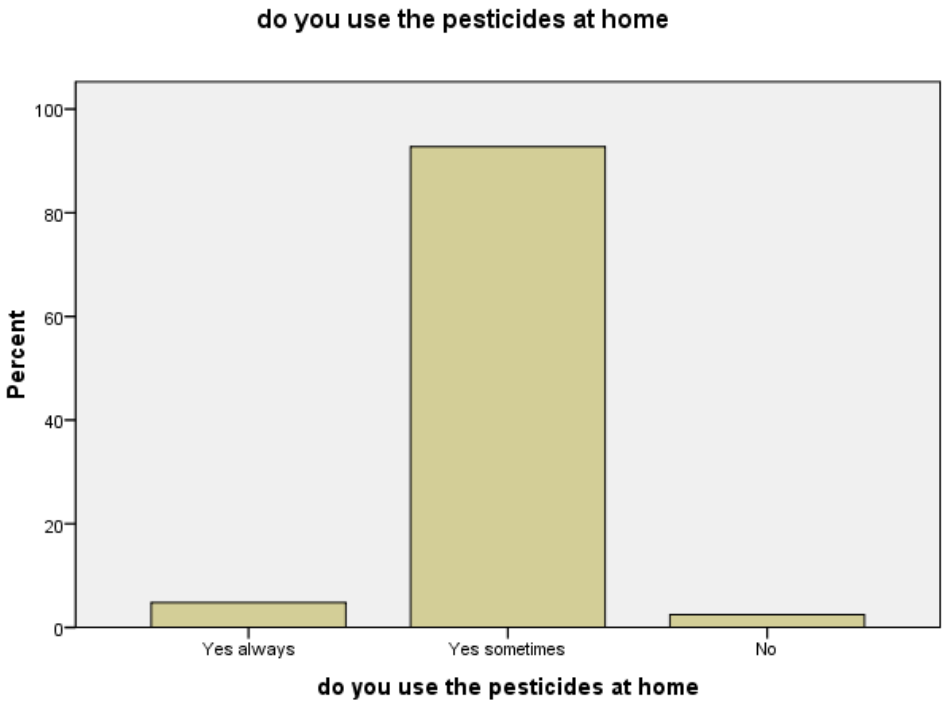


Figure 20. Use of insecticides insides houses of patients with CL.

4.13. Use of Namosiya by participants

Participants have been asked about using namosiya in their sleep. Almost none of respondents (0.2%) were using cover (namosiya) in their beds (fig21)

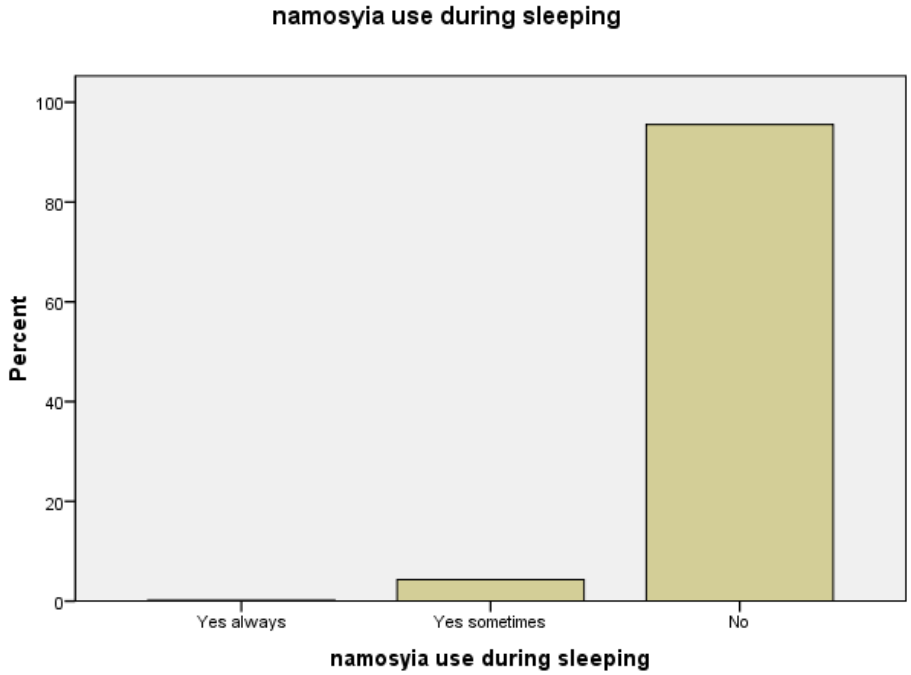


Figure 21. Use of net covers (namosiya) by patients of CL in their beds.

