



Short Communication

Prevalence of Cutaneous Leishmaniasis in Khyber Pakhtunkhwa Province of Pakistan: A Case Study

Ajmal Khan^{1,2*}, Qaisar Jamal¹, Fazal Subhan¹, Akhtar Muneer³ and Akram Shah¹

¹Department of Zoology, University of Peshawar, Postcode 25120, Peshawar, Khyber Pakhtunkhwa, Pakistan

²Center for Animal Sciences and Fisheries, University of Swat, Main Campus Charbagh, Post Code 19120, Swat, Khyber Pakhtunkhwa, Pakistan

³Leishmania Center/Dermatology Unit Kuwait Teaching Hospital Peshawar, Postcode 25140, Peshawar, Khyber Pakhtunkhwa, Pakistan

Article Information

Received 29 July 2022

Revised 06 February 2024

Accepted 27 February 2024

Available online 17 October 2024 (early access)

Authors' Contribution

AK: Conceptualization, methodology, data interpretation and analysis, Draft preparation; QJ, AS: Conceptualization, methodology, data interpretation and analysis, draft review and editing; FS: Methodology, draft review and editing; AM: Methodology, formal analysis, draft review and editing.

Key words

Cutaneous leishmaniasis, Protozoan disease, *Leishmania tropica*, *Leishmania major*, Prevalence, Khyber Pakhtunkhwa

ABSTRACT

Cutaneous leishmaniasis (CL) is a vector born protozoan disease with an annual incidence of 1.5 million cases, and is endemic in 88 countries across the world. The present descriptive cross-sectional study was conducted from January 2013 to February 2014 to cover all the four seasons. The data of this study was analyzed and processed to determine the prevalence of CL in patients reported to *Leishmania* Center/Dermatology Unit Kuwait Teaching Hospital Peshawar, Khyber Pakhtunkhwa (KPK), Pakistan during this specific period in correlation with nationality, locality, sex, age group, and month. In this study, a total number of 4479 positive cases of CL were reported, out of which 20.3% (910/4479) were new cases while 79.9% (3569/5579) were follow up cases. The prevalence of CL was found to be higher (95.31%) among local Pakistanis than Afghan refugees (4.69%). Among the locals, maximum cases were reported from two tehsils of District Khyber viz., Jamrud (41.09%) and Bara (37.95%). Out of 4479 total positive cases, 2579 (57.58%) were males, while females accounted for 1900 (42.42%). The infection was more prevalent in spring (34.75%) and winter (34.01%). The most frequent cases of CL were observed significantly in the age group of 0-9 years, followed by the age group of 10-19 years, while the least disease prevalence was in the people of age above 50 years. The socio-economic and household conditions, environmental changes, population displacement, and exposure to sandfly bites are the main factors for CL infection. Our data show that Khyber Pakhtunkhwa and adjacent tribal areas are the endemic foci of CL, caused by *Leishmania tropica* and *Leishmania major*.

Cutaneous leishmaniasis (CL) is a main public health and social problem in tropical, subtropical, and Mediterranean regions of the world including Pakistan. It generally affects the poorest people in developing countries and is considered one of the world's most ignored and poverty-related diseases (Alamzeb *et al.*, 2021; Gupta *et al.*, 2013; Pavli and Maltezou, 2010; Hajjarun *et al.*, 2004). CL is also known as Oriental sore (boil), Jericho boil,

Aleppo boil, Delhi boil, Chiclero's ulcer, Leishmanosa, Mughlaiphora, Saldana and Kaldana. In Pakistan it is caused by *Leishmania tropica* and *Leishmania major* and is the only frequent isolated causative agents of the disease in many areas of Pakistan (Khan, 2013; Bhutto *et al.*, 2009). CL is transmitted through the bite of infected female sand flies of the genera *Phlebotomus* and *Lutzomyia* in the Old and New World's, respectively. The disease gained high attention due to some reasons including expanding international travel, population overgrowth and HIV/AIDS pandemic (Urbano *et al.*, 2011; Mitropoulos *et al.*, 2010).

