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OCCURRENCE AND DEMOGRAPHIC DISTRIBUTION OF LEISHMANIASIS FROM KP, PAKISTAN

Dr. Huma Fatima[1]*, Faiza Humayun[1] Anmol Akbar[1], Said Miraj Ud Din[2], Nargis Shaheen[2], Attiya Iqbal[2], Syed Aizaz Ali Shah[2], Chaitenya Verma[3]

[1*]Department of Zoology, Women University Mardan, KP, Pakistan
[2]Department of Zoology, Quaid-i-Azam University, Islamabad
[3]Department of Pathology, College of Medicine, The Ohio State University, Columbus, OH 43210 United State

***Corresponding Author:** Dr. Huma Fatima
Email(s): drhumafatima@wumardan.edu.pk, & fhuma26@yahoo.com

ABSTRACT
Leishmaniasis is a parasitic disease caused by a protozoan parasite *Leishmania that* is transmitted to humans by the bite of sand fly. The vectors of *Leishmania* have two species i.e; Phlebotomus was in Old World and Lutzomyia were in New World. *Leishmania* were held to prevalent in 88 countries throughout the world. Leishmaniasis was one of the most ignored health difficulties in tropical and subtropical regions. Leishmanisis was expresses in complicated procedures as: Cutaneous Leishmaniasis (CL), Mucosal Cutaneous Leishmaniasis (MCL), Diffuse Cutaneous Leishmaniasis (L), and Visceral Leishmaniasis (VL). The global prevalence of Leishmaniasis was 12 million. In Pakistan the first main endemic of Leishmaniasis was reported from Quetta, Baluchistan in 1935 following a plain earthquake. Worldwide the prevalence of Cutaneous Leishmaniasis was increasing in children in the age of 15 years. Leishmaniasis infections were found in all ages and most commonly Cutaneous Leishmaniasis infected age groups were 10 to 40 years. In human part of the body site of lesion Leishmaniasis were found in neck, nose, hand, cheek, face, legs, arms and ears. The increases period were 2 to 8 weeks. Internationally, there were an estimated 1.5-2 million new cases and 70000 deaths each year, and 350 million people were at the risk of infection by the illness. From the current study of *Leishmania* in the eleven districts of KP from 2018-2020 concluded that the year wise district prevalence of Leishmanial patient of KP cases from 2018- 2020 showed high prevalence in Mardan and low prevalence in other districts. The data was also reported showed that males were more affected as compare to females. The age wise prevalence was highly reported in age group 1 to 24 years and low in 75 and above years old group. The sites of lesion were highly reported on hands and low on other parts of the body.

Keywords: *Leishmania,* Cutaneous leishmanisis, mucutaneous leishmanisis, Visceral leishmanisis , Lifecycle of *leishmania,* site of lesions, year wise, Age wise ,Gender wise, district wise, Month wise

1. INTRODUCTION
Leishmania is a vector-borne zoonotic disease affecting millions of people worldwide. This disease is caused by haemoflagellate obligate intracellular parasitic protozoan. There are two main groups of parasite; The old world species occurring in Europe, Africa and Asia, and the new world species

occurring in America, about 53 species of the parasite have been described from different region of the world; of these,31 species are known to parasite of mammals and 20 species are pathogenic for human being. *Leishmania* infection is transmitted to humans and to other mammals by the bite of an infected female sand fly vector belonging to the family Psychodidae. The transmission can either be zoonotic, in which the reservoir hosts are wild animals, domestic animals, or anthroponotic, in which the reservoir host is human [1].

Leishmaniasis is a poverty-related disease in which poverty and diseases reinforce each other in various cycles. Poverty determinants like malnutrition, poor housing, displacement illiteracy, gender discrimination, immune system weakness, and lack of resources are the associated factors. Visceral *Leishmania* is the most severe form of Leishmanial, primarily distributed in East Africa, South America, South Asia, and Mediterranean Region, with an estimated 50'000 to 90'000 new cases each year. Total 90% of reported visceral Leishmanial cases occur in Ethiopia, Brazil, Kenya, India, Somalia, South Sudan, and Sudan. In 2015 the World Health Organization classified the visceral *Leishmania* as NTD [2].

In Pakistan, the visceral Leishmaniasis is mainly restricted to the eastern Pakistan and Abbottabad regions in the north. Cutaneous Leishmaniasis is reported from all parts of the country, particularly Baluchistan and Khyber Pakhtunkhwa Provinces with a significant proportion found in children aged 14 years or less. According to a study in which Cutaneous Leishmaniasis is being viewed from a purely parasitological perspective, Cutaneous Leishmaniasis was the most common form and is account for almost 0.7-1.3 million new cases per year. Cutaneous Leishmaniasis leaves a disfiguring scar on face. Globally, this disfiguring affects 1 to 1.5 million people. Approximately 90% of these infections occur in Pakistan, Afghanistan, Syria, Saudi Arabia, Algeria, Islamic Republic of Iran, Brazil and Perue. Cutaneous Leishmaniasis is still considered as an important health problem in many parts of the world especially the Mediterranean and Middle East countries [3].

The genus Leishmania belong to phylum Euglenozoa,class Kineroplastea,order Trypanosomatid, family Trypanosomatidae [4].

The female sand fly probes with its proboscis, lacerating capillaries to form a small collection of blood, from which it feeds. Sand fly becomes infected when it consumes blood containing amastigotes- infected macrophages. Amastigotes convert to Promastigote in the gut of the sand fly at ambient temperatures. Promastigote reproduce and differentiate to infective, metacyclic Promastigote form involving several infective stages, measuring approximately 10-20 micrometer in length and 1.5-3.0 micrometer in diameter. Development from amastigotes to metacyclic Promastigote takes 1-2 weeks, depending upon the *Leishmania* specie. When mature, metacyclic Promastigote migrate to the proboscis of the sand fly. They hinder with its capacity to take the next blood meal. The saliva of sand flies contains factor(s) that increase their infectivity for macrophages by inhibiting the L-arginine- dependent nitric oxide killing mechanism of macrophages [5].

Cutaneous Leishmania is mainly caused by *L. donovani, L. major, L. tropica, L. Aethiopica, L. infantum.* Cutaneous Leishmaniasis is the most prevalent clinical form of Leishmaniasis. It causes an open sore at the bite sites, which heals in a few months to a year and half, leaving an unpleasant looking scar. Diffuse cutaneous Leishmania produces wide spread skin lesions which resemble leprosy and may not heal on its own [6].

