

Clinical, haematological and biochemical studies of babesiosis in native goats in Mosul

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Abstract

The study included examination of 175 native goats, 27 were infected with *Babesia ovis*, *B. motasi*, *B. foliata* and *B. taylori*, (recorded in Mosul for the first time) and 25 were clinically normal and served as control. Results indicated that the percentage of the infection with Babesiosis was 15.42% and the percentage of parasitemia ranged between 3.5-10.4% with a mean 6.95%, infected goats showed signs of loss of appetite, weakness, pale mucous membranes, jaundice, fever, coughing, nasal discharge, recumbency, diarrhea and haemoglobinuria. A statistically significant decrease were recorded in total red blood cells (RBC), haemoglobin concentration (Hb), packed cell volume (PCV) and platelets counts. Anemia was of microcytic hypochromic type. A statistically significant increase in erythrocyte sedimentation rate and significant increase in total white blood cells was recorded due to significant increase in lymphocyte and neutrophile count. Results of the biochemical testes indicated an increase in activity of alanin amino transferase (AST), aspartate amino transferase (ALT), total bilirubin, blood urea nitrogen and icterus index, with a significant decrease in total serum protein, albumin and globulin levels. Results also indicated the presence of Rhipicephalus ticks which were: *Rh. sanguineus* and *Rh. turanicus*.

Keywords: Babesia, Goats, Hematology.

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دراسة سريرية ودموية وكيموحيوية لداء البايبيزوسز في المعز المحلي في الموصل

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الخلاصة

شملت الدراسة فحص ١٧٥ معزاً محلياً تضمنت ٢٧ راساً مصاباً بطفيلي *Babesia ovis* و *B. motasi* و *B. foliata* و *B. taylori* (سجلت لأول مرة في مدينة الموصل) و ٢٥ راساً من المعز سليمة سريريا عدت كمجموعة سيطرة، اظهرت نتائج الدراسة ان نسبة الاصابة بالطفيليات بلغت (١٥,٤٢%) وبنسبة تطفل تراوحت بين (٣,٥-١٠,٤%) وبمعدل (٦,٩٥%)، وعانت المعز المصابة من فقدان الشهية والضعف العام وشحوب الاعشية المخاطية المبطنة للعين واليرقان وارتفاع درجة حرارة الجسم والسعال والافرازات الانفية ورفود الحيوان على الارض والاسهال والبيلة الهيموغلوبينية Haemoglobinurea، وكما اظهرت التغيرات الدموية للمعز المصاب وجود انخفاض معنوي في العدد الكلي لكريات الدم الحمر وكمية خضاب الدم وحجم الخلايا المرصوصة وأعداد الصفائح الدموية، وكان فقر الدم من النوع ذي الكريات الصغيرة الحجم قليلة الصباغ Microcytic hypochromic anemia ولوحظ زيادة معنوية في سرعة تنقل كريات الدم الحمر، كما سجلت زيادة معنوية ($P < 0.01$) في العدد الكلي لخلايا الدم البيض بسبب الزيادة المعنوية في اعداد الخلايا اللمفية والعدلات فضلا عن ارتفاع في نشاط خميرة الالانين ناقلة الامين (ALT) وخميرة الاسبارتيت ناقلة الامين (AST) ومستويات البيلروبين الكلي Total bilirubin وبتروجين يوريا الدم Blood urea nitrogen والمنسب اليرقاني Icterus index، في حين لوحظ انخفاض معنوي في مستوى البروتين الكلي للمصل Total serum protein وكذلك الالبومين والكلوبيولين، وقد تم تشخيص نوعين من قراد Rhipicephalus وهما (*Rh. sanguineus* و *Rh. turanicus*).

