

The Infection Rate of Babesia spp. in Mammals for the Period from 2000 - 2020 AD. in Iraq

Dr. Huda Ghanim Dakhil¹

Abstract

Babesiosis is a peril infectious disease with a world-wide spread cause by *Babesia* spp. parasites, affecting many species of mammals and man. Babesiosis has economic impact, it causes to losses production of meat and milk (quality and quantity) of infected animals and can cause death. The aims of this review to know the infection rate of babesiosis in animals in the governorates of Iraq, and knowing the areas that haven't been recorded it till now.

Collected 38 researches in severals areas of Iraq recorded infections of babesiosis in many types of animals, six governorates are :Al-Tamim, Al-Anbar, Kerbalaa, Wasit, Misan, and Dhi Qar didn't study it. the highest infection rate was recorded in foals in Nineveh was 81.11%, while the lowest noticed in sheep 0.01% and cattle 0.17% in Nineveh (northern of Iraq).

Ten species only of *Babesia* spp. were registered in several species of animals in Iraq are: *B. ovis*, *B. equi*, *B. gibsoni*, *B. taylori*, *B. foliata*, *B. Motasi*, *B. caballi*, *B. bigemina*, *B. Canis* and *B. microti*.

Keywords : babeiosis, Babesia spp., Review study, apcomplexans, sporozoan, Iraq

معدل الإصابة بأوالي الكمثرات البابيزيا في الثدييات للمدة 2000-2020م في العراق
م. د. هدى غانم داخل¹

الخلاصة

يعد داء الكمثرات البابيزيا احد الامراض المعدية المنتشرة في العالم والتي تسببها أوالي البابيزيا *Babesia* spp. التي تصيب العديد من أنواع الحيوانات اللبونة وكذلك الانسان، كما تسبب خسائر اقتصادية في انتاج اللحم والحليب (كما ونوعا) في الحيوانات الخمجة وقد يسبب الموت في بعض الأحيان. تهدف هذه المراجعة إلى معرفة مدى انتشار المرض في محافظات العراق، ومعرفة المحافظات التي لم تسجله حتى الآن.

تم جمع 38 بحثاً سجل انتشار داء الكمثرات البابيزيا، وتبين ست محافظات لم تدرسه وهي التأميم والأنبار وكربلاء وواسط وميسان وذي قار. سجلت أعلى نسبة انتشار في المهر في نينوى 81.11 %، وأدنى نسبة انتشار كانت في نينوى في الأغنام 0.01% والماشية 0.17%. دونت 10 أنواع فقط من البابيزيا في أنواع متعددة من الحيوانات وهي: *B. ovis* و *B. equi* و *B. gibsoni* و *B. taylori* و *B. foliata* و *B. motasi* و *B. caballi* و *B. bigemina* و *B. canis* و *B. microti*.

الكلمات المفتاحية : داء الكمثرات البابيزيا، أنواع البابسـيا، دراسة مرجعية، طفيليات المعقد القمي، الطفيليات الابتدائية، العراق

Affiliation of Author

¹ Gifted School, Ministry of Education, Missan, Al-Emara, Iraq, 62001
hudaalsabahi83@gmail.com

¹ Corresponding Author

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¹ مدرسة الموهوبين، وزارة التربية، ميسان، العمارة، العراق، 62001
hudaalsabahi83@gmail.com

¹ المؤلف المراسل

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Introduction

The first reported of babesiosis was in 1888 by Viktor Babes who detected the presence of a round bodies in red blood cells (RBC) in sheep and cattle in Romania, Smith and Kilborne were transmitting a babesiosis named tick fever to susceptible cattle [1].

