An Epidemiology Study of Some Protozoan Parasitic Diseases in Iraq from 2011 Till 2015

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Abstract

The parasitic diseases including leishmaniasis, toxoplasmosis and malaria are globally wide spread with potentially harmful consequences if it does not treat. Leishmaniasis is caused by the protozoan parasites *Leishmania*. Many *Leishmania spp*. causes skin ulcers and nodules. Other species damage the internal organs. Toxoplasmosis is caused by the protozoan parasites *Toxoplasma gondii*. Malaria is one of tropical and semi-tropical parasitic diseases caused by the protozoan parasites *Plasmodium*. This study assesses the epidemiology of the leishmaniasis, toxoplasmosis and malaria infection for the period from 2011 till 2015 in Iraq. From 2011 till 2015, 3611 patients with visceral leishmaniasis, 21473 patients with cutaneous leishmaniasis, 4365 patients infected with toxoplasmosis, 31 patients with malarial infections were recorded in Iraq. The parasitic diseases including leishmaniasis and toxoplasmosis nowadays have a wider geographical distribution in Iraq. This increase is mainly attributed to the environmental conditions, great migration, urbanization that occurs during the study period. In contrast, according to this study malaria has been greatly reduced in Iraq in the last years and this could be due to the use of protective clothing, insecticides, insect repellents and bed nets. [DOI: 10.22401/JUNS.20.3.17]

Keywords**:** Epidemiology, Leishmaniasis, Toxoplasmosis, Malaria.

Introduction

Leishmaniasis is a complex disease caused by the genus *Leishmania*. The main mode of transmission occurs through the bite of infected female sandflies (genus *Phlebotomus*) in the Old World and *Lutzomyia* in the New World [1]. Leishmaniasis consists of four main clinical syndromes: cutaneous leishmaniasis (CL), muco-cutaneous leishmaniasis; visceral leishmaniasis (VL) (kala-azar) and post-kala-azar dermal leishmaniasis (PKDL) [2]. *L. major, L. tropica* and sometimes *L. infantum* are the causative agents of cutaneous leishmaniasis in Old World (mostly in Afghanistan, Algeria, Saudi Arabia, Brazil, Iran, Iraq, Syria, and Sudan). In Iraq, two species are present: *L tropica*, and *L. major*. Both species were reported as causative agents of leishmaniasis in Iraq [3]. Among parasitic diseases, mortality from leishmaniasis is second only to malaria and according to recent reports; around 1.3 million new cases are reported every year [4]. VL is the most severe form of leishmaniasis, VL is fatal if not treated; 500,000 cases of VL occurs each year, around 90% cases of VL was reported from 5 countries; India, Bangladesh, Brazil, Nepal and Sudan and soon Iraq with 4,000-5,000 annual case will be added as 6th country to the above list [5]. Eighty three (48 %) of the VL patients were resident of central parts of Iraq [6].

Toxoplasma gondii is a parasitic protozoan [7]. It is one of the most common parasites in humans. The serological investigations estimate that up to a third of the world's population has been exposed to this widespread zoonotic agent. About 20% to 90% of the world's adult populations in different regions are reported to have contact with the parasite. Between 30 and 50% of the world adult human population is may be chronically infected with *T. gondii* depending on geographic location [8]. Worldwide, over 6 billion people have been infected with *T. gondii*. Seroprevalence, measured by IgG against *T. gondii*, varies worldwide, being reported to be 6.7% in Korea, 12.3% in China, 23.9% in Nigeria, 46% in Tanzania and 47% in France, and can be as high as 98% in some regions. The overall prevalence rate of toxoplasmosis among the general population

in Iran is 39.3% [9]. In the United States, prevalence of toxoplasmosis declined, but around 14% of the individuals are seropositive by the age of 40 years, with one million new infections each year, resulting in 750 deaths, making toxoplasmosis the second most common cause of deaths related to food-borne diseases [10]. Toxoplasmosis was raised up after Iraq occupation with a frequency of infection more than 40% compared to eighties of Iraqi women which was not exceed 2% of the women tested at that time [11].