4.14. Geography of houses and presences of caves around patients residences

The geography of houses of study participants were of focus of this study. It has been found that around 83% (964/1150) of study samples live on mountain valleys while only 4.5% (52/1150) were living on sahel (fig. 23).

The presence of cracks and caves around the residence of patients with CL was investigated. Clearly more than 50% of patients have caves or cracks near where they live. 41% of them have those caves or cracks but at longer distances of their homes (fig. 24).

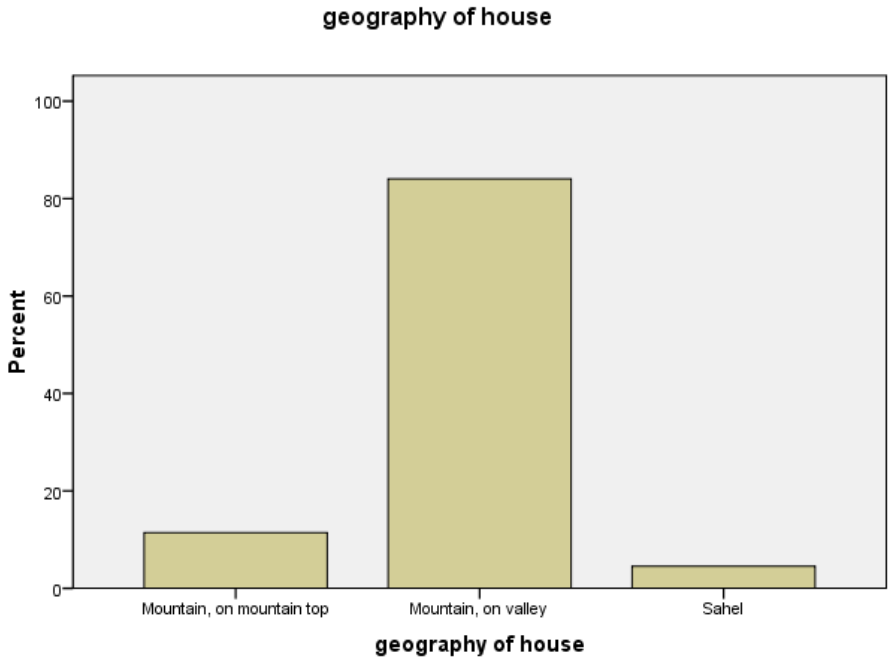


Figure 22. Distribution of patient's houses.

