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Epidemiological study on acute cutaneous leishmaniasis in Morocco

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ABSTRACT

Objective: To describe and compare the epidemiological features of anthroponotic cutaneous leishmaniasis (ACL) caused by *Leishmania tropica*, and zoonotic cutaneous leishmaniasis (ZCL) due to *Leishmania major* in Morocco.

Methods: We performed a retrospective study of ZCL and ACL cases reported during the last ten years in Morocco (2004–2013). Epidemiological data were analyzed by using Pearson's correlation method as well as Tukey test and digital maps were produced for incidence repartition calculated by using ArcMap GIS version 10.

Results: A total of 41 656 cases of cutaneous leishmaniasis were notified between 2004 and 2013 in Morocco. The mean incidence was 139 cases/100 000 population/10 years and it was significantly higher in 2010. In the spatial context, ACL form was the most common in Morocco, while ZCL was the most important in terms of the number of reported cases. For both forms, the highest incidence occurred in females and children (0–14 years). When analyzed according to the number of cases in each province, Errachidia (8728 cases) and Azilal (3523 cases) were the most affected by ZCL and ACL, respectively, while the highest incidence was noted in Zagora (231 cases/100 000 population/10 years) and in Chichaoua (97 cases/100 000 population/10 years), for ZCL and ACL, respectively. Maps of incidence repartition were performed to identify the risk area of ZCL and ACL.

Conclusions: ZCL and ACL are still major health problems in Morocco. We highlight the spatiotemporal change of cutaneous leishmaniasis incidence through the country during the last ten years and we underline the correlation between ZCL incidence and the percentage of rural population in Morocco.

1. Introduction

Leishmaniasis are parasitic diseases with a wide range of clinical symptoms. In the skin, they range from localized cutaneous and mucocutaneous leishmaniasis to diffuse cutaneous leishmaniasis (CL), whereas in the viscera they range from sub-clinical to potentially fatal disease^[1,2]. These parasitic protozoans are usually transmitted to a human host via a bite by an infected

female phlebotomine sandfly (Diptera: Psychodidae) on exposed parts of the human body. Leishmaniasis currently threaten 350 million persons in 88 countries^[2].

Caused by three *Leishmania* species [*Leishmania major* (*L. major*), *Leishmania tropica* (*L. tropica*) and *Leishmania infantum* (*L. infantum*)], CLs are endemic, widespread and represent a public health problem in most countries in the Mediterranean basin^[3].

In Morocco, CL is widely distributed as three nosogeographic entities. *L. major* is transmitted by *Phlebotomus papatasi* and is associated with zoonotic cutaneous leishmaniasis (ZCL) in the arid regions along the northern edge of the Sahara desert^[4–6]. *L. infantum* is transmitted by *Phlebotomus ariasi* and causes zoonotic cutaneous disease (and mainly zoonotic visceral form) in the north and centre-south regions of the country^[5–7]. Lastly, *L. tropica*, causative agent of anthroponotic cutaneous leishmaniasis (ACL), is widespread in the semi-arid regions of

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Central and South-western Morocco, and transmitted by *Phlebotomus sergenti* (*P. sergenti*)^[5,6,8]. The main reservoirs for ZCL by *L. infantum* and *L. major*, respectively, are dogs and rodents^[9,10], with humans fulfilling this function for ACL by *L. tropica*^[11].

Over the past decade, the epidemiological situation of CL has changed significantly. It is acquiring an increasingly epidemic status with geographic expansion to previously free areas and the emergence of new foci in several provinces of Morocco. A total of 24804 cases of *L. major* CL and 16852 cases of *L. tropica* CL were recorded between 2004 and 2013 in Morocco. *L. infantum* CL meanwhile is a rare condition with a few sporadic cases in the north of the country (especially in Sidi Kacem Province) and few epidemiological data are available^[5,12]. This study was designed to describe and compare the epidemiological features of *L. major* and *L. tropica* CL cases during a ten year period (2004–2013) in Morocco.

2. Materials and methods

2.1. Study area and population

Located between the Atlantic and the Mediterranean between latitudes 21N–36N and longitudes 1W–17W, Morocco was placed in the extreme northwest of the African continent. It had the most important permanent rivers in the Maghreb but suffers in semi-arid to arid areas from a lack of water during all seasons^[13]. Morocco's climate was Mediterranean and mainly characterized by hot and dry summer where rainfall was almost completely absent except in mountain areas (which have significant thunderstorm activity) and particularly high evaporation. It was characterized also by a temperate to mild winter in the coastal strip, cool to cold in the country's interior, on the chains of the Atlas, in the Rif and the highlands of the eastern^[14].

Morocco had a surface area of 710850 km² and a population of 29891708 with 13428074 inhabitants in rural areas^[15].