Malaria is the most devastating and widespread of all parasitic diseases in the world and is a major cause of morbidity and mortality in developing countries. Four species of *Plasmodium* i.e. *P. falciparum*, *P. vivax*, *P. malariae* and *P. ovale* cause malaria in humans. These parasites infect the RBCs of blood and cause anemia, nausea and fever. Mosquitoes act as vector for the spread of *Plasmodium*. The epidemiology of malaria depends on the vector's biology, the *plasmodium* species, and the human host of the regions. Nowadays, malaria is considered as a tropical disease [12]. Approximately, 1.2 billion are at high danger; the World Health Organization (WHO) states that there were 214 million cases of symptomatic malaria in 2015. Between 2000 and 2015, the prevalence of malaria decreased to 32 percent, and the number of annual malaria cases estimated by the WHO decreased by 18 percent. The vast majority of these cases and deaths are due to *P. falciparum*. The Institute for Health Metrics and Epidemiology (IHME) reported malaria deaths peaked at 1.82 million in 2004 and fell to 1.24 million in 2010; more than 80 percent of the deaths occur in sub-Saharan Africa. The WHO's estimates of deaths from malaria (438,000 in 2015) are substantially lower than the reliable estimates from IHME [13]. In Iraq, a total of 4134 malaria cases were recorded in 1999 [14].

Methodology

The data presented in this paper were gathered from Communicable diseases control center, parasitology and helminthology units in Baghdad for the period from January 2011 to June 2015.

Statistical Analysis

The Statistical Analysis System- SAS (2012) program was used to study the effect of different factors and parameters. Chi-square test was used to compare among percentages of diseases in this study.

Results

During the years 2011- 2015, 3611 patients with kala azar, 21473 patients with CL, 4365 patients infected with toxoplasmosis, 31 patients with malaria were recorded as shown in the tables (1,2,3 and 4). In 2011, Missan province showed the highest incidence rates of infections with VL (197 patients) while in Dahok, Erbil and Sulimaniyah province were nil (0 patients) Table (1). For CL in the same year Diala showed the highest rate of infection (717 patients), Dahok was nil. Diala province also showed the highest rate of toxoplasmosis (280 patients). Baghdad Kerkh, Anbar, Muthana, Thiqar and Miasn were nil. Najaf showed the highest rate of malaria (9 patients), other provinces were nil except Karbala and Missan (1 patients).

In 2012, Thiqar showed the highest incidence rate of infection with VL (212 patints) while Dahok, Erbil, Sulimaniyah and Ninewah showed no incident rate 0 patients. For CL in the same year, Diala showed the highest rate of infection (508 patients), Dahok has 2 patients only. Diala also showed the highest rate of toxoplasmosis (176 patients). Dahok, Erbil and Sulimaniyah were nil. Najaf showed the highest rate of malaria (5 patients), other provinces were nil except Karbala (1 patients). In 2013, 2014 and 2015, Thiqar showed the highest incidence rates of infections with VL: 111, 72 and 82 respectively. Dahok, Erbil, Sulimaniyah and Ninewah showed no incident rate (0 patients).

In 2013, Diala showed the highest rate of CL (297patients) while Dahok was nil. For toxoplasmosis, Diala also record the first case (214 patients). For malaria, Erbil and Najaf recorded 3 patients other provinces were nil except Karbala and Qadisyah (1 patients). In 2014, Babil showed the highest rate of CL (772 patients), while Anbar was with 3 patents only. Missan recorded the highest rate of toxoplasmosis (339 patients). Anbar and Muthana were nil of this infection. Karbala

showed two patients for malaria other provinces were nil. In 2015, Thiqar showed a huge number of kala azar (82 patients), Diala showed a huge number of CL 2983 patients, Erbil showed 4 only. For toxoplasmosis, Najaf showed (180 patients) while Dahok, Sulimaniyah, Karbala, Anbar and Muthana were nil. For malaria, Karbala showed (2 patients) while Baghdad Rasafa showed one only.

Table (1)

Distribution of Kala azar infection among Iraqi governorate from 2011 till 2015.