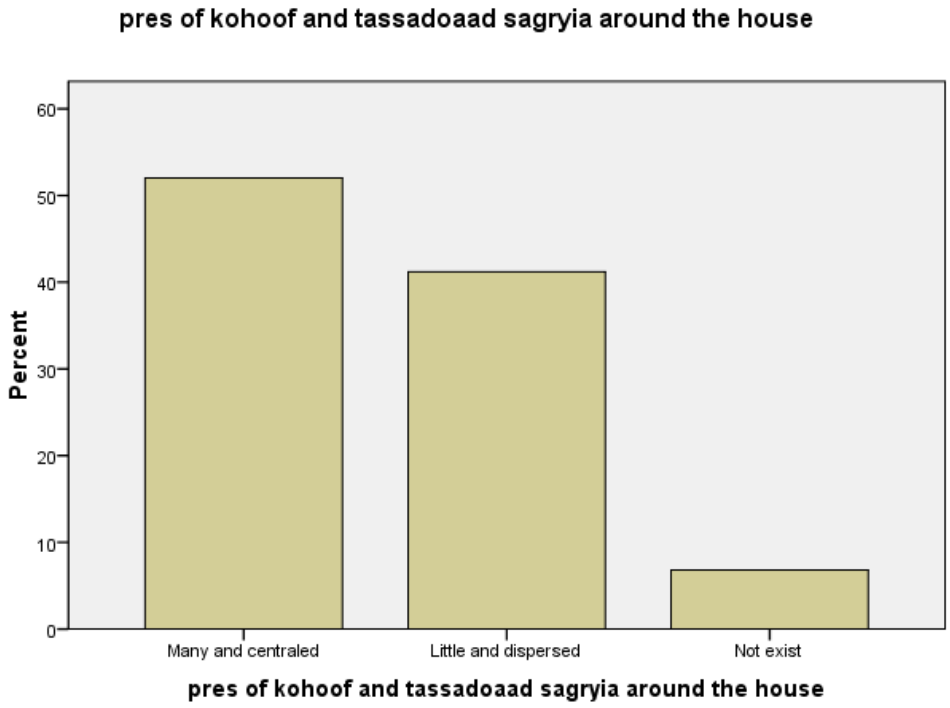


Figure 23. Presence of caves and cracks near the residence of patients with CL.

Chapter 5

Discussion

5.1.Discussion

Leishmania spp are the causative agents of leishmaniasis, a parasitic disease with wide range of symptoms including cutaneous (CL), mucocutaneous and visceral (VL) leishmaniasis. The disease currently affects around 350 million people in more than 88 countries worldwide (Desjeux, 2001). CL in Palestine, similar to other parts of the eastern Mediterranean basin is known to be caused by both L. major and L. tropica. Public health control measures in any country are strongly dependent on the information coming from the surveillance systems. On CL, for example, the WHO Expert Committee report (1990) stated that passive case detection, treatment and reporting should be the basis for a control program. Notification of the ministry of Health (MOH) of leishmaniasis in Palestine is required by law. Therefore, this study uses reported cases of CL in northern parts of West Bank of Palestine to MOH in order to get insights about possible causes of infection by this disease.

Leishmaniasis is endemic in areas of tropics, subtropics, in southern Europe, in settings ranging from rain forests in the Americans to deserts in western Asia, and from rural to periurban areas. CL is considered as an emerging disease to the area since it has been thought for long time that the disease was eradicated.

There are a number of ecological, clinical, epidemiological and entomological studies concerning the leishmaniasis that have been conducted in the area (Jaffe et al. 2004; Al-Jawabreh et al 2004). However,

from our observation the number of cases of CL has increased in the area of north West Bank. Thus, it was of great importance to analyse the causes of this increase in the area.

There were 1150 patients with CL included in this study in the period between 2000 and 2010. Thus, this study confirms that an important and active focus of leishmaniasis has been in existence in northern of West Banks, particularly in Jenin district. Other studies have previously reported the endemicity of both VL and CL in Palestine including Jericho, Jerusalem, Hebron, Safed, Negev **(Abdeen eta ., 2000; Vinititsky et al., 2010; Singer et al., 2008; Jaffe et al., 2004; Al-Jawabreh et al., 2003; Amro et al., 2009)**. The mean age of our study participants is about 24 years. About 50% of patients were below 18 years old. It seems that children are the most affected age group. Similar finding was reported also by a study on VL in Jenin district **(Abdeen et al (2002)**. Al-Jawabreh et al (2003) has reported similar findings where high rate of infection in children. It is expected that children will be easily infected in hyperendemic situation and we would expect that this gives children a protective immunity as adults.

The incidence of CL was found to be the highest in Tubas district followed by Jenin. In Tubas district, incidence of CL showed dramatic increase by5-fold between 2000 and 2010. Incidence in other parts of West Banks as indicated by this study is low. Reported incidence in West Bank for 2003 is 10 per 100,000 **(Klaus *et al*., 1994; Baneth et al., 1998; Abdeen *et al*.,**

2002; Anders *et al*., 2002; Al-Jawabreh *et al*., 2004, Jaffe *et al*., 2004, Schoenian 2003; Ministry of Health, 2004). This finding is in agreement with epidemiological reports of the area. For example, incidence in [Israel] was reported to be stable throughout the 1990 0.5-2.5/100,000 (Leventhal et al. 2001). However, other reports found high incidence of CL214/100,000 in 2004-2005) in other parts of [Israel] (Singer et al. (2008). Several studies have reported the endemicity of leishmanisis and sand fly vector in Jordan valley and Jericho **(Al-Jawabreh *et al*., 2003; Jaffe et al., 2004; Janini et al., 1995)**. Incrimination of Phlebotomus papatasi as vector of Leishmania major in the southern Jordan Valley. Janini et al., 1995).