Babesiosis is a disease that caused by the genus *Babesia*, is one type of apicomplexans/ sporozoan, is an emerging zoonosis [2], There are over a hundred known species of *Babesia*, several of which are infection domestic animals [3,4] a few species reported have the ability to infect humans [5] The first case of human babesiosis was recorded in 1957 in Croatia [6]. Zoonotic *Babesia* spp. is need to two hosts to complete their life cycle, ticks (genus: *Ixodes*) as a definitive host that transmitted the causative agents of the disease and vertebrates as intermediate hosts, which go through three stages: (1) gametogony (sexual reproduction) inside tick gut, (2) sporogony (asexual reproduction) development in the salivary gland of tick, (3) finally merogony (asexual reproduction) development in blood of vertebrates [7] (Figure 1). The diagnosis of babesiosis is an important to prevent the distribution of the disease, during the acute stage of bodies the number of *Babesia* spp. inside the erythrocytes (RBC) will increase, that they can be detected by light microscope by using Giemsa stain, however, in chronically infected animals can be also detected by microscope also [8], and by other more such as immunological diagnosis such as the Enzyme-linked immunosorbent assay (ELISA) and molecular Methods by polymerase chain reaction (PCR) [1,9,10].

Symptoms observed in animals babesiosis depend on pathogenic effects and virulence of *Babesia* spp. and host age, immune of infected animals breed of animal (local or foreign) and species of *Babesia*, *B. bovis* is the most pathogenic, followed by *B. bigemina* and *B. divergens* previously, and other such as *B. ovata*, have usually low pathogenic [11]. Clinical cases are clearly in adult animals, while younger remain asymptomatic, [12]. The Common symptoms include flu-like signs such as fever, headache, chills, loss of appetite, fatigue, nausea, elderly, shortness of breath and may cause hemolytic anemia, hepatomegaly, splenomegaly, renal failure and some time death [13,14]. *B. bovis*-infected RBC in endothelial can lead to cerebral babesiosis, multiorgan failure and respiratory distress [15], pathogenicity is mainly associated with erythrocyte destruction leading to anemia, which may cause changes of infected animals behavioral due to brain anoxia. crisis in *B. bigemina* and *B. divergens* are noted especially hemoglobinuria which observed at the peak of the blood hemolysis. Fever is frequent can lead to abortions in pregnant mammals or temporary reduction of fertility, Other signs are anorexia, depression and hemoglobinemia [16,17].

Treatment of babesiosis was Successful on early diagnosis, followed by prompt of chemotherapeutic drugs. Two anti-*Babesia* drugs are available to treat it, in livestock mammals imidocarb dipropionate and diminazene aceturate [15]. The concern of drug dairy products and residues in meat has led to the withdrawal from many European countries [1, 15]. Recently several of Pharmacological compounds have been developed to control this disease [18].

Aims of the study

The aims of this review to know the infection rate of babesiosis in animals in the governorates of Iraq, and knowing the areas that haven't been recorded it till now, for the purpose of urging researchers to

study the disease in all Iraqi governorates to form an imagination about the infection rate and species of babesia in Iraq.