Governorate	2011	2012	2013	2014	2015	P-value
Dahok	0	0	0	0	0	1.00 NS
Erbil	0	0	0	0	0	1.00 NS
Sulimaniyah	0	0	0	0	0	1.00 NS
Ninewah	1	0	0	0	0	0.894 NS
Kirkuk	43	47	4	4	0	0.001 **
Salaheldin	18	7	2	4	1	0.001 **
Diala	181	176	80	37	72	0.001 **
Baghdad Rasafa	26	30	20	14	23	0.037 *
Baghdad kerkh	56	16	16	18	26	0.001 **
Anbar	78	80	15	0	0	0.001 **
Wasit	150	61	53	42	66	0.001 **
Babil	73	129	97	72	36	0.001 **
Karbala	13	9	1	2	0	0.046 *
Najaf	12	5	6	4	6	0.049 *
Qadisyah	128	112	75	52	52	0.001 **
Muthana	21	29	23	10	11	0.038 *
Thiqar	169	212	111	72	82	0.001 **
Missan	197	80	57	34	22	0.001 **
Basrah	41	54	16	16	3	0.001 **
Iraq	1207	1047	576	381	400	0.001 **
P-value	0.001 **	0.001 **	0.001 **	0.001 **	0.001 **	----

**** (P≤0.05), ** (P≤0.01), NS: Non-significant.***

Table (2)

Distribution of leishmaniasis infection among Iraqi governorate from 2011 till 2015.

Governorate	2011	2012	2013	2014	2015	P-value
Dahok	0	2	0	8	9	0.0446 *
Erbil	18	8	1	6	4	0.023 *
Sulimaniyah	55	77	95	229	601	0.001 **
Ninewah	186	321	130	88	71	0.001 **
Kirkuk	117	97	81	70	108	0.001 **
Salaheldin	628	326	203	120	321	0.001 **
Diala	717	508	297	652	2983	0.001 **
Baghdad Rasafa	14	20	16	50	415	0.001 **
Baghdad Kerkh	98	94	92	98	191	0.001 **
Anbar	288	324	291	3	62	0.001 **
Wasit	143	34	18	9	987	0.001 **
Babil	17	112	143	772	162	0.001 **
Karbala	215	209	69	32	216	0.001 **
Najaf	59	62	21	84	311	0.001 **
Qadisyah	32	35	20	15	897	0.001 **
Muthana	28	29	51	43	616	0.001 **
Thiqar	39	30	51	194	1589	0.001 **
Missan	316	190	46	426	1706	0.001 **
Basrah	76	25	28	20	103	0.001 **
Iraq	3046	2503	1653	2919	11352	0.001 **
P-value	0.001 **	0.001 **	0.001 **	0.001 **	0.001 **	----

**** (P≤0.05), ** (P≤0.01).***

Table (3)
Distribution of Toxoplasmosis infection among Iraqi governorate from 2011 till 2015.

Governorate	2011	2012	2013	2014	2015	P-value
Dahok	18	0	27	16	0	0.025 *
Erbil	101	0	178	121	108	0.001 **
Sulimaniyah	0	0	116	184	0	0.001 **
Ninewah	93	0	123	63	1	0.001 **
Kirkuk	15	47	39	57	2	0.001 **
Salaheldin	13	7	29	37	11	0.029 *
Diala	280	176	214	81	37	0.001 **
Baghdad Rasafa	26	30	0	10	1	0.001 **
Baghdad Kerkh	0	16	0	12	2	0.039 *
Anbar	0	80	1	0	0	0.001 **
Wasit	1	61	20	16	156	0.001 **
Babil	2	129	12	59	3	0.001 **
Karbala	90	9	19	16	0	0.001 **
Najaf	263	5	165	170	180	0.001 **
Qadisyah	112	112	84	84	32	0.001 **
Muthana	0	29	0	0	0	0.035 *
Thiqar	0	212	104	89	25	0.001 **
Missan	0	80	0	339	157	0.001 **
Basrah	82	54	136	84	45	0.001 **
Iraq	1096	1047	1267	195	760	0.001 **
P-value	0.001 **	0.001 **	0.001 **	0.001 **	0.001 **	----

** (P≤0.05), ** (P≤0.01).*

Table (4)
Distribution of Malaria infection among Iraqi governorate from 2011 till 2015.