Tubas and part of Jenin district is very close to Jordan valley. Therefore, it is expected to find high incidence in these areas. The increase of incidence in recent years may be explained by advance in development and animal production activities as well as for better diagnosis. Additionally, reports has indicated the presence of animal reservoirs and the presence of sand fly vector proven or suspected to be vectors of CL in other parts of Middle East and Mediterranean are also present in Jenin and Tubas areas **(Abdeen et al. 2002).**

More than 70% of the study participants were living in villages and peripheral of villages. Similar finding with regard with eco-distribution of leishmaniasis was published where L. tropica is more common in suburbs and villages **(Jacobson et al., 2003)**. Vinitsky et al (2010) concluded also

that most of patients with CL were living in the city outskirts. Others have reported that the infection occurs both in old housing and new suburban settlements and also in peripheral villages **(Postigo, 2010).**

With regard of site of infection, the results showed that more than two third of our patients have their infection on their peripheral areas (hands and legs). About 25% of patients have their infection is on face. In other studies, it has been found that face and head are more affected in children and limbs were more affected in adults **(Al-Jawabreh et al., 2003).** The disagreement in results may be explained that children stay homes at night. It is well known that the activity of sand flies vectors is at night. Most of our patients use nets at their windows. This should protect them from infection by sand fly vector. This result may indicate that infection of patients (mostly) children are infected outside their houses. we should also not conclude that all nets are closed at night.

The current study showed that about 40% of participants reported dogs around their homes. Many patients have seen rat holes near where they live. Both dogs and rats are known as reservoir to CL taking into consideration that our dogs are mostly stray dogs. Sandfly vector feeds on a wide variety of hosts, including both mammals and birds. It is well known that fat sand rat *Psammomys obesus* maintains *L. major* in most foci in different countries from morocco in West to Syria and Saudi Arabia in the east. We do not know about the size of distribution of this gerbil in the area of the study. Therefore, we would recommend further studies on this aspect.

Dogs have reported as reservoir to the anthroponotic CL, although, it is thought that this is an incidental host and that the only host is human (Postigo, 2010). We would also recommend to analyze the role of dogs in transmission of CL in the study areas.

The epidemiology of CL in the Palestine and neighbouring countries appears to be undergoing a transition. Several factors, both environmental and ecological, may have contributed to the increase in CL incidence in the area particularly in Jenin districts during the period of 2000-2010. These include the expansion of towns and villages, the establishment of new settlements, and increase agricultural and poultry production. These conditions have led to an increase in refuse and solid waste providing good habitat to the vector sand fly and also attracting stray dogs and wild caned reservoir hosts.

5.2.Conclusion

The current study confirms the area of north West Bank is endemic with CL. Tubas and Jenin were found to be hyperendemic with CL since they showed high level of infection as depicted by the incidence rate of infection. Most of our patients were children of less than 18 years of old. Most of our participants are living in suburban areas. Dogs and rats are seen near residence of CL patients.

The high incidence of CL in north of West Bank and stabilization of this incidence necessitate the adoption of control measures by Palestinian authorities to tackle this problem.

5.3.Recommendations

Based on the results of this study we recommend the following

1. Expand this survey to include other parts of West Bank
2. To study the vector reservoir in the area in order to have clear insight on transmission of CL
3. The high incidence of CL in the area of study, particularly Jenin and Tubas areas make it urgent for health authorities to put measures and control program to eradicate *Leishmania* vector and reservoirs.
4. We strongly recommend ministry of health to establish surveillance system to ensure monitoring of leishmaniasis trends in the districts to permit the detection of new emerging foci and allow the monitoring of spatial dynamics of different forms of leishmaniasis, including VL, in order to better conduct preventive measures.