Mucocutaneous Leishmaniasis is caused by *L. braziliensis, L. panamensis, L. Amazonensis, L. guyaneisis.* Mucocutaneous Leishmania causes both skin and mucosal ulcers with damage primarily of the nose and mouth. Mucosal lesions are highly destructive, severely disfiguring and potently deadly. Upper respiratory tract, nose and oral cavity are the most frequent initial sites of mucosal lesions. Initially, Mucocutaneous Leishmania clinically starts with unspecific symptoms of inflammation i.e. nasal congestion, erythema, edema, serous rhinorrhea, and epistasis [7].

Visceral Leishmaniasis (kala azar) is the most severe form of Leishmaniasis mainly caused by *L. donovani, L. infantum and L. chagasi*. It is the prevalent form of Leishmaniasis. Sign and symptoms include fever, weight loss, hepatosplenomegaly, anemia and leucopenia [7].

There are several methods of laboratory diagnosis of Leishmaniasis including parasitological, immunological & molecular tests given as under: Spleen aspirate and biopsy, Liver biopsy, Bone

marrow aspiration, Lymph node fine needle aspiration cytology and biopsy, Blood buffy coat, Tegumentary Leishmaniasis, Culture examination, Isolation in experimental animals, Direct agglutination test, Fluorescent antibody test, ELISA, Immune blotting, Rapid antibody detection method, Antigen detection., Diagnosis using amastigotes specific antigen, Leishmania skin test (LST), PCR [8].

Leishmaniasis can be partly prevented by control of its vector using following nets treated with insecticides while sleeping. Use of insecticides impregnated dog collars and treatment of infected dogs, destroying burrows of rodents, spraying houses and animal shelters with insecticides to kill sand flies.

Most cases of Cutaneous Leishmaniasis spontaneously heal with chemotherapy. The most widely used drugs are antimonial and paromomycin. Historically the antimonial, sodium stibogluconate and melgumine have been most widely used to treat visceral disease. Miltefosine, an alkyl phosphocholine analogue, is an oral agent with few side effects and high cure rates [9].

2. METHODOLOGY

2.1 Ethical Approval

The objectives and ethical approval of this research study was approved by Ethical Review Committee of Department of Biological Sciences, Women University Mardan, Pakistan.

2.2 Consent Approval

The Consent approval was taken from MS of the hospitals and guardians/parents of patients.

2.3 Study Area

The current study was conducted in eleven districts (Buner, Swat, Dir, Bajaur, Malakand, Swabi, Upper Dir, Nowshehra, Mumand, Charsadda, and Mardan) of Khyber Pakhtunkhwa. (Figure 1)

2.3.1 Mardan

The Headquarters of Mardan Division in KP province of Pakistan. Mainly situated an altitude at 34°12'0N 72°1'60E. The over-all area of district Mardan is about 632 kilometers having 894.7 population densities. Mardan is a collusion **of** different private networks getting together to shape a broad city [10].

2.3.2 Dir

District Dir is found within the Northern of Khyber Pakhtunkhwa Pakistan. It lies in Hindu Kush extend between 35° 10 to 35° 16 North Scope and 71° 50 to 71° 83 East Longitude. Dir (L) has a range of 1585 km2 and having the population of 717649 with a depth of 543.3 individuals per kilometer [11].

2.3.3 Buner

District Buner is found within the North Area of Khyber Pakhtunkhwa. It lies between North 34°09′ 34°43′ and East 72°10′ 72°47′, covering a region of 1760 kilometer square. The region is included by Swat and Shangla to the North, by Malakand Office to the west, by Mardan Area to the south and by Hazara Division to the east [12].

2.3.3 Swabi

District Swabi was announced and updated to area on 1st July 1998. Sometime recently the upgrade, it was a tehsil of Mardan Locale. It lies between 72˚ -13' and 72˚ - 49' East longitude and 33○ -55' and 34○ - 23' north scope [13].

2.3.4 Bajaur

District Bajaur is bound on its north-east by Area Dir, south-east by Area Malakand, south by District Mumand and on its west and south-west by Afghanistan. The District of Bajaur lies between 34˚-33 to 34˚- 58 north scopes and 71˚-15 to 71˚-45 east longitudes [13].

2.3.5 Swat

Swat (5367 kilometer square) lies between 34° 36′ 56″ -36° 02′ 54″ North & 71° 42′ 30″- 072° 07′ 05″ East has to some degree warm and humid climate with brief and direct summers; temperature once in a while rises over 37°C. The yearly precipitation midpoints around 33 inches with around 17 inches amid June-September. The human population of Swat is almost 2.31 million. With tall mountains, green knolls, and clear lakes, it may be a place of incredible normal magnificence and could be a well- known advertisement for sightseers. This district is bordered by Shangla, Buner, Dir (Malakand) and Chitral. It has various environments for mosquito breeding [14].

2.3.6 Malakand

Malakand is situated within the region of Khyber Pakhtunkhwa, Pakistan. It lies between 71°37' to 72° 14' East longitudes and 34°22' to 34° 41' North scopes. In 1970, the District was molded as a Tribal Range Managed by Common government, it had as of now recognized as the Malakand Secured Zone. From 1970, the range turned out to be a portion of Malakand Division. Deliberately the Malakand district lies in key position because it goes around as a door to Lower Dir, Bajaur, Buner and Swat. Already, the area was congested with different trees sorts, be that as it may, nowadays the district have a desolate see. Close Dargai, the Dir and Swat is associated to the Mardan by Malakand Pass a location where the neighboring Pushtun tribes battled two savage battles in 1895 and 1897 withthe Majestic British Armed force [15].

2.3.7 Upper Dir

District Upper Dir is situated with Longitudes and Latitudes of 35.2042º North and 71.8722º east respectively. District Upper Dir is bounded by District Chitral to the Northern Side, by Bajaur and Afghanistan to the Western side, by District Lower Dir to the Southern side and by District Swat to Eastern side. Panjkora River is originates from Kohistan, District Upper Dir and flow southward dividing District Upper Dir into two halves [16].

2.3.8 Charsadda

District Charsadda is the 7th largest district in the Province of Khyber Pakhtunkhwa, located between 34˚2'42" to 34˚27'24" North Latitude and 71˚29'10" to 71˚56'7" East Longitude. The significant crops in the area are sugarcane, wheat, rice, and tobacco. Intensive monsoonal rainfall and melting of snow from the mountainous region are the primary sources of river flow. The main sources of irrigation in the district are River Swat, River Kabul along with the upper and lower swat canal, Michni Dalazak canal, and Dooaba feeder canal [14].

2.3.9 Nowshehra

The total area of District Nowshehra is .74, 521 km² (28,773 sq mile)**.** Nowshehra is the capital city of Nowshehra District present in the province Khyber Pakhtunkhwa of Pakistan. It is the most 78th largest city in Pakistan and ninth largest city in the province of Khyber Pakhtunkhwa. It is Located the boarder Valley of Peshawar and it lies on the River Kabul, and is approximately 27 miles (43 kilometers from the east of provincial capital Peshawar [13].