CL is endemic in 88 countries worldwide with an estimated 1.5 million new cases every year, and 90% of the cases occur in 7 countries namely Afghanistan, Algeria, Pakistan, Peru, Saudi Arabia, and Syria (Jarjani *et al.*, 2019; Pavli and Maltozhu, 2010; Reithinger and Dujardin, 2007). Pakistan is situated in sub-tropical region of the world and is endemic for CL. This infection is found

* Corresponding author: ajmalkhan399@hotmail.com
0030-9923/2024/0001-0001 \$ 9.00/0



Copyright 2024 by the authors. Licensee Zoological Society of Pakistan.

This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

in all the four provinces of Pakistan including Khyber Pakhtunkhwa (KPK). During 1996-2000, the incidence of CL in Sindh province of Pakistan has increased to an alarming level (Bhutto *et al.*, 2003). It was first endemic in Baluchistan and has now become highly prevalent in KPK, Sindh, and parts of Punjab. The endemic areas of the disease in Pakistan include Dir, Derabughti, D.G. Khan, Rajanpur, Jacobabad, Larkhana, Dadu, Quetta, Qila Abdullah, Pishin and Qila Saifullah (Durrani *et al.*, 2011; Soomro *et al.*, 2009).

In Pakistan, CL occurs throughout the year and various outbreaks have been reported frequently by various scientists. Records are not available about the ever first report of the infection to Pakistan; however, in 1935 a severe outbreak of the disease was occurred in Quetta after a severe earthquake (Samiullah *et al.*, 2009). First authentic report on outbreak of cutaneous leishmaniasis was published by Professor Mark Rowland of London School of Hygiene and Tropical Medicine in 1997 from Timergara Afghan refugee camp of district Dir, KP, Pakistan (cited in Kolaczinski *et al.*, 2004). In 2002, the most severe outbreaks of the disease occurred in two districts of Sindh province *viz.*, Dadu and Larkana, in which about 11000 cases were registered during 2001-2002 (Samiullah *et al.*, 2009).

The status of CL in Pakistan is expected to be changing and spreading to non-endemic areas, due to recent large population movements of internally displaced persons (IDPs) because of armed forces operations and severe flooding. It is also a major problem faced by the soldiers of Pakistan armed forces stationed in tribal areas of Pakistan and Pak-Afghan border. The present study was designed to determine the prevalence of CL in Khyber Pakhtunkhwa (KPK) and adjacent areas and to assess its pattern in correlation with region, gender, age, and month along with the associated risk factors.

Materials and methods

The study was conducted from January 2013 to February 2014 in the dermatology out-patient unit, Kuwait Teaching Hospital (KWH) Peshawar, KPK, Pakistan. KWH is a focal point for CL patients from Peshawar and other parts of the province including adjacent tribal areas.

A total of 4479 CL positive patients, who visited KWH were examined by an expert dermatologist. The suspected clinical diagnosed CL cases were confirmed through microscopy (exudate smears). The lesions of the positive CL patients were punctured with sterile lancets, the exudates were smeared on slides and the diagnosis was done on the basis of direct microscopic visualization of the stained *Leishmania* amastigotes.

The prevalence of CL in KPK Province of Pakistan and adjacent former tribal areas was calculated in

percentage in correlation with nationality, locality, sex, age, and month.

Results and discussion

The present study reports the prevalence of CL in human population of KPK province of Pakistan along with the adjacent former tribal areas. The new cases or incidence of CL was reported to be 20.3% (910/4479) in the area while the follow up cases were reported to be 79.7% (3569/4479). A total of 4479 CL infected individuals, both local Pakistanis (4269/4479; 95.31%) and Afghan refugees (210/4479; 4.69%) were reported in this study, who visited KWH from January 2013 to February 2014. The results show that cutaneous leishmaniasis has attained epidemiological proportion in KPK. A similar study conducted from September 2019 to January 2020 has reported 358 CL cases in some selected districts of KPK (Iqbal *et al.*, 2022). A more recent study also reported a total of 3188 microscopically confirmed CL cases in KPK province of Pakistan in 2021, which shows the infection is still increasing and needs more attention (Ullah *et al.*, 2023). Previous studies also reported similar results (Jamal *et al.*, 2013; Samiullah *et al.*, 2009). The reason for higher prevalence among local Pakistanis may be the novelty of the disease in the area, low immunity against CL and large sample size of the local population. The local Pakistanis were not previously exposed to this disease while Afghan refugees were previously exposed to the disease so have develop resistance due to which the infection is more prevalent in locals than war affected Afghan refugees.