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Appendix

استبيان خاص بمرض الليشمانيا الجلدية

عزيزي المواطن إن هذه الاستمارة سوف تستخدم فقط من اجل الدراسة فقط ولن يتم نشر أي أسماء وسوف يكون هنالك سرية تامة وسوف يتم نشر نتائج هذه الدراسة . إن مرض الليشمانيا منتشر في فلسطين وخاصة شمال الضفة الغربية حيث لوحظ في الآونة الأخيرة إن هذا المرض في ازدياد،حيث هذا المرض يسببه طفيل وينتقل إلى الإنسان من خلال بعوضة ال sand fly وهذه البعوضة تتواجد بكثرة في فلسطين، حيث ينتقل الطفيل الى أحشاء البعوضة وذلك بعد لدغ الحيوان الخازن لهذا الطفيل مثل الكلاب الضالة و الوبر الصخري ،وبعد فترة من الزمن تظهر اثار هذه اللدغة اما بشكل حبة او قرحة .ان هذا المرض ليس بخطير و يمكن الشفاء منه و يوجد علاج متوفر في

وزارة الصحة ويعطى مجانا .

المحافظة:.....

سنة الإصابة:.....

تاريخ بداية الأعراض.....

تاريخ التبليغ.....

الاسم:..... اسم رب الأسرة .....

هاتف.....

مكان السكن:

1 – مدينة: أ– في وسط المدينة ب– في الأطراف

2 – قرية: أ– في وسط القرية ب– في الأطراف

3–مخيم

4– في الخلاء (البادية)

العمر:.....

الجنس: 1– ذكر 2–انثى

الوظيفة:..... الحالة الاجتماعية:.....

مكان العمل أو المدرسة .....

سنوات التعليم : المصاب..... الأب..... الأم.....

هل المصاب انتقل لمنطقة فيها إصابات بالمرض ؟

1- نعم □

2- لا □

إذا كان الجواب نعم، اذكر المكان:.....

- هل التشخيص مبني على الأعراض؟

1- نعم □

2 - لا □

- هل تم تأكيد التشخيص مخبرياً ؟

1- نعم □

2 - لا □

مكان الإصابة

1- الوجه

2- الأطراف

3- أخرى .....

اذكر عدد الإصابات (عدد الحبات)

1- واحدة

2- اثنتين

3- اكثر (كم عددها) .....

ماهي طبيعة الإصابة

1-قرحة □

2- حبة □

الدخل الشهري للعائلة :

ما هو معدل الدخل الشهري للعائلة ؟ ..... دينار أردني تقريباً

<u>تربية الحيوانات والدواجن القريبة من المنزل</u>

1. حسب الجدول التالي حدد أنواع وأعداد الحيوانات التي يمتلكها صاحب المنزل أو الجيران ؟

النوع	العدد	المسافة عن المنزل	فترة وجودها
1. أبقار			
2. ماعز			
3. أغنام (نعاج و خراف)			
4. دجاج			

الاصحاح البيئي والصحة الشخصية

1.هل النفايات الصلبة متراكمة حول المنزل؟

1. نعم بشكل واضح
2. نعم بكميات قليلة
3. لا

2. ما هي طريقة حفظ النفايات.....

3. ما هي طريقة نقل النفايات؟ ..... وذلك بمعدل ..... مرة / الاسبوع

4. ما هي طريقة التخلص النهائي من النفايات .....

5. ما هي الطريقة المتبعة للتخلص من الحيوانات الميته.....

6. ما هو معدل وجود جثث حيوانات ميتة قبل الاصابة قرب المنزل؟

1. باستمرار
2. أحياناً
3. نادراً

7. هل يوجد جحور للفئران حول المنزل أو بالقرب منه؟

1. نعم
2. لا

8. هل يتم التخلص من المياه العادمة عن طريق رشها حول المنزل ؟

1. نعم وبشكل دائم
2. أحياناً
3. نادراً
4. لا مطلقاً

9-هل يوجد على شبابيك المنزل منخل (شبك)

1- نعم
2 -لا
3- البعض

10-هل دائماً تحكم اغلاق منخل النوافذ:

1-نعم دائماً
2-في بعض الاحيان

3- نادراً جداً

11-هل سبق و نمت خارج المنزل او على الاسطح او في الخلاء:

1-نعم في معظم الاحيان

2-نعم احيانا

3-نادرا جداً

4-لا

استخدام المبيدات لمكافحة الحشرات:

1 -هل تستعملون أي من مواد مكافحة الحشرات في المنزل :

1-نعم دائماً

2-نعم احيانا

3-لا

2-هل تستعملون الناموسية اثناء النوم :

1- نعم دائماً

2- احياناً

3- لا

3-قبل ظهور أعراض المرض هل كان ينام أحد مع المصاب في نفس الغرفة:

1-نعم (حدد الاسماء).....