2.3.10 Mumand

The total area of district Mumand 2296 kilometer. District Mumand is a district in Peshawar Division of Khyber Pakhtunkhwa province in Pakistan. Until 2018, it was an agency of Federally Administered Tribal Areas, with merger of FATA with Khyber Pakhtunkhwa, it was created as an

agency in 1951. Mumand is bordered by Bajaur District to the north, Khyber District to the south, Malakand and Charsadda district to the east and Peshawar district to the south east. [13].

2.4 Sample Size
The sample size was consisted of 3122 patients via convenient sample at the age range from 1 to 75 above years including both genders male and female. The data was collected from DHQ office of Mardan

2.5 Study Design/Time Duration
The cross sectional and survey search design was used in this study. The collected data had been from August 2018 to December 2020 time duration. From eleven districts of KP. The Total samples collected were 3122 for this study.

2.6 Study attributes
The studies attributes involve are age, gender, districts, month and site of lesion of 3122 patients.

2.7 Inclusion criteria
The patients with symptoms of lesions of skin, face, arms and legs. self-healing, serious disability, permanent scratches or wounds, enlarged spleen, extended irregular fever, loss of weight, enlarged liver, enlarged lymph nodes, anemia, cough and diarrhea etc. was included in this study.

2.8 Exclusion criteria
Those people, who were not agreeing to participate in this study, were excluded.

2.9 Data analysis
All the collected data was analyzed using through Microsoft Excel. Data was described and presented using tables and graphs on excel sheet version (2013) as to find the prevalence of *Leishmania*

3 RESULTS
3.1 Overall prevalence of Leishmanial patients
The data of Leishmanial patients were collected from 11 districts of KP and among them high prevalence was reported in district Mardan 1329 (43%) as compared to 417 (13%) in Malakand, 416 (13%) in Dir, 309 (10%) in Upper Dir, 281 (9%) in Nowshehra, similarly low prevalence 140(4%) was reported in Swat, 85 (3%) in Charsadda,76 (2%) in Swabi, 23 (1%) in Buner,23 (1%) in Mumand and 29 (1%) in Bajaur. (Figure 2 and Table 1).

3.2 Year wise prevalence of Leishmanial patients
Out of 3122 total recruited cases the year wise districts prevalence of Leishmanial patients in the eleven districts of KP from 2018-2020 showed the prevalence was high in Mardan 5%, 47% and 46% respectively and low in other districts (Table 2).

3.3 Overall gender wise prevalence of Leishmanial patients
Out of 3122 total cases recruited the gender wise prevalence of Leishmanial patients in the eleven districts of KP from 2018-2020 showed that 1737 (56%) were male patients and 1385 (44%) were female patients. Male were more affected as compare to females (Figure 3 and Table 3).

3.4 Annual gender wise prevalence of Leishmanial patients in the eleven districts of KP
Out of 1580 total recruited cases the annual gender wise prevalence of Leishmanial patients in the eleven districts of KP from 2018-2020 showed the same trend i.e. the prevalence was high in male as compare to females (Table 4).

3.5 Gender wise distribution of Leishmanial patients

Out of 3122 total cases recruited the gender wise distribution of Leishmanial patients in the eleven districts of KP from 2018-2020 showed that Prevalence was high in Mardan district 1332 (100%) and in this district 758 (57%) were male and 574 (43%) were female affected and the Prevalence was low in district Mumand 16 (100%). In this district 8 (50%) were male and 8 (50%) were female. Male were more infected as compared to female in eleven districts included in this study. Same trend was observed all districts except district Mumand. In this district Male and Female were equally infected (Table 5)

3.6 Overall month wise prevalence of Leishmanial patients

In this study area Leishmania was observed in nearly every month of the years. Out of 3122 total cases 486 (16%), 458 (15%), 433 (14%), 308 (10%), 279 (9%), 227 (7%), 176 (6%), 150 (5%), 144 (5%), 149 (5%) and 115 (4%) were the prevalence rate for the months of January to December respectively. The highest prevalence of Leishmania cases was observed in February 486 (16%) as compared to others month and the lowest prevalence of Leishmania cases was observed in October 115 (4%) (Figure 4 and Table 6)

3.7 Month wise distribution of Leishmanial patients

In this study area Leishmania was observed in nearly every month of the years. Out of 3122 total cases recruited the month wise distribution of Leishmanial patients in the eleven districts of KP from 2018-2020 showed that the high prevalence was observed in Mardan district 1332 (100%). Prevalence from January to December i.e. 96 (7%), 154 (12%), 197 (15%),171 (13%), 74 (6%), 30 (10%), 98 (7%), 60 (5%), 114 (9%), 70 (5%), 83 (6%) and 85 (6%)respectively. The highest prevalence of Leishmania cases was observed in March 197 (15%) as compared to other months and the lowest prevalence of Leishmania cases was observed in August 60 (5%) in district Mardan. The low Prevalence was observed in Mumand district 16 (100%). From January to December i.e. 2 (13%),2 (13%),6 (38%), 1 (6%), 0 (0%), 0 (0%),5(3%),0 (0%),0 (0%),0 (0%),0 (0%),0 (0%) respectively. The highest prevalence was observed in March 6 (38%) and lowest prevalence was observed in May, June, August, September, October, November and December 0(0%) (Table 7)

Table 1 Overall prevalence of Leishmanial patients in the eleven districts of KP

DISTRICTS	2018	2019	2020	TOTAL	PERCENTAGE %
Mardan	15	846	468	1329	43%
Malakand	108	161	148	417	13%
Dir	20	167	229	416	13%
Upper Dir	61	193	55	309	10%
Nowshehra	43	218	20	281	9%
swat	35	90	15	140	4%
Charsadda	8	51	26	85	3%
Swabi	6	41	29	76	2%
Buner	8	11	4	23	1%
Mumand	8	3	6	17	1%
Bajaur	12	5	12	29	1%
TOTAL	**324**	**1786**	**1012**	**3122**	**100%**

Table 2 Year wise prevalence of Leishmanial patients in the eleven districts of KP

DISTRICTS	2018	2019	2020
	N (%)	**N (%)**	**N (%)**
Mardan	15 (5)	846 (47)	468 (46)
Malakand	108 (33)	161 (9)	148 (15)
Dir	20 (6)	167 (9)	229 (23)
Upper Dir	61 (19)	193 (11)	55 (5)
Nowshehra	43 (13)	218 (12)	20 (2)

swat	35 (11)	90 (5)	15 (1)
Charsadda	8 (2)	51 (3)	26 (3)
Swabi	6 (2)	41 (2)	29 (3)
Buner	8 (2)	11 (1)	4 (0)
Mumand	8 (2)	3 (0)	6 (1)
Bajaur	12 (4)	5 (0)	12 (1)
TOTAL	**100%**	**100%**	**100%**