Table I shows locality, gender, age and month wise prevalence of CL infected patients in KPK province of Pakistan. The infection was more prevalent in two tehsils of District Khyber of erstwhile FATA *viz.*, Jamrud (41.09%) and Bara (37.95%), while the infection rate was lowest (0.12%) in district Buner. The reason for higher prevalence in tehsil Jamrud and Bara of Khyber is due to the geography, family, and cultural relation of these tribal people with the people of Afghanistan and Afghan refugees residing in different areas of Pakistan.

Table I shows that the CL prevalence rate was higher in males than females. The higher prevalence rate in male is due to their increased vulnerability to the bite of sand flies, which is influenced by factors such as sleeping without shirts during warm seasons and frequent travel to CL endemic areas for employment or other purposes. On the other hand, the females are comparatively protected from sand flies bite as they often use well-covered dresses and are restricted to houses due to Pakhtoon local culture. This may however also depend on gender-related variances in the host response to infectivity (Travi *et al.*, 2002). Previous studies conducted by Jamal *et al.* (2013), Samiullah *et al.* (2009) and Nawaz *et al.* (2010), also

reported similar higher infection in males. Some studies attributed the gender difference observed in some parasitic disease to hormonal effects (Bailey and Diana, 2007; Khan and Muneeb, 2005; Kassiri *et al.*, 2012).

Table I. Age-wise, gender-wise, locality-wise and month-wise prevalence of cutaneous leishmaniasis in Khyber Pakhtunkhwa, Pakistan.

	New cases	Follow up cases	Total positive cases	Prevalence
Nationality				
Pakistanis	868	3401	4269	95.31%
Afghan refugees	42	168	210	4.69%
Locality				
Jamrud	356	1398	1754	41.09%
Bara	330	1290	1620	37.95%
Peshawar	96	340	436	10.21%
Landikotal	56	218	274	6.42%
Swabi	15	89	104	2.44%
Nowshera	14	62	76	1.78%
Buner	1	4	5	0.12%
Gender				
Male	517	2062	2579	57.58%
Female	393	1507	1900	42.42%
Age group (Years)				
0-9	319	1387	1706	38.09%
10-19	246	1062	1308	29.20%
20-29	157	458	615	13.73%
30-39	70	334	404	9.02%
40-49	66	181	247	5.51%
50-59	24	84	108	2.41%
Above 60	28	63	91	2.03%
Month				
Jan-2013	112	277	389	8.68%
Feb-2013	102	404	506	11.30%
Mar-2013	119	407	526	11.74%
Apr-2013	64	344	408	9.11%
May-2013	51	239	290	6.47%
Jun-2013	45	165	210	4.69%
Jul-2013	31	176	207	4.62%
Aug-2013	49	98	147	3.28%
Sep-2013	37	138	175	3.91%
Oct-2013	37	121	158	3.53%
Nov-2013	49	154	203	4.53%
Dec-2013	68	235	303	6.76%
Jan-2014	91	413	504	11.25%
Feb-2014	55	398	453	10.11%

Table I also shows the prevalence of cutaneous leishmaniasis in different age groups. The highest age specific prevalence of CL was recorded in patients with age group of 0-9 years with an infection rate of 38.09%, and the lowest prevalence rate was observed in patients having age group of above 60 years (2.03%). Previously

Nawaz *et al.* (2010) had reported that CL affect more cases in the age group of 0-9 years, whereas Jamal *et al.* (2013) have shown that most highly infected age group with CL is person of 11-20 years old. The reason for highest infection rate in the children is due to their more outdoor activities and less developed immune systems.

Considering month-wise prevalence of CL (Table I), the highest prevalence rate was reported in the month of March 2013 (11.74%), which the lowest prevalence rate of infection was recorded in the month of August 2013 (3.28%). The prevalence of CL fluctuates significantly throughout the year with the highest rates occurring during the initial three months of the year i.e. in winter season. This fluctuation pattern is attributed to increased activity of sand flies during warm seasons (June to September), particularly in temperate regions like Pakistan (Majidnia *et al.*, 2023). The infected sand flies transmit the disease during their active months which results in appearance of symptoms in the subsequent winter and spring seasons.