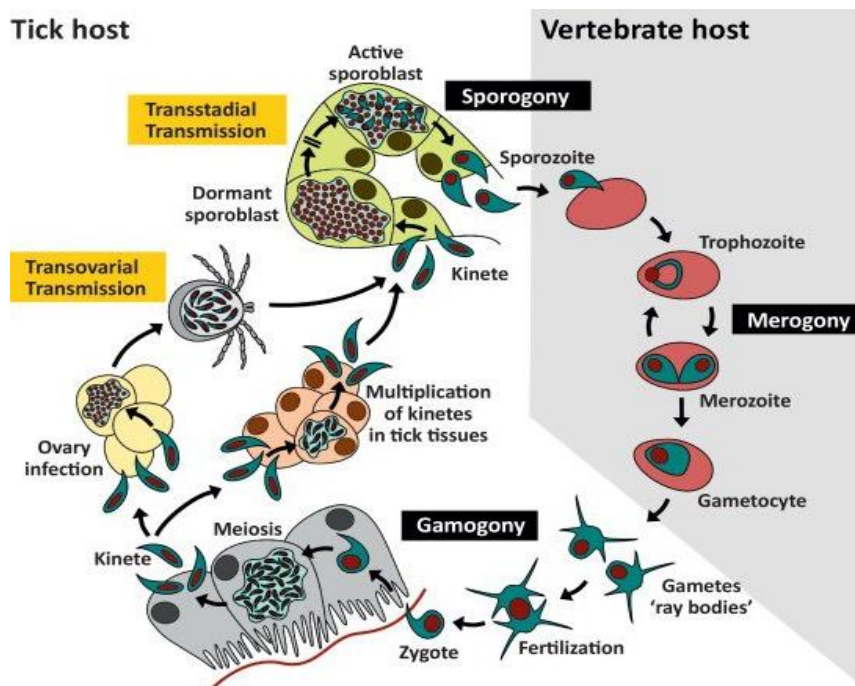


Figure 1 : *Babesia* spp. [7].

Methods

A total of 38 references from Google scholar , PubMed and Iraq Academic Scientific Journals dealing with *Babesia* spp. in Iraq and published from 2000- 2020AD., used to provide all of the present review studies about infections rates of this disease in several animals in Iraq. Data from this references was collected to appear *Babesia* spp., hosts, infection rates , methods of diagnosis and study areas, and the arrangement depended on Governorates and years of research publishing.

Review literatures

After a spacious literature search , abstracts and full-text articles were reviewed, A total of 38 relevant research articles (English and Arabic) on zoonotic *Babesia* spp. collected in table1, as well as, the all species infection animal in several areas of Iraq an arranged in table 2 to facilitate review studies .

Table1: Babesia spp. in mammals in Iraq

Governorates	Infection animals	Species of Babesia	Examination Methods	Percentage of infection	References
Erbil	Cattles	<i>B.bigemina</i>	Seroprevalence (ELISA)	27.27%	[9]
	Sheep			6.77%	
	Goats			7.14%	
	Wild goats			9.09%	
Duhok	Goats	<i>B. motasi</i>	Light microscopic	4%	[19]
Duhok Erbil Sulaimaniya	Cattles	<i>Babesia</i> spp.	Light microscopic and ELISA	11.7% 12.4% 56.9%	[20]
Duhok Erbil Sulaimaniya	Sheep	<i>B. ovis</i>	PCR	1.5%	[21]
Sulaimaniya	Sheep Goats	<i>B. ovis</i> <i>B. taylori</i> <i>B. foliata</i> <i>B. motasi</i>	Light microscopic	56.3% in sheep, 64% in goats	[22]
Sulaimaniya	Cattles	<i>Babesia</i> spp.	Microscopic examination of 1-Hemolymph 2-blood	36.4 2.7	[23]
Erbil	Horse Mule Donkey pony	<i>B. caballi</i>	1-Microscopic examination 2-ELISA	11.2% 6.9%	[24]
Erbil	Horses Mules Donkeys Ponies	<i>B. caballi</i>	Microscopic examination competitive ELIS A	1.7% 11.2%	[25]
Erbil	Horses Mules Donkeys Ponies	<i>B. caballi</i>	PCR	8.82%	[26]