Governorate	2011	2012	2013	2014	2015	P-value
Dahok	0	0	0	0	0	1.00 NS
Erbil	0	0	3	0	0	0.920 NS
Sulimaniyah	0	0	0	0	0	1.00 NS
Ninewah	0	0	0	0	0	1.00 NS
Kirkuk	0	0	0	0	0	1.00 NS
Salaheldin	0	0	0	0	0	1.00 NS
Diala	0	0	0	0	0	1.00 NS
Baghdad Rasafa	0	1	0	0	1	0.920 NS
Baghdad Kerkh	0	0	0	0	0	1.00 NS
Anbar	0	0	0	0	0	1.00 NS
Wasit	0	0	0	0	0	1.00 NS
Babil	0	0	0	0	0	1.00 NS
Karbala	1	1	1	2	2	0.93 NS
Najaf	9	5	3	0	0	0.041 *
Qadisyah	0	0	1	0	0	0.920 NS
Muthana	0	0	0	0	0	1.00 NS
Thiqar	0	0	0	0	0	1.00 NS
Missan	1	0	0	0	0	0.920 NS
Basrah	0	0	0	0	0	1.00 NS
Iraq	11	7	8	2	3	0.438 NS
P-value	0.044 *	0.185 NS	0.37 NS	0.883 NS	0.802 NS	----

** (P≤0.05), NS: Non-significant.*

Discussion

Recently, CL and VL have a wider geographical distribution than before [15]. The increase in leishmaniasis prevalence is mainly attributed to several risk factors that are clearly man made. Generally, these factors include environmental conditions, demographic, great migration, deforestation, urbanization and immunosuppression. The environment and the population movements possibly lead to variations in the number, range and density of the vectors and reservoirs thus, may increase human exposure to infected sandflies. Leishmaniasis affect the poor population and usually outbreak occurs during harvesting seasons [16]. Other important environmental risk factors including living in houses with cracked mud, damp earthen floors, sleeping on floor or outside, and vegetation near house can assist sand fly survival and enhance vector abundance by providing diurnal resting places, breeding sites, and humidity. It should be noted that sand flies can hide in cracks in the house walls, ceiling or floor [15].

The main source of human *Toxoplasma* infections is probably most often the result of ingestion of tissue cysts contained in raw or undercooked meat is common in many animals used for food, including sheep. Cultural habits may also affect the acquisition of *T. gondii* infection; for example, in France the prevalence of *T. gondii* in humans is very high. Elsewhere are 32% in New York City and 22% in London. The high incidence of *T. gondii* infection in humans in France related in part to the French routine of eating some of their meat raw. The infection in Central and South America has high prevalence probably due to the high levels of contamination of the environment by oocysts [17]. Accumulated evidence shows that changes in these environmental factors can strongly influence the transmission and distribution of *T. gondii*, such as rapid urbanization and global warming [18].

The seasonal variation in malaria parasite prevalence can be due to changes in *Anopheles* profusion during the year. High rainfall in the rainy season produced pools and swamps due to poor drainage, producing suitable conditions for mosquitoes. In the hot season, the construction of water pools around some public water taps due to poor drainage, combined with much sunlight is helpful to breed the mosquitoes. In Iraq, malaria has been greatly reduced due to the reduction in man-vector contact which achieved through the use of protective clothing, insecticides, insect repellents, bed nets or environmental management [19].

In Iraq, the parasitic diseases including leishmaniasis, toxoplasmosis and malaria represent one of the serious public health problems. There are many factors that play important roles in the presence and distribution of these diseases in different parts of Iraq including the use of clay to build some houses in villages. Moreover, the people that works long hours outdoors where they are more exposed to insects' bites, great migration, and urbanization that occurs during the study period. Important components for reducing the parasitic diseases including more sensitive diagnostic tools, effective use of anti- parasitic diseases drugs, improved personal and community hygiene, and mosquito control.

References

[1] Sakkas H.; Gartzonika C. Levidiotou S. Laboratory diagnosis of human visceral leishmaniasis. J Vector Borne Dis. 53: 8–16, 2016.