Major risk factors associated with CL are poor socioeconomic conditions, poor housing and poor sanitary conditions, high temperature and high humidity, domestic animals and pets, non-meshed windows in living rooms, exposed body parts and uncovered sleeping habits, non-use of insect repellents and nets, outdoor activities in dawn and dusk, environmental changes and population displacement, and malnutrition as reported in our previous study (Jamal *et al.*, 2013) as well as other researchers (Alzahrani *et al.*, 2023; Lana *et al.*, 2021; Ullah *et al.*, 2016). According to these reports, about 70-80% of the infected individuals were found to be infected due to the mentioned risk factors. The sandflies are nocturnal and are more active from dusk to dawn when temperature falls and humidity rises (Lawyer and Perkins, 2000) so those individuals who are performing outdoor activities in these times are more susceptible to sandfly bites and subsequent leishmaniasis infection.

This study concludes that CL is emerging as a major public health problem in KPK province of Pakistan. The infection was found to be more prevalent among male local population with maximum cases in Jamrud and Bara tehsils of Khyber Agency. Children were found to be more susceptible to get infected with appearance of symptoms mostly in the months of January-March. The measures for prevention of sandfly bites and improving socioeconomic and sanitary conditions play an important role in preventing the infection.

Funding

The study received no external funding.

Ethics statement

The study was approved by Ethics Committee of

University of Peshawar. The informed consent was taken from all participants for which a specially designed proforma was used containing information regarding name of the patient, father's name, gender, age, nationality, locality, family history, diagnosis, treatment and follow up schedule.

Statement of conflict of interest

The authors have declared no conflict of interest.