Introduction

Babesiosis is caused by intraerythrocytic protozoan parasites of the genus *Babesia*, the disease which is transmitted by hard ticks (family: Ixodidae), affect a wide range of domestic and wild animals and occasionally humans (1). *Babesia* occurs seasonally and the peaks of infection were observed in rainy season (2). *Babesia* forms can vary as pear-shaped, round and elongated (3) Clinically Babesiosis is characterized by fever, inappetence, increased respiratory rate, muscle tremors, anemia, jaundice, body weight loss, and hemoglobinuria in the final stages (4,5). Anemia is very common for all infected animals, hemoglobinuria may not observed in animals infected with *B. ovis* (6) Four species of *Babesia* have been reported from sheep and goats mainly consisting of one large form (*B. motasi*) and three small forms (*B. ovis*, *B. foliata* and *B. taylori*) (7), while Friedhoff referred that the Babesiosis in domestic small ruminants is due to at least three species, namely : *B. ovis*, *B. motasi* and *B. crassa* (8). *B. ovis* is less pathogenic than *B. motasi* for sheep infection and cause relatively moderate haemolytic anemia (9,10), whereas Friedhoff considered the *B. ovis* is the most important causative agent which transmitted by *Rhipicephalus bursa*, *R. turanicus*, *Hyalomma anatolicum excavatum* and probably by *R. evertsi evertsi* (11), whereas the known vector of *B. motasi* are *Haemophysalis punctata* and *R. bursa* and the *B. motasi* is more pathogenic than *B. ovis* in India and northern Africa. In animals affected with *Babesia* spp. The studies revealed that decrease in the total erythrocytes counts, haemoglobin concentration, packed cell volume and platelets counts, and in biochemical studies showed increase in activity of alanine amino transferase, aspartate amino transferase, total bilirubin, blood urea nitrogen and icterus index, with decrease in total serum protein. (12-14)

The percentage of infection with *B. ovis* in goats in Al-Arich city and El-Hassanah center were 7.0% (15) whereas the prevalence of *B. ovis* infection in Awassi sheep in Urfa, Turkey was 41.02% (16). Little work has been done on *Babesia* spp in Mosul, Iraq on goats, hence the present study was taken to determine the occurrence of *Babesia* spp together with clinical, haematological and some biochemical changes.

Materials and methods

A total of 175 goats, 2-5 years of age and from both sexes were examined in the Teaching Veterinary Hospital (College of Veterinary Medicine, University of Mosul) and from other regions in Mosul city, for the possibility of infection with babesiosis. Clinically normal goats (n=25) served as control. Careful clinical examination of all suspected animal were carried out.

Blood was collected from jugular vein for haematological examination by using (Automatic full digital cell counter, Beckman USA) to get of total red blood cells (RBC), haemoglobin concentration (Hb), packed cell volume (PCV), mean corpuscular volume (MCV), mean corpuscular hemoglobin concentration (MCHC), platelets counts and total and differential leukocytes count (TLC & DLC), and westergren method used for get erythrocyte sedimentation rate (ESR) (17). Thin blood smears were taken from the vein of the ear and stained with Giemsa were used to identify the *Babesia* and the percentage of parasitemia (18). Blood serum samples were tested spectrophotometrically for the biochemical changes of alanine amino transferase, aspartate amino transferase, blood urea nitrogen and total serum protein, albumin and globulin by using available kits (Randox, U.K.), total bilirubine using available kits (Biomerex, France), and Icterus Index by using potassium dichromate according to (18). Statistical analysis were done by using t-test (19).

Results

Clinically infected goats showed different signs graduated from loss of appetite, emaciation, pale mucous membranes, jaundice, fever, coughing, nasal discharge, recumbency, diarrhea and haemoglobinuria as well as presence of ticks (*Rhipicephalus sanguineus* and *Rh. turanicus*) were detected on different parts of the body (Table 1).

Table (1): Clinical signs of infected goats (n=27) with babesiosis.

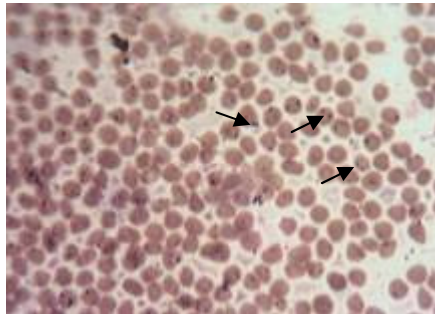
Clinical signs	No. of infected goats	%
Pale mucous membranes	24	88.9
Loss of appetite	21	77.8
Haemoglobinuria	21	77.8
Diarrhea	16	59.3
Emaciation	15	55.6
Jaundice	13	48.1
Nasal discharge	10	37
Coughing	9	33.3
Recumbency	7	25.9
Ticks (<i>Rhipicephalus sanguineus</i> and <i>Rh. turanicus</i>)	15	55.6

Significant increase (P<0.01) were encountered in body temperature, respiratory and heart rates While, ruminal contractions were reduced significantly (Table 2).