[2] Chappuis F., Sundar S., Hailu A., Ghalib H., Rijal S., Peeling R.W., Alvar J., Boelaert M. Visceral leishmaniasis: what are the needs for diagnosis, treatment and control? Nature Reviews Microbiom, 5, 873–882, 2007.

[3] Rahi A.A., Hraiga B.A., Hassoni J.J. Some epidemiological Aspects of Cutaneous Leishmaniasis in Kut city, Iraq. Sch. J. App. Med. Sci, 2:451-455, 2014.

[4] Alsamarai A.M., Alobaidi., A.H.A., Aljumaili Z.K., Jasim M.M., Qatal S.. Cutaneous Leishmaniasis in Iraq: A Continuing Endemic Disease. J Drug Des Res, 3(1): 1024, 2016.

[5] World Health Organization. Communicable diseases who/cds/; 17, 2003.

[6] Rahi A.A., Ali M.A., Valian H.K., Mohebali M., Khamesipour A. Seroepidemiological Studies of Visceral Leishmaniasis in Iraq. Sch. J. App. Med. Sci, 1 (6): 985-989, 2013.

[7] Flegr J. Influence of latent *Toxoplasma* infection on human personality, physiology and morphology: pros and cons of the *Toxoplasma*–human model in studying the manipulation hypothesis. J. Exp. Bio, 216: 127-133, 2013.

[8] Khalil1, H. I.; Merdaw, M. A.; Abdullah, A. M.; El-Hashimi, W. K.; Al-Bashier, N. M. and Mohemmad, H. J. Estimation of *Toxoplasma gondii* infection by Serological and Immunohistochemical methods in Baghdad City-Iraq. IJAR, 4 (4): 272-278, 2016.

[9] Rahimi M. T., Daryani A., Sarvi S., Shokri A., Ahmadpour E., Teshnizi S.H., Mizani A., Sharif M.. Cats and *Toxoplasma gondii*: A systematic review and meta-analysis in Iran, 823:1-10, 2015.

[10] João M.F., Justine R.S., Rubens B., Jr Devin G., Kevin L.W. Toxoplasmosis: A Global Threat. J Glob Infect Dis, 3(3): 281–284, 2011.

[11] Al-Jebouri M., Al-Janabi M., Ismail H.. The prevalence of toxoplasmosis among female patients in Al-Hawija and Al-Baiji Districts in Iraq. OJEpi, 3: 2, 2013.

[12] Shah H., Khan R., Naz F., Arif Jan A. H., Ullah R. Prevalence and distribution of malaria parasites in general population of district Dir Lower, Khyber Pakhtunkhwa, Pakistan. J. Entomol. Zool. Stud, 4(4): 1211-1215, 2016.

[13] Murray C.J., Rosenfeld L.C., Lim S.S. Global malaria mortality between 1980 and 2010: a systematic analysis. Lancet, 379:413, 2012.

[14] Shamo F.J. 2001. Malaria in Iraq. *Med Parazitol (Mosk)*. (1):46-7.

[15] Oryan A., Alidadi S., Akbari M. Risk Factors Associated With Leishmaniasis. Trop Med Surg, 2:3, 2014.

[16] Oryan A., Akbari M. Worldwide risk factors in leishmaniasis. Asian Pac J Trop Med, 9 (10): 925–932, 2016.

[17] Mohamed K., Kodym P., Maly M., Intisar E.L. Environmental and Food Habitat Risk Factors Associated with *Toxoplasma gondii* Infection in Rural Women in Sudan. Int. J. Curr. Microbiol. App. Sci, 3(2): 208-222, 2014.

[18] Yan C., Liang, L., Zheng K., Zhu X. Impact of environmental factors on the emergence, transmission and distribution of *Toxoplasma gondii*. Parasit Vectors, 2016; 9: 137, 2016.

[19] Nkuo-Akenji T., Ntonifor N.N., Ndukum M.B., Abongwa E.L., Nkwescheu A., Anong D.N., Songmbe, M., Boyo M.G. Ndamukong K. N., Titanji V.P. Environmental factors affecting malaria parasite prevalence in rural Bolifamba, South- West Cameroon. Afr J Health Sci, 13 (1-2): 40-6, 2006.