Table 3 Overall gender wise prevalence of Leishmanial patients in the eleven districts of KP

GENDER	2018	2019	2020	TOTAL	PERCENTAGE %
Male	184	950	603	1737	56%
Female	140	836	409	1385	44%
TOTAL	**324**	**1786**	**1012**	**3122**	**100%**

Table 4 Annual wise gender prevalence of Leishmanial patients in the eleven districts of KP

GENDER	2018	2019	2020
	N (%)	**N (%)**	**N (%)**
Male	184 (57)	950 (53)	603 (60)
Female	140 (43)	836 (47)	409 (40)
TOTAL	**100%**	**100%**	**100%**

Table 5 Gender wise distribution of Leishmanial patients in the eleven districts of KP

District	Gender	Frequency/percentage
Mardan	Male	758 (57%)
	Female	574 (43%)
		1332 (100%)
	Male	200 (50%)
Malakand	Female	199 (50%)
		399 (100%)
Dir	Male	230 (58%)
	Female	170 (42%)
		400 (100%)
Upper Dir	Male	161 (50%)
	Female	160 (50%)
		321 (100%)
Nowshehra	Male	148 (50%)
	Female	149 (50%)
		297 (100%)
Swat	Male	101 (85%)
	Female	18 (15%)
		119 (100%)
Charsadda	Male	82 (76%)
	Female	26 (24%)
		108 (100%)
Swabi	Male	49 (64%)
	Female	27 36%)
		76 (100%)
Buner	Male	14 (61%)
	Female	9 (39%)
		23 (100%)

Mumand	Male	8 (50%)
	Female	8 (50%)
		16 (100%)
Bajaur	Male	16 (52%)
	Female	15 (48%)
		31 (100%)

Table 6 Overall month wise prevalence of Leishmanial patients in the eleven districts of KP

MONTH	POSITIVE CASES	PERCENTAGE %
January	433	14%
February	486	16%
March	458	15%
April	308	10%
May	197	6%
June	279	9%
July	227	7%
August	150	5%
September	176	6%
October	115	4%
November	144	5%
December	149	5%
TOTAL	**3122**	**100%**

Table 7 Month wise distribution of Leishmanial patients in the eleven districts of KP

District	Month	Frequency/percentage
Mardan	January	96 (7%)
	February	154 (12%)
	March	197 (15%)
	April	171 (13%)
	May	74 (6%)
	June	130 (10%)
	July	98 (7%)
	August	60 (5%)
	September	114 (9%)
	October	70 (5%)
	November	83 (6%)
	December	85 (6%)
		1332 (100%)
Malakand	January	106 (27%)
	February	50 (13%)
	March	46 (12%)
	April	25 (6%)
	May	27 (7%)
	June	46 (12%)
	July	34 (9%)
	August	23(6%)
	September	8 (2%)
	October	8 (2%)
	November	6 (2%)
	December	20 (5%)
		399 (100%)
Dir	January	27 (7%)
	February	77 (19%)
	March	19 (5%)
	April	38 (10%)
	May	16 (4%)
	June	0 (0%)
	July	23 (6%)
	August	41 (10%)
	September	37 (9%)
	October	28 (7%)
	November	44 (11%)
	December	50 (13%)
		400 (100%)
Upper Dir	January	20 (6%)
	February	61 (19%)
	March	57 (18%)
	April	21 (7%)
	May	29 (9%)
	June	21 (7%)
	July	29 (9%)
	August	17 (5%)
	September	3 (1%)

	October	27 (8%)
	November	9 (3%)
	December	27 (8%)
		321 (100%)
Nowshehra	January	110 (37%)
	February	51 (17%)
	March	90 (30%)
	April	4 (1%)
	May	5 (2%)
	June	33 (11%)
	July	4 (1%)
	August	0 (0%)
	September	0 (0%)
	October	0 (0%)
	November	0 (0%)
	December	0 (0%)
		297 (100%)
Swat	January	24 (20%)
	February	24 (20%)
	March	30 (25%)
	April	19 (16%)
	May	13 (11%)
	June	5 (4%)
	July	4 (3%)
	August	0 (0%)
	September	0 (0%)
	October	0 (0%)
	November	0 (0%)
	December	0 (0%)
		119 (100%)
Charsadda	January	9 (8%)
	February	20 (19%)
	March	22 (20%)
	April	10 (9%)
	May	7 (6%)
	June	17 (16%)
	July	16 (15%)
	August	7 (6%)
	September	0 (0%)
	October	0 (0%)
	November	0 (0%)
	December	0 (0%)
		108 (100%)
Swabi	January	30 (39%)
	February	12 (16%)
	March	16 (21%)
	April	5 (7%)
	May	13 (17%)
	June	0 (0%)
	July	0 (0%)

	August	0 (0%)
	September	0 (0%)
	October	0 (0%)
	November	0 (0%)
	December	0 (0%)
		76 (100%)
Buner	January	4 (17%)
	February	1 (4%)
	March	1 (4%)
	April	6 (26%)
	May	2 (9%)
	June	0 (0%)
	July	2 (9%)
	August	1 (4%)
	September	2 (9%)
	October	2 (9%)
	November	2 (9%)
	December	0 (0%)
		23 (100%)
Mumand	**January**	2 (13%)
	February	2 (13%)
	March	6 (38%)
	April	1 (6%)
	May	0 (0%)
	June	0 (0%)
	July	5 (31%)
	August	0 (0%)
	September	0 (0%)
	October	0 (0%)
	November	0 (0%)
	December	0 (0%)
		16 (100%)
Bajaur	**January**	1 (3%)
	February	11 (35%)
	March	8 (26%)
	April	0 (0%)
	May	0 (0%)
	June	0 (0%)
	July	3 (10%)
	August	6 (19%)
	September	2 (6%)
	October	0 (0%)
	November	0 (0%)
	December	0 (0%)
		31 (100%)

Table 8 Overall age wise prevalence of Leishmanial patients in the eleven districts of KP

AGE	2018	2019	2020	TOTAL	PERCENTAGE %
1- 24 year	225	1090	578	1893	61%
25-49 year	62	480	264	806	26%
50-74 year	29	196	155	380	12%
75 year to above	8	20	15	43	1%
TOTAL	**324**	**1786**	**1012**	**3122**	**100%**

Table 9 Annual age wise prevalence of Leishmanial patients in the eleven districts of KP

AGE	2018	2019	2020
	N (%)	**N (%)**	**N (%)**
1- 24 year	225 (69)	1090 (61)	578 (57)
25-49 year	62 (19)	480 (27)	264 (26)
50-74 year	29 (9)	196 (11)	155 (15)
75 year to above	8 (2)	20 (1)	15 (1)
TOTAL	**100%**	**100%**	**100%**