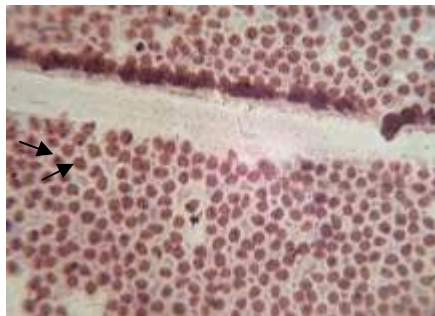
Examination of blood smear revealed four types of *Babesia* in infected goats, which were: *B. ovis*., *B. taylori*, *B. foliata* and *B. motasi*. (Fig1). The number of goats which

were infected with *Babesia spp* was (27) with percentage (15.42%) and the parasitemia ranged between (3.5-10.4%) in a mean of (6.95%).

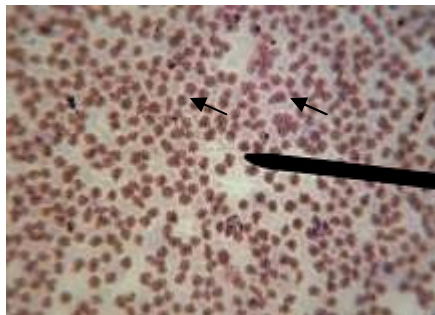
B. ovis (round form) at the margin of the red cells (1.66-2.32) micron with mean 1.88 micron ⁽¹⁾.



B.taylori (round appear) under go several fission (1.66-1.19) micron with mean 1.74 micron ⁽²⁾.



B. foliata. round lies more centrally in red cells (1.66-1.99) micron with mean 1.83 micron ⁽³⁾.



B.motasi (pyriform stages) (2.9-4.15) micron with mean 3.27 micron ⁽⁴⁾.

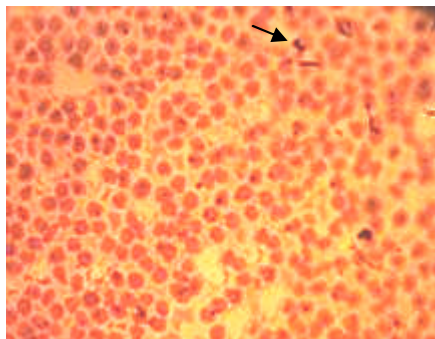


Figure (1): four types of babesia in infected goats, which were: *B.ovis* ⁽¹⁾, *B.taylori* ⁽²⁾, *B.foliata* ⁽³⁾ and *B. motasi* ⁽⁴⁾ in blood smear.

Table (2): Body temperature, respiratory rates, heart rates and ruminal contractions of infected goats with babesiosis.

Parameters	Control	Infected
	Mean±S.E.	Mean±S.E.
Body temperature °C	39.10±0.51	40.8±0.82**
Respiratory rate/min	26.21±3.82	53.32±7.95**
Heart rate/min	79.81±8.62	112.4±10.90**
Ruminal contraction/5 min	4.09±0.20	2.52±1.5**

** P<0.01, * P<0.05

There was a significant reduction (P<0.01) in the mean values of TRBC, Hb, PCV, platelets count, anemia was of Microcytic hypochromic type due to significant reduction (P<0.01) in the Mean Corpuscular Volume (MCV) and Mean Corpuscular Haemoglobin Concentration (MCHC). A statistically significant increase of ESR encountered and results also indicated a significant increase (P<0.01) in total leukocytes count due to significant increase in neutrophils and lymphocytes count (Table 3).

Table (3): Blood parameters of infected goats with babesiosis and control group.

Parameters	Control	Infected
	Mean ± S.E.	Mean ± S.E.
RBC x 10 ⁶ microliter	6.10 ± 0.54	4.21 ± 1.15**
Hb g/100 ml	10.35 ± 2.43	6.93 ± 2.52**
PCV %	32.40 ± 3.22	26.13 ± 4.33**
MCV %	64.37 ± 5.68	61.40 ± 5.46**
MCHC g/100 ml	32.35 ± 4.33	28.31 ± 2.20**
Platelets x 10 ³ microliter	769 ± 157	349 ± 103**
ESR mm/24 h	0.62 ± 0.43	3.94 ± 1.34**
WBC x 10 ³ microliter	7.68 ± 2.35	10.95 ± 3.73**
Neutrophils %	61.33 ± 1.46	61.87 ± 1.02*
Lymphocytes %	37.50 ± 0.93	39.20 ± 1.31**
Monocytes %	0.20 ± 0.03	0.15 ± 0.10
Eosinophils %	0.15 ± 0.03	0.00 ± 0.00
Basophils %	0.04 ± 0.01	0.06 ± 0.01
Parasitemia	---	3.5 – 10.4%

** P<0.01, * P<0.05.

Results of biochemical examination showed a significant increase (P<0.01) in activity of AST, ALT, as well as in levels of total bilirubin, BUN and Icterus index, however significant decrease were recorded in total protein, albumin and globuline values of infected goats (Table 4).