References

- Alamzeb, M., Ali, S., Rahid, M.U., Khan, B., Ihsanullah, Adnan, Omer, M., Ullah, A., Ali, J., Setzer, W.N., Salman, S.M., Khan, A. and Shah, A., 2021. *Nat. Prod. Commun.*, **16**: 1-13. <https://doi.org/10.1177/1934578X211031148>
- Alzahrani, M.J., Elfaki, N., Abdalla, Y.H.A., Alkhadher, M.A., Ali, M.H.M. and Ahmed, W.A.M., 2023. *Int. J. Gen. Med.*, **16**: 723-731. <https://doi.org/10.2147/IJGM.S401618>
- Bailey, M.S. and Diana, N.J., 2007. *Clin. Dermatol.*, **25**: 203-211. <https://doi.org/10.1016/j.clindermatol.2006.05.008>
- Bhutto, A.M., Soomro, R.A., Nonaka, S., and Hashiguchi, Y., 2003. *Int. J. Dermatol.*, **42**: 543-8. <https://doi.org/10.1046/j.1365-4362.2003.01818.x>
- Bhutto, A.M., Soomro, F.R., Baloch, J.H., Matsuuro, J., Veezato, H., Hashiguchi, Y. and Katakura, K., 2009. *Acta Trop.* **111**: 295-298. <https://doi.org/10.1016/j.actatropica.2009.05.009>
- Durrani, A.Z., Durrani, H.Z., Kamal, N. and Mehmood, N., 2011. *Pakistan J. Zool.*, **43**: 263-271.
- Gupta, A., Nagar, M., Mishra, S.S. and Lahariya, C., 2013. *Int. J. trop. Dis. Hlth.*, **3**: 73-81. <https://doi.org/10.9734/IJTDH/2013/2732>
- Hajjarian, H., Mohebbali, M., Razavi, M., Rezaei, S., Kazemi, B., Edrissian, G., Mojtabavi, J. and Hooshmand, B., 2004. *Iran. J. Publ. Hlth.*, **33**: 8-15.
- Iqbal, W., Iram, U., Nisar, S., Musa, N., Alam, A., Khan, M.R., Ullah, B., Ullah, M. and Ali, I., 2022. *Braz. J. Biol.*, **8**: 84. <https://doi.org/10.1590/1519-6984.249124>
- Jamal, Q., Shah, A., Ali, N., Ashraf, M., Awan, M.M. and Lee, C.M., 2013. *Pakistan J. Zool.*, **45**: 537-541.
- Jarjani, O., Mirkarimi, K., Charkazi, A., Shahamat, Y.D., Mehrbakhsh, Z. and Bagheri, A., 2019. *Parasite Epidemiol. Contr.*, **3**: 1-6. <https://doi.org/10.1016/j.parepi.2019.e00099>
- Kassiri, H., Sharifinia, N., Jalilian, M. and Shemshad, K., 2012. *Asian Pac. J. trop. Dis.*, **S382-S386**. [https://doi.org/10.1016/S2222-1808\(12\)60186-8](https://doi.org/10.1016/S2222-1808(12)60186-8)
- Khan, A., 2013. *Antileishmanial activity of alkaloids isolated from Berberis glaucocarpa against promastigotes of Leishmania tropica clinical field isolate KWH₂₃*. M. Sc. thesis, Department of Zoology, University of Peshawar, KP, Pakistan.
- Khan, S.J. and Muneeb, S., 2005. *Dermatol. Online J.*, **11**: 4. <https://doi.org/10.5070/D325B5X6B4>
- Kolaczinski, J., Brooker, S., Reyburn, H. and Rowland, M., 2004. *Trans. Roy. Soc. Trop. Med. Hyg.*, **98**: 373-378. <https://doi.org/10.1016/j.trstmh.2003.11.003>
- Lana, J.T., Mallipudi, A., Ortiz, E.J., Arevalo, J.H., Llanos-Cuentas, A. and Pan, W.K., 2021. *Trop. Med. Hlth.*, **49**: 40. <https://doi.org/10.1186/s41182-021-00332-0>
- Lawyer, P.G. and Perkins, P.V., 2000. Leishmaniasis and trypanosomiasis. In: *Medical entomology* (eds. B. Eldridge and J. Edman). Kluwer Academic Publishers, Dordrecht. https://doi.org/10.1007/978-94-011-6472-6_8
- Majidnia, M., Ahmadabadi, Z., Zolfaghari, P. and Khosravi, A., 2023. *BMC Publ. Hlth.*, **23**: 1190. <https://doi.org/10.1186/s12889-023-16121-9>
- Mitropoulos, P., Konidas, P. and Konidas, M.D., 2010. *J. Am. Acad. Dermatol.* **63**: 309-322. <https://doi.org/10.1016/j.jaad.2009.06.088>
- Nawaz, R., Khan, A.M., Khan, S.U. and Rauf, A., 2010. *Gomal J. med. Sci.* **8**: 16-19.
- Pavli, A. and Maltezou, H.C., 2010. *Int. J. Infect. Dis.*, **14**: 1032-1039. <https://doi.org/10.1016/j.ijid.2010.06.019>
- Reithinger, R. and Dujardin, J.C., 2007. *J. clin. Microbiol.*, **45**: 21-25. <https://doi.org/10.1128/JCM.02029-06>
- Samiullah, S., Jan, A.H., Wazir, S.M. and Ali N., 2009. *J. Pak. Assoc. Dermatol.*, **19**: 212-215.
- Soomro, F.R., Pathan, G.M., Abbasi, P., Bajaj, D., Bhatti, N.S., Hussain, J., Bhutto, A.M. and Hashiguchi, Y., 2009. A survey of cutaneous leishmaniasis at Village Gaibi Dero, District Larkana, Sindh, Pakistan. *Gomal J. Med. Sci.*, **7**: 137-139.
- Travi, B.L., Osorio, Y., Melby, P.C., Chandrasekar, B., Arteaga, L. and Saravia, N.G., 2002. *Infect. Immun.*, **70**: 2288-2296. <https://doi.org/10.1128/IAI.70.5.2288-2296.2002>
- Urbano, J., Minaya, G., Sanchez-Moreno, M., Gutierrez-Sanchez, R. and Marin, C., 2011. *Ibero-Latin Am. J. Parasitol.*, **70**: 145-156.
- Ullah, K., Khan, N.H., Sepulveda, N., Munir, A. and Wahid, S., 2016. *J. Parasitol.*, **102**: 501-506. <https://doi.org/10.1645/15-919>
- Ullah, W., Yen, T.Y., Niaz, S., Nasreen, N., Tsai, Y.F., Rodriguez-Vivas, R.I., Khan, A. and Tsai, K.H., 2023. *Trop. Med. Infect. Dis.*, **8**: 128. <https://doi.org/10.3390/tropicalmed8020128>