Table 10 Age wise distribution prevalence of Leishmanial patients in the eleven districtsof KP

District	Age	Frequency/percentage
Mardan	1-24 year	785 (59%)
	25-49 year	360 (27%)
	50-74 year	175 (13%)
	75 and above	12 (1%)
		1332 (100%)
Malakand	1-24 year	292 (73%)
	25-49 year	73 (18%)
	50-74 year	30 (8%)
	75 and above	4 (1%)
		399 (100%)
Dir	1-24 year	290 (73%)
	25-49 year	62 (16%)
	50-74 year	39 (10%)
	75 and above	9 (2%)
		400 (100%)
Upper Dir	1-24 year	190 (59%)
	25-49 year	96 (30%)
	50-74 year	26 (8%)
	75 and above	6 (2%)
		321 (100%)
Nowshehra	1-24 year	223 (75%)
	25-49 year	51 (17%)
	50-74 year	21 (7%)
	75 and above	2 (1%)
		297 (100%)
Swat	1-24 year	70 (59%)
	25-49 year	30 (25%)
	50-74 year	16 (13%)
	75 and above	3 (3%)

		119 (100%)
Charsadda	1-24 year	74 (69%)
	25-49 year	30 (28%)
	50-74 year	4 (4%)
	75 and above	0 (0%)
		108 (100%)
Swabi	1-24 year	36 (47%)
	25-49 year	22 (29%)
	50-74 year	16 (21%)
	75 and above	2 (3%)
		76 (100%)
Buner	1-24 year	9 (39%)
	25-49 year	6 (26%)
	50-74 year	6 (26%)
	75 and above	2 (9%)
		23 (100%)
Mumand	1-24 year	12 (75%)
	25-49 year	4 (25%)
	50-74 year	0
	75 and above	0
		16 (100%)
Bajaur	1-24 year	14 (45%)
	25-49 year	9 (29%)
	50-74 year	7 (23%)
	75 and above	1 (3%)
		31 (100%)

Table 11 Overall site of lesion wise prevalence of Leishmanial patients in the eleven districts of KP

SITE OF LESION	FREQUENCY	PERCENTAGE %
Hand	961	31%
Face	884	28%
Foot	413	13%
Multi	192	6%
Nose	191	6%
Legs	165	5%
Finger	91	3%
Head	47	2%
Lips	71	2%
Ear	22	1%
Chin	35	1%
Back	35	1%
Chest	15	0%
TOTAL	**3122**	**100%**