Table (4): Biochemical parameters of infected goats with babesiosis and control group.

Parameters	Control	Infected
	Mean \pm S.E.	Mean \pm S.E.
AST U/L	27.13 \pm 9.52	77.37 \pm 6.94**
ALT U/L	23.65 \pm 5.12	29.63 \pm 4.59**
Total bilirubin mg/100 ml	0.26 \pm 0.10	0.69 \pm 0.17**
Total protein g/100 ml	6.70 \pm 0.79	3.63 \pm 0.53**
albumin g/100 ml	4.07 \pm 0.22	2.10 \pm 0.21**
Globulin g/100 ml	2.64 \pm 0.57	1.27 \pm 0.12*
BUN mg/100 ml	32.78 \pm 7.64	68.46 \pm 12.89**
Icterus index units	2.67 \pm 0.39	6.31 \pm 1.16**

** P<0.01, * P<0.05.

Discussion

The results of this study showed that the clinical signs observed in infected goats were in agreement with the results of other studies carried out by different researchers concerning ruminants infected with babesiosis (2,3,7). The cause of pale mucous membrane was development of anemia and decrease in erythrocyte count and haemoglobin (12), while jaundice due to increase in the total bilirubine (direct and indirect) and icterus index (18), the haemoglobinuria may be due to intravascular haemolysis and high rate of destruction of erythrocytes and haemoglobinemia (20,21).

Two types of ticks were diagnosed in this study, they were *Rhipicephalus sanguininus* and *Rh. turanicus* and Friedhoff added that *Babesia ovis* is transmitted by *Rh. bursa*, *Rh. turanicus* *Hyalomma anatolicum excavatum* and probably *R. evertsi evertsi* (11), while Mazyed and Khalaf identified *Hyalomma anatolicum excavatum* and *Haemophysalis sulcata* in infected goats with *B. ovis* and *Theileria ovis* (15). In general the distribution of the parasite is correlated with the distribution of tick vector species (16). Four species of babesia (*B. ovis*, *B. motasi*, *B. foliata*, *B. taylori*) were diagnosed in this study, which were also described by (7,12).

The percentage of infection with *Babesia spp* was (15.42%) whereas Mazyed and Khalaf recorded (7%) of infection with *B. ovis* in goats (15) and in another study on goats in a village in south west Nigeria showed (20.4%) infection with *B. motasi* (2).

Haematological parameters showed relatively significant decrease in values total Red blood cells, haemoglobin concentration, packed cell volume and platelets counts, compared to control group, these results were in agreement with studies carried out on sheep and goats by others (2,12,22) and this might be due to intravascular haemolysis of erythrocyte, increase erythrocyte phagocytosis by reticuloendothelial system and restricted erythropoietic activity in bone marrow (20,21).

Anemia was microcytic hypochromic type due to significant reduction in the mean corpuscular volume and mean corpuscular haemoglobin concentration this was in agreement with the study of (23) in foals. The increase in ESR values refers to the correlation between the sedimentation of RBCs and the intensity of anemia (18), and Allen added that increase in ESR values due to decrease in Packed cell volume (24). The significant increase in WBCs was due to increase in lymphocytes, this was in agreement with (3) in sheep.

Biochemical parameters showed relatively significant increase in the AST and ALT may be due to indirect damage of liver, kidney tissue and myocardium, changes indicated to a possible damage to the liver, kidney tissue (25), Wright added that increase in the AST due to distraction of RBCs (26).

The increase in total bilirubin due to damage of liver and increase in the indirect bilirubin was due to erythrocyte haemolysis (18), Babesia also reported to causes nephrosis, renal ischemia, dehydration and some heart diseases that causes increase in BUN, (26,27). The increase in the icterus index was due to increase in Total bilirubin in serum and dehydration (26).

The reduction in total protein, albumin and glubulin values is might be due to decrease production from the liver due to direct and indirect effect of parasite, digestive disturbance (diarrhea), loss of appetite and high fever (28,29).

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