2-لا

4-هل أصيب أحد من الأشخاص الذين يسكنون بالمنزل بمرض اللشمانيا الجلدية منذ أن سكنتم المنزل وحتى الآن ؟

1-نعم

2-لا

5-سبق و أن أصيب أحد من الأشخاص الذين يسكنون بالجوار بمرض اللشمانيا الجلدية ؟

1-نعم

2-لا

6. تضاريس المنطقة التي يقع فيها مكان السكن:

أ. منطقة جبلية على قمة الجبل

ب. منطقة جبلية في الوادي

ج. منطقة سهلية

7. وجود كهوف و تصدعات صخرية قريبة من المنزل:

أ. كثيرة و منتشرة

ب. قليلة و متباعدة

ج. غير موجودة

8. هل قام المجلس المحلي برش المنزل بالمبيدات لمكافحة الحشرات خلال فصل الصيف الذي سبق ظهور المرض ؟

1. نعم (انتقل الى سؤال رقم 9)

2 . لا

3 لا اعرف

9. كم مرة تم رش المبيدات و متى و أين تم رشها، مثلاً: على الجدران داخل المنزل، على الجدران خارج المنزل داخل الحظائر؟

1- مرة

3- مرتان

4- ثلاث مرات

4 - لا اعرف

قسم خاص بالكلاب و الحيوانات البرية:

أ. الفئران والقوارض :

1. هل يوجد فئران أو جرذان حول المنزل أو في الجوار:

أ. نعم

ب. لا

ج. لا أعرف

2. إذا كانت الاجابة على السؤال السابق نعم أين توجد الفئران أو الجرذان يمكن اختيار أكثر من إجابة؟

أ. داخل المنزل

ب. حول المنزل

ج. قريباً من المنزل في (صِف المكان) ..... على بعد ..... متر

د. داخل حظيرة الحيوانات على بعد ..... متر من المنزل.

هـ. أخرى حدد ..... على بعد ..... متر من المنزل.

3. هل يمكن ملاحظة جحور الفئران و أماكن تواجدها حول المنزل و في الجوار؟

أ. نعم

ب. لا

ج. لا أعرف

4. هل سبق و أن رأيت الفئران أو الجرذان أثناء النهار ؟

أ. نعم

ب. لا

ج. لا أعرف

5. هل كانت تظهر الفئران أو الجرذان أثناء النهار بشكل .....

أ. مستمر يومياً

ب. بين الحين و الآخر

ج. نادراً

ب. الكلاب الضالة :

1. كم تقدر أعداد الكلاب الضالة التي قد تتواجد حول المنزل أو في الجوار:

أ. أكثر من 6 كلاب

ب. من 3 – 5 كلاب

ج. من 1 – 2 كلب

د. غير موجودة

هـ. لا أعرف

2. معدل وجود الكلاب الضالة:

أ. باستمرار (يومياً تقريباً)

ب. من 3 – 4 أيام / اسبوع

ج. مرة اسبوعياً

د. مرة /شهر

هـ. نادراً

3. بعد أماكن تواجدها عن المنزل:

أ. أقل من 100 متر

ب. من 100 – 300 متر

ج. أكثر من 300 متر

4. أوقات توجدها :

أ. أثناء ساعات المساء

ب. أثناء النهار

ج. أثناء ساعات المساء أو النهار

د.على مدار الساعة

5. فترة تواجدها:

أ. دقائق معدودة (تمر من المنطقة)

ب. من 1- 3 ساعة

ج. أكثر من ثلاث ساعات

د. الكلاب المنزلية:

1. هل كان يوجد في المنزل أو الجوار (على بعد 300 متر) كلب أو عدة كلاب قبل ظهور إصابة بمرض اللشمانيا ؟ (السؤال حول الظروف في فترة ظهور الاصابة)

1. نعم

2. لا

وسام صبيحات

0599281212

جامعة النجاح الوطنية

كلية الدراسات العليا

وبائية داء الليشمانيا الجلدية في شمال الضفة الغربية–فلسطين

إعداد

وسام صبيحات

إشراف

د. أيمن حسين

قدمت هذه الأطروحة استكمالاً لمتطلبات درجة الماجستير في الصحة العامة بكلية الدراسات العليا في جامعة النجاح الوطنية في نابلس– فلسطين.