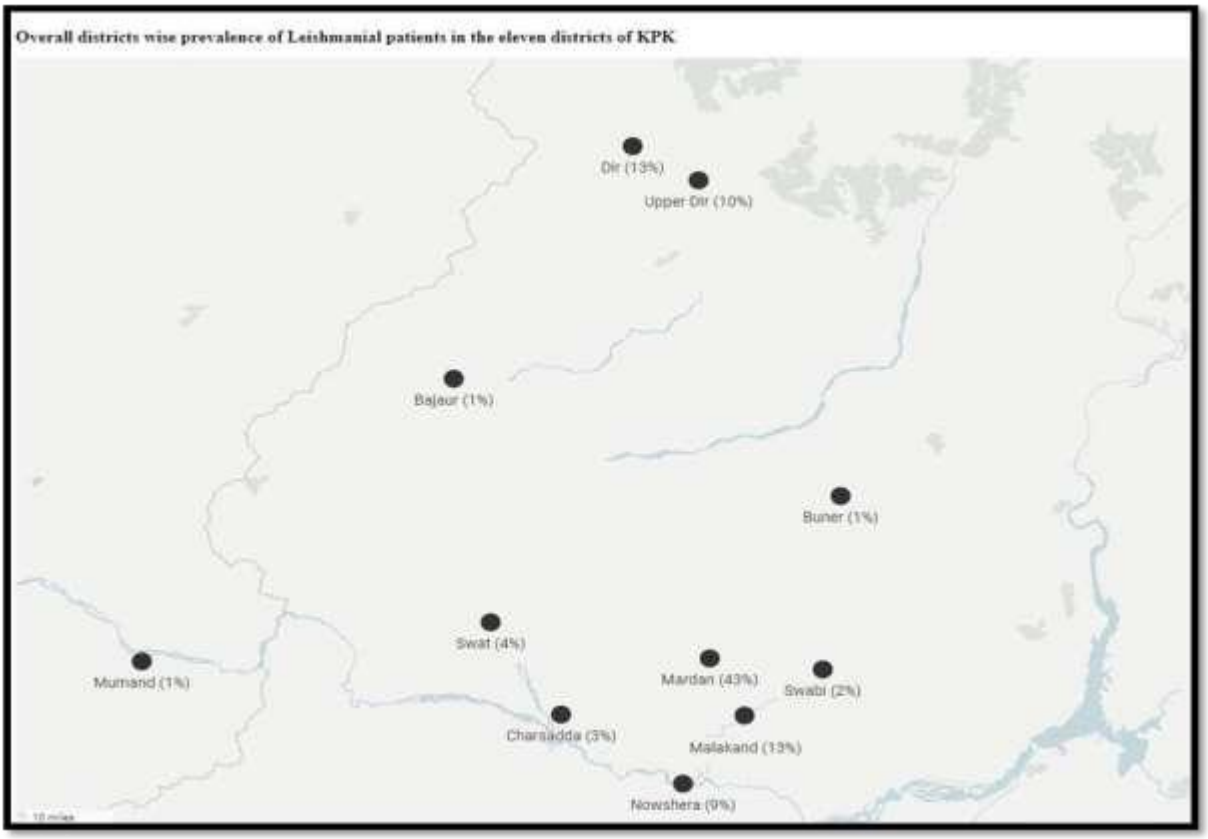

Figure 1 study areas of KP / sites of data collection

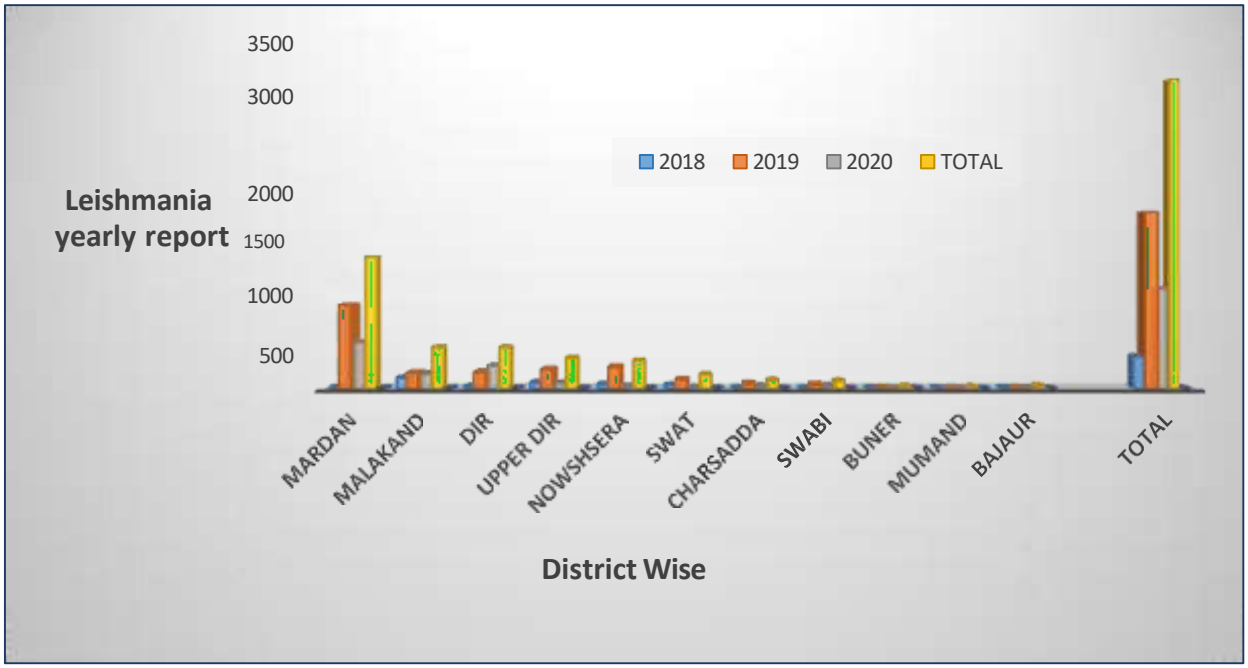

Figure 2 Overall prevalence of Leishmanial patients in the eleven districts of KP

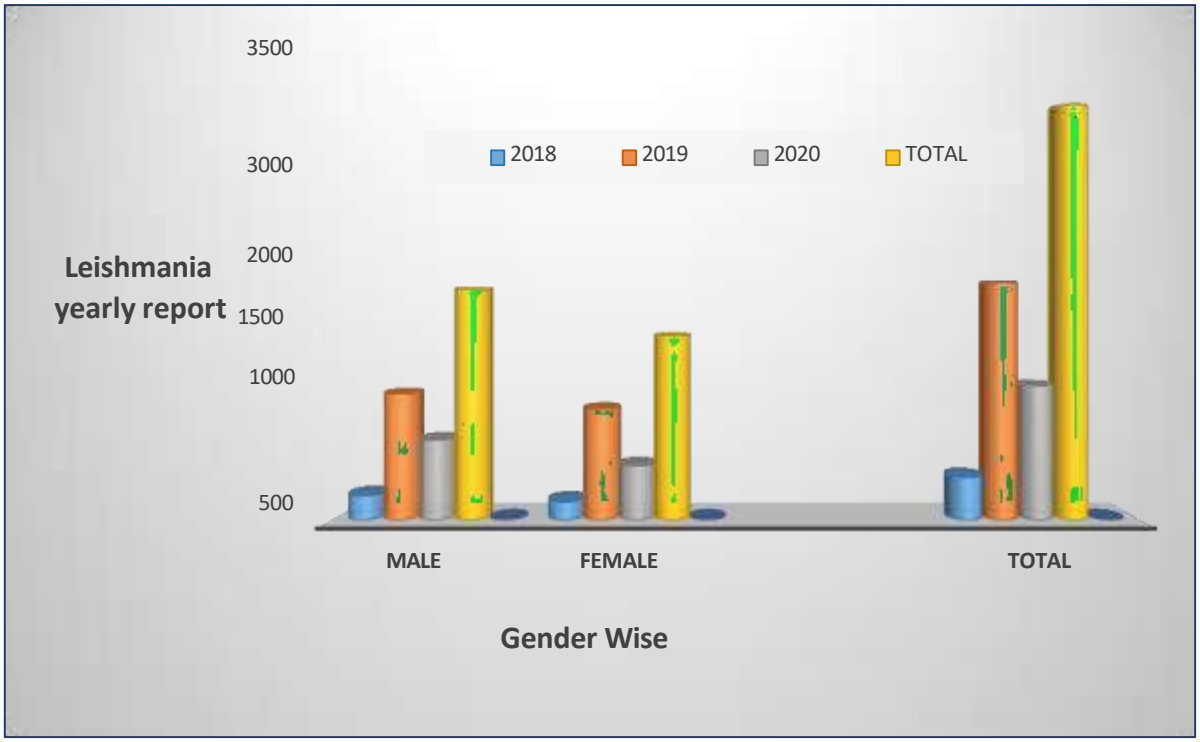

Figure 3 Overall gender wise prevalence of Leishmanial patients in the eleven districts of KP