Nineveh	Dogs	<i>B.canis</i> <i>B. gibsoni</i>	Light microscopic	32%	[27]
Nineveh	Foals	<i>B. equi</i> <i>B.Caballi</i>	Light microscopic	81.11% 18.88%	[28]
Nineveh	Stray cats	<i>Babesia</i> spp.	Light microscopic	26%	[29]
Nineveh	Goats	<i>B.ovis</i> <i>B.taylori</i> <i>B.foliata</i> <i>B. motasi</i>	Light microscopic	15.42%	[30]
Nineveh	Horses and donkeys	<i>B. equi</i> <i>B. caballi</i>	ELISA	71.73% 42.22%	[31]
Nineveh	Cattle	<i>B.ovis</i> <i>B.bigemina</i>	Light microscopic	30,66% 24,33%	[32]
Nineveh	Cattle	<i>Babesia</i> spp.	1-Light Microscopic by use Giemsa stain 2- fluorescent microscopic by use Acridine orange stain	44% 42%	[33]
Nineveh	Cattle Sheep	<i>Babesia</i> spp.	Light Microscopic	0.17% 0.01%	[34]
Salah ad Din	Cattles	<i>B.bovis</i>	Light microscopic	8.8 %	[35]
Baghdad	Stray dogs	<i>Babesia</i> spp.	Light microscopic	65.68%	[36]
Baghdad	Stray dogs	<i>B. gibsoni</i>	Light microscopic	48.14%	[37]
Baghdad	Draught horses	<i>B.equi</i> <i>B. caballi</i>	Light microscopic	15.5 14.4	[38]
Baghdad	Cattles	<i>B.ovis</i> <i>B.bigemina</i>	Light microscope PCR ELISA	9.33% 10% 66.6%	[39]
Baghdad	Cattles	<i>B.ovis</i>	PCR	10%	[40]

Baghdad	Sheep	<i>Babesia</i> spp.	Light microscope	17.86	[41]
Baghdad	Horses	<i>B. caballi</i>	Light Microscopic PCR	16.66%	[42]
Baghdad	Dogs	<i>B. canis</i>	Light Microscopic PCR	5.1%	[43]
Diyala	Cattle	<i>B. ovis</i> <i>B. bigemina</i>	Light microscopic	30%	[44]
Diyala	Cattles	<i>Babesia</i> spp.	Light Microscopic	3.5%	[45]
Al-Najaf Al-Ashraf	Camels	<i>Babesia</i> spp.	Light Microscopic PCR	17.5% 65.16%	[46]
Al-Najaf Al-Ashraf	Buffalo	<i>B. ovis</i> <i>B. bigemina</i>	Light Microscopic PCR	38.30 7.45	[47]
Al-Qadisiya	Sheep& Goats	<i>Babesia</i> spp.	PCR	33.6% 11.7%	[48]
Al-Qadisiya	Goats	<i>B. ovis</i> <i>B. motasi</i>	Light microscopic	11.7%	[49]
Al-Qadisiya	Cattles	<i>B. ovis</i>	PCR	47.91%	[50]
Al-Qadisiya	Camels	<i>B. ovis</i> <i>B. bigemina</i>	PCR	8.9. % 12.22%	[51]
Various zones	Carnivores	<i>Babesia</i> spp.	PCR	2.3%	[52]
West province	Buffalo	<i>B. bigemina</i>	Light microscope Indirect-ELISA PCR	1.68 25.7 11.73	[53]
Basrah and Muthanna	Camels	<i>B. caballi</i>	Light Microscopic PCR	9.95% 31.57%	[54]
Basrah	Cattle	<i>B. bovis</i> <i>B. microti</i> <i>B. motasi</i>	PCR	27.14% 37.1%	[55]

Table2: Species of *Babesia* recorded in animals in Iraq

Infection animal	<i>Babesia</i> spp.
Cattle	<i>B. bovis</i> <i>B.microti</i> <i>B. motasi</i> <i>B.ovis</i> <i>B.bigemina</i>
Waterbuffalo	<i>B.ovis</i> <i>B.bigemina</i>
Sheep and Goats	<i>B.ovis</i> <i>B.taylori</i> <i>B.foliata</i> <i>B. motasi</i> <i>B.bigemina</i>
Horses and Donkeys	<i>B. equi</i> <i>B.Caballi</i>
Camels	<i>B.ovis</i> <i>B.bigemina</i>
Dogs	<i>B. canis</i> <i>B. gibsoni</i>
Cats	<i>Babesia</i> spp.