2012

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إشراف

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الملخص

لقد كانت الليشمانيا مشكلة صحية عامة في جنوب غرب آسيا والعالم العربي منذ الأزل وذكرت أيام حكم الفراعنة في مصر والأشوريون في بلاد ما بين النهرين. والسبب لهذا المرض طفيليات الليشمانيا. هناك عدة أنواع من هذه الطفيليات التي تسبب داء الليشمانيا حيث أكد الأشكال الثلاثة: الجلدي (CL، MCL) والحشوية (VL) داء الليشمانيا.ان شمال فلسطين هي مركز لمنطقة تعيش فيها CL البسيطة هي مفرطة التوطن. ان طفيلي الليشمانيا ينتقل عن طريق ذبابة الرمل الناقل بدعم من مجموعة واسعة من الحيوانات الخازنة موزعة على معظم المناطق المأهولة في فلسطين هنالك نوعان من داء الليشمانيا في فلسطين : واحد هو CL الرئيسية الناجمة *L. major* or *L. tropica*. والآخر هو الحشوية الناجم عن الطفيلية *L. infantum* وتفيد التقارير الرسمية أن معدل حدوث داء الليشمانيا في العام2003 في جميع المناطق الفلسطينية في الضفة الغربية باستثناء قطاع غزة أكثر من 10 لكل 100000 **الأهداف:** وبائية مرض الليشمانيا الجلدية في فلسطين والدول المجاورة ويبدو أنه يمر بمرحلة انتقالية. من ملاحظتنا أثناء العمل في عيادة الأمراض المعدية في وزارة الصحة ، لاحظنا ارتفاعا في عدد المرضى الذين يعانون من الليشمانيا الجلدية في منطقة شمال الضفة الغربية. ولذلك، تم تصميم هذه الدراسة لدراسة حالات الليشمانيا الجلدية خلال فترة السنوات العشر السابقة ، فضلا عن دراسة بيئية، والعوامل الوبائية والاجتماعية التي يمكن أن تؤدي إلى هذا الارتفاع. **المنهجية:** هذه الدراسة هي بأثر رجعي مستعرضة الدراسة. تم استعراض 1150 ملفات المرضى من أجل ملء استبيان صمم من قبل الباحث. يتضمن الاستبيان الديمغرافية، والأسئلة السريرية والتشخيصية، والوبائية. تم جمع معلومات عن العمر والجنس والإقامة والمعلومات الشخصية وكذلك معلومات عن الحيوانات المستأنسة

والبرية حول المرضى. وانه أيضا تم جمع معلومات عن طبيعة المنازل والتدابير الوقائية التي تم اتخاذها من قبل الناس لتجنب لدغة ذبابة الرمل الناقل. **النتائج:** إن النتائج الأكثر إثارة للدهشة وجدت في هذه الدراسة أن الدراسة تؤكد أن المنطقة مفرطة التوطن لداء الليشمانيا الجلدية . وتبين أن نسبة الإصابة في منطقة طوباس وجنين أكثر من باقي المناطق في هذه الدراسة بما لا تقل عن 5–10. لا يوجد فرق بين الذكور والإناث في الإصابة الليشمانيا الجلدية . ومع ذلك، وجد أن فئة الأطفال هي الأكثر عرضة. وأظهرت موقع الإصابة بين المرضى التي تتأثر في الغالب الأطراف والساقين. ولم يبلغ عن الفئران والكلاب من قبل المرضى حول منازلهم. ومن المعروف أن تلك الحيوانات تعمل كمخازن للناقلات ذبابة الرمل. تم العثور على أكثر من 70٪ من المرضى CL سكان الضواحي، رغم أنه تبين أن المرضى من مواقع جغرافية مختلفة.