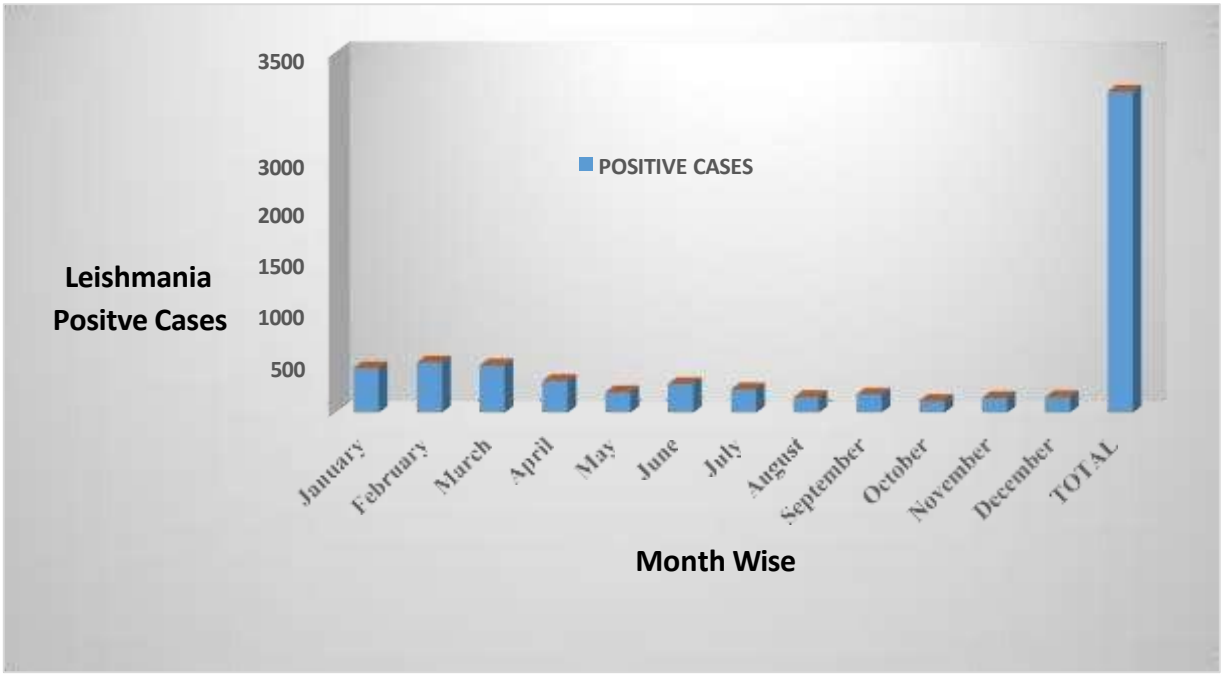

Figure 4 Overall month wise prevalence of Leishmanial patients in the eleven districts of KP

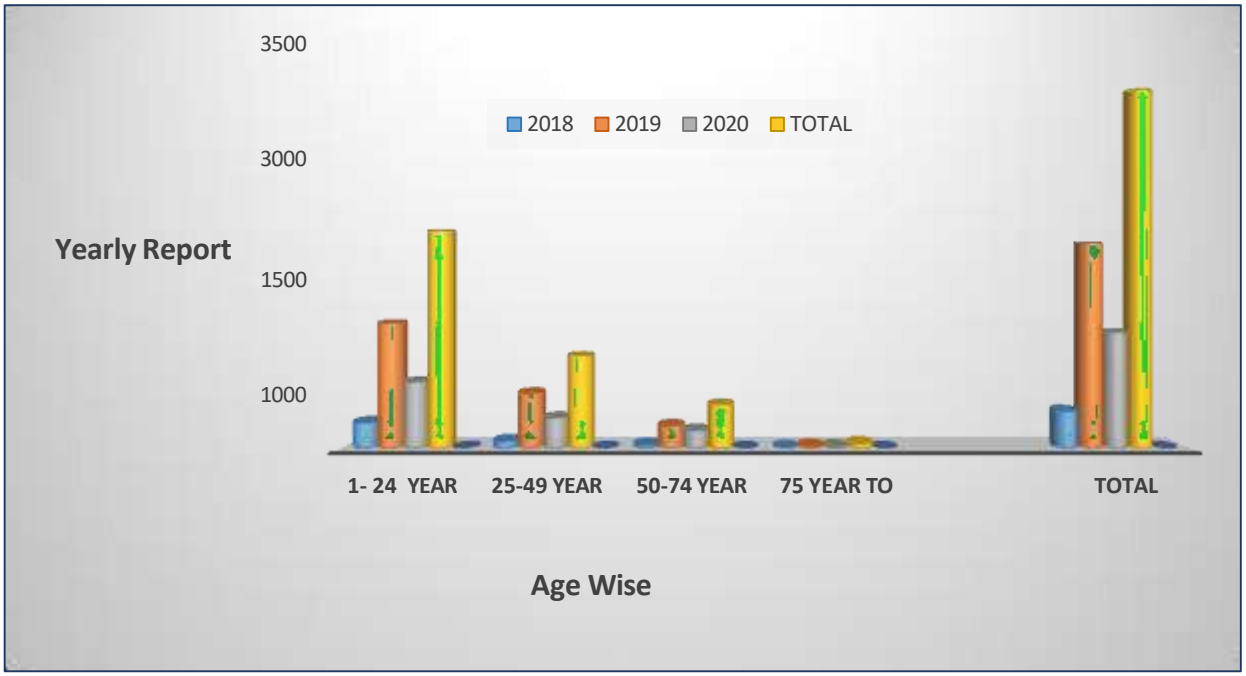

Figure 5 Overall age wise prevalence of Leishmanial patients in the eleven districts of KP

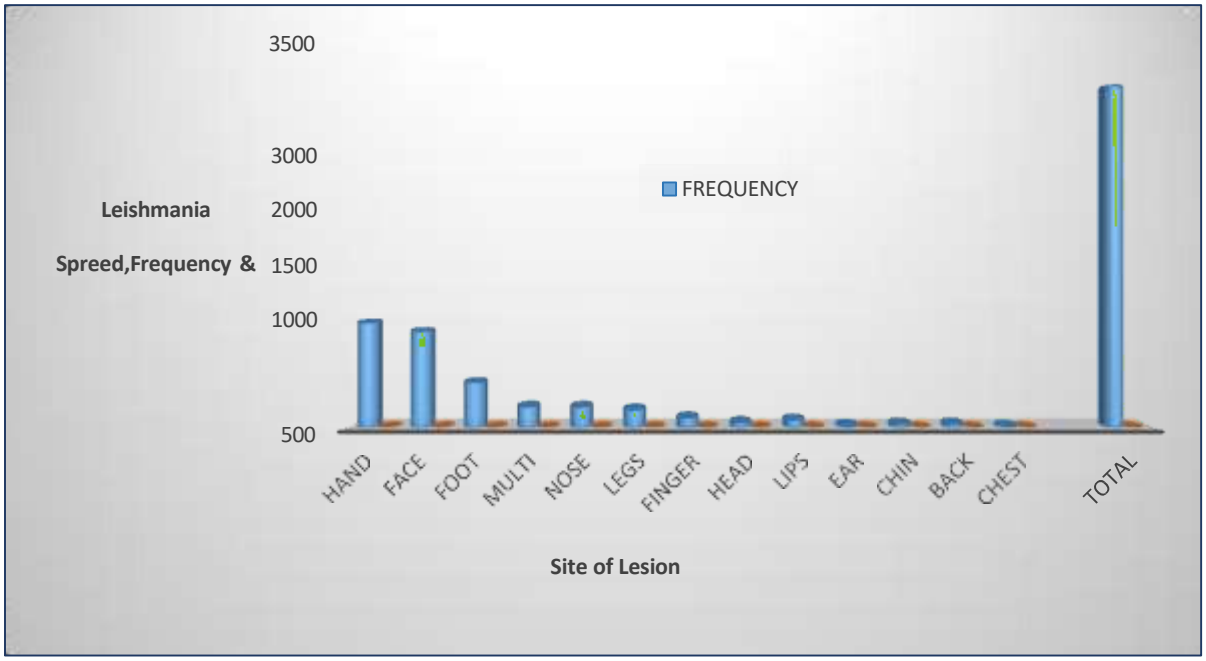

Figure 6 Overall site of lesion wise prevalence of Leishmanial patients in the eleven districts of KP

4. DISCUSSION

In current study implies the three years (2018-2020) prevalence of Leishmanisis in district Mardan. In this study high prevalence was reported in district Mardan (43%) as compared to (9%) was reported in Nowshehra. While the lowest prevalence was reported in Bajaur (1%). A study was conducted by Galgamuwa et al., in (2018) in Sri Lanka. They found high prevalence was in Anuradhapura district (31.5%) while the lowest prevalence was in Kurunegala district (7.2%).