Discussion

The current study is a first review about infection rate of Babesiosis in Iraq. The oldest collected research about infection rate of *Babesia* spp. after 2000 recorded in 2005 [27], but some researchers reported in some animals a long time ago, such as *B. canis* in dogs 14.3% in Musol by light microscope [56], also has been recorded by other oldest studies [57,58]. There are no clear reasons for the scarceness of studies on babesiosis in Iraq and neglected studies in many governorates.

The current study recorded highest infection rate in foals in Nineveh 81.11% [28], to the lowest was observed in sheep 1.5% [21] and goats 4% of Kurdistan-Iraq (northern of Iraq) [19]. Moreover, other governorates recorded rate less than 70% in several animals, The different in rate from governorates may be due to use of pesticides to kill the ticks that transmit this disease, The presence of *Babesia* spp. in all the world is depends on the geographic distribution of ticks, The most common ticks of *Babesia* spp. are *Ixodes scapularis* in North America, *I. ricinus* in Europe, and *I. persulcatus* in

Asia [5], Also the different infection rate can be due to treatment of infected animal or due to the different in researchers' experience to diagnose it and confirm the infection, beside the number of samples , type of techniques used, The current study noted several methods used to diagnosis babesiosis in Iraq are light microscopic was the most common through using giemsa stain, fluorescent microscopic by use Acridine orange stain, ELISA and molecular diagnosis using PCR, These methods are common in the entire world [8,1,10], [54] confirmed high sensitivity and specificity for PCR of *B. caballi* and *T. equi* . [39] indicated to the positive of *Babesia* spp. (*B.bovis* and *B.bigemina*) that had noticed 9.33% by blood smear examination, but 10% with *B. bovis* by PCR technique and 66.6% with *B. bigemina* by used ELISA method. Several studies noticed in another Arabic countries of *B.bovis* and *B. bigemine* in cattle Such as Syria [59] observed 15.46% and 18.84 by ELISA, 9.18% ,15.46 % PCR, and 18.36% , 21.74% by used IFAT methods of *B.bovis* and *B. bigemine* respectively, and the same species recorded in Egypt 3.97%, 5.30% respectively by PCR and 9.27%, 10.60% used ELISA method and observed in the same methods in water buffalos were 4.17 and 10.42 by PCR and 11.46 and 15.63 by ELISA [60].

Ten only of *Babesia* spp. in mammals in Iraq were: *B. ovis*, *B. equi*, *B. gibsoni*, *B. taylori*, *B.foliata*, *B. motasi*, *B. microti*, *B. caballi*, *B. bigemina* and *B. canis*. Can be diagnosis many new species in Iraq if increase the studies about this parasite, [55] observed two new species in Iraq (*B. microti* and *B. motasi*) by PCR methods, In another side many species were recorded in world in many animals, such as *B. bovis* and *B. bigemina* diagnosis in cattle in America, Africa, Asia, Australia and

Europe , as well as *B. major* in Asia and Europe, *B. occultans* in Africa, *B. ovata* in Asia , *B.divergens* in Europe , *B. sp. Kashi* in China . Also in water buffalo they recorded *B. orientalis* in Asia and *B. bovis* and *B. bigemina* in America and Asia, also noticed in sheep such as *Babesia sp. Xinjiang* in China , and *B. crassa*, *B. ovis* and *B. Matosi* in Africa , Asia and Europe. *B. trautmanmi* in pig in Africa and Europe , *B.equi* in Europe and America . several species of *Babesia* in dogs were *B. vogeli*, *B. conradae*, *B. gibsoni*, *B. vitalii*, *B. rossi* and *B. canis* , in America, Asia, South Africa and Europe . In cat, the researchers observed two species were *B. felis* and *B. canis* in South Africa and Asia [61].

Conclusion

Microscopes , ELISA and PCR good techniques to diagnosis *Babesia* spp., Six provinces where Babesiosis has not been studied .

Recommendations

Increase studies of Babesiosis in Iraq, specially in Tamim, Al-Anbar, Kerbalaa, Wasit, Misan, and Dhi Qar. and increase studies on other land vertebrates animals.

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