2.2. Epidemiological data

The present study was a retrospective analysis of the CL in Morocco. Epidemiological data were obtained from the bulletins, registers and reports published by the local and national medical services. These epidemiological data were recorded after active or passive screening (leishmaniasis is a certifiable disease in Morocco). We used clinical and epidemiological data provided by the Moroccan Directorate of Epidemiology and Fight Against Diseases, during 2004–2013^[16].

2.3. GIS data base and statistic analysis

Digital maps were produced for incidence repartition calculated for the studied area by using ArcMap GIS version 10. The output was two maps each depicting the incidence of ZCL and ACL.

All data were analyzed by using SPSS software and Pearson's correlation method. Results were considered significant when the *P*-value was less than 0.05 by using a Tukey test.

3. Results

Table 1 shows the general characteristics of all provinces (*n* = 52) affected by CL (ZCL and ACL) and the incidence (cases/100000 inhabitants/10 years) of CL in Morocco. For ZCL, the

Table 1

Geographic, demographic and epidemiologic characteristics of each province affected by CL in Morocco.

CL form	Provinces	Latitude	Longitude	Rural population (%)	Incidence (cases/100000 inhabitants/10 years)	
ZCL	Boulemane*	33.363	-4.730	70.93	35.01	
	Errachidia*	31.934	-4.423	64.89	156.81	
	Figuig	32.213	-1.368	51.20	179.32	
	Jrada	34.312	-2.164	38.77	99.58	
	Midelt	32.684	-4.735	100.00	39.75	
	Ouarzazate*	30.907	-6.908	70.29	87.60	
	Taourirt	34.416	-2.900	42.29	0.10	
	Tata	29.746	-7.970	67.88	15.29	
	Tinghir	31.522	5.518	78.27	15.18	
	Zagora	30.332	-5.837	661.06	231.08	
	ACL	Agadir	30.412	-9.604	21.10	0.23
		I Outanane				
		Al haouz	31.307	-7.858	89.22	14.64
		Al Hoceima	35.249	-3.938	70.06	2.65
		Azilal	31.967	-6.569	83.81	69.83
		Ben Slimane	33.616	-7.131	63.18	0.05
Béni Mellal		32.339	-6.355	52.71	5.99	
Berkane		34.924	-2.320	42.24	0.22	
Boulemane*		33.363	-4.730	70.93	11.61	
Chefchaouen		35.171	-5.272	89.56	2.02	
Chichaoua		31.545	-8.765	87.09	96.96	
Chtouka		30.071	-9.162	86.65	0.44	
Ait Baha						
Driouach		34.982	-3.383	70.64	5.02	
El jadida		33.241	-8.505	72.92	0.01	
El kelaa		32.050	-7.409	75.95	1.07	
Sraghna						
Errachidia*		31.934	-4.423	64.89	0.45	
Essaouira		31.514	-9.770	421.73	66.55	
El Hajeb		33.693	-5.372	57.32	0.46	
Fahs Anjra		35.766	-5.667	100.00	1.13	
Fès		34.035	-5.000	2.33	0.84	
Fkih Ben salah		32.508	-6.694	100.00	6.31	
Guelmim		34.234	-3.351	31.18	4.50	
Guercif		34.233	-3.351	100.00	6.11	
Inezgane		30.356	-9.550	8.10	0.17	
A Melloul						
Kenitra		34.263	-6.581	50.94	0.05	
Khemisset		33.821	-6.069	58.03	0.19	
Khenifra		32.939	-5.668	47.23	0.31	
Larache		35.184	-6.151	53.52	1.40	
Marrakech		31.637	-7.997	21.22	0.33	
Meknes		33.893	-5.556	19.99	0.91	
Mdiq		35.684	-5.330	6.40	0.58	
Fnideq						
Moulay Yacoub	34.088	-5.181	97.90	5.32		
Nador	35.168	-2.939	49.34	2.55		
Ouazzane	34.800	-5.583	18.88	8.56		
Ouarzazate*	30.907	-6.908	70.29	15.64		
Sale	34.038	-6.803	6.56	1.03		
Safi	32.321	-9.219	52.86	0.05		
Sefrou	33.831	-4.840	53.18	32.94		
Settat	33.002	-7.621	66.16	6.11		
Sidi Kacem	34.236	-5.713	69.91	17.88		
Sidi Slimane	34.261	-5.923	100.00	37.66		
Tanger	35.777	-5.839	7.73	0.17		
Assilah						
Taounate	35.249	-3.940	89.83	15.31		
Taroudannte	30.468	-8.869	76.11	5.67		
Taza	34.228	-4.021	66.33	12.96		
Tetouan	35.577	-5.368	24.37	4.19		
Tiznit	29.708	-9.730	75.97	0.26		

*:Provinces with both ZCL and ACL forms.

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