A study was conducted by [17] in Mali (Bamako) districts. They found high prevalence was in Diema (85.1%) followed by Kolokani (24.6%) and the lowest prevalence was in Kolondieba (2.7%). A study was conducted by **[4]** in Upper and Lower Dir district in KP they found high prevalence was in Timergara (27%) followed by Rabath (12.3%), Manjai and Khal (9.7%), Khargram (8%), Warria and Munda (6%),Talash and Jhandol (4.4%) and the lowest prevalence was in Tarpatar and

Mansoor Abad (2.6%). A study was conducted by [14] in Khyber Pakhtunkhwa, Pakistan. They found high prevalence was in North Waziristan (61.4%) followed by Bannu (55.6%), Hangu (43.5%), Karrak (42.9%) and the lowest prevalence was in Kohat (38.9%).

In current study the highest ratio of Leishmanisis infection were observed more male (56%) than female (44%). A study was conducted by [18] in Dargai region in Pakistan. Prevalence of Leishmanisis 70.58% were recorded in male and 29.42% in female. One of the reasons for higher incidents in male during hot summer season the male were sleeping outdoors. The reasons for lower incident to female to Parda (Hijab) and keep themselves covered in sheet that is thought to give them safe against the sand fly bite. A study was conducted by [19] in Peshawar, 78.85% were recorded in male and 21.25% were female. A study was conducted by [20] in Utmah district 88% were recorded in male and 12% were female. A study was conducted by [21] in Dir district, KP. In Lower Dir the highest prevalence 58% were male while the lowest prevalence 42% were found in females and the Upper Dir 55% were recorded in male and 44% were female.

A study was conducted by [22] in south West of Iran the highest prevalence 61.59% were male while the lowest prevalence 38.41% were found in females. A study was conducted by [23] in Multan they found high prevalence of Leishmaniasis was in male (60%) while the lowest prevalence (40%) were found in females. A study was conducted by [24] in three district of Sindh in Pakistan. They found high prevalence of Leishmaniasis was in male (56%) and the lowest prevalence were found in female (44%).

In current study the prevalence of Leishmaniasis were also observed in month wise. The highest prevalence of Leishmaniasis cases were recorded in February (16%) infected as compared to other and the lowest prevalence of Leishmanisis case were recorded in October (4%). A study was conducted by [25] in Dir Lower district, they found high prevalence in October (26.2%) followed by September (23.4%), November (17.6%) and December (13.0%). A study was study conducted by [26] in ten district in Eastern Pakistan. They found high prevalence of Leishmaniasis was in June-September (47.79%), followed by October- November (28.92%), March- May (20.46%) and the lowest was in December-February (2.81%).

A study was conducted by [27] in four district of KP including Karak, Lakki Marwat, Kohat and Hangu. They found high prevalence was in March (1.77%) and the lowest prevalence was in December (0.25%). A study was conducted by [21] in Dir district KP. They found high prevalence was in September (28%) followed by October (21.5%) and the lowest prevalence was in December (9%).

A study was conducted by [28] in Mazandaran Province. The high prevalence of Leishmaniasis was in autumn (53.22%), in summer (20.96%) in winter (16.15%) and the lowest prevalence was in spring (9.67%).

In the current study the prevalence of Leishmaniasis were observed in all age groups. In the age group 1 to 24 years (61%) were high prevalence of Leishmaniasis. In the age group 25 to 49 years (26%) than followed by age group 50 to 74 years (12%) and age group above 75 years were (1%) respectively. A study was conducted by [29] in Malakand district. They found high prevalence was in (54%) cases in Leishmaniasis in age group 1 to 5. Followed by age group 16 to 30 (19.5%), 31 to 45 age group (18.8%) and age group above 46 years (7.7%). A study was conducted by [4] in Upper and Lower Dir district. They found high prevalence of Leishmaniasis infection in children age 6 to 10 years (73%) than age group 11 to16 years (27%).

The current study of Leishmaniasis patient in eleven districts of KP from 2018- 2020. The high prevalence of Leishmanial patient have hand lesion on hand (31%) while other part frequency of lesion (28%) on face. Other parts have frequency like Foot (13%), multi (6%) nose (6%), legs (5%), finger (3%), head and lips (2%). The lowest prevalence of Leishmanisis were ear, chin and back (1%). A study was conducted by [30] in North- Central Nigeria. The medical manifestations of the infection were more prevalent on the legs (69.72%), than followed by the hand (8.10%) and minimum on the head (3.84%). A study was conducted by [31] in Baluchistan. Site of lesion were found to be more complicated on face (41%) in the cases of CL, as compared with limbs (37%) and legs (22%). A study was conducted by Rahman in (2017) in Dir lower district. The majority of the

patients site of lesion were on face (25.4%) than followed by arms (21.6%), legs (15.5%), mixed (13.6%), nose (12.7%) and feet (11.3%).

Conclusion

From the current study of *Leishmania* in the eleven districts of KP from 2018-2020 concluded that the year wise district prevalence of Leishmanial patient of KP cases from 2018- 2020 showed high prevalence in Mardan and low prevalence in other districts. The data was also showed that males were more affected as compare to females. The age wise prevalence was highly reported in age group 1 to 24 years and low in 75 and above year old age group. The site of lesion was highly reported on hands and low on other parts of the body.

Author's contribution

HF Design the study, FH and AA collect the data, SMD and SH analyze the data, NS and AI organize the data, SAAS and HF Write the manuscript, CV review the manuscript

Conflict of interest

Authors have no conflict of interest.

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List of Abbreviation

DHQ	Districts Head Quarter
ELISA	Enzyme Linked Immunosorbent Assay
FATA	Federally Administered Tribal Areas
KP	Khyber Pakhtunkhwa
L. aethiopica	*Leishmania aethiopica*
L. amazonensis	*Leishmania amazonensis*
L. braziliensis	*Leishmania braziliensis*
L. chagasi	*Leishmania chagasi*
L. donovani	*Leishmania donovani*
L. guyaneisis.	*Leishmania guyaneisis*
L. infantum	*Leishmania infantum*
L. major	*Leishmania major*
L. panamensis	*Leishmania panamensis*
L. tropica	*Leishmania tropica*
MS	Medical Superintendent
NTD	Neural Tube Defect
PCR	Polymerase Chain Reaction

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