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The Effect of Babesia on Some Blood Parameters in Camels (*Camelusdromedarius*) Inthenortheastern of Libya

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Abstract
The study involved 160 camels raised in northeastern Libya from 2021–2022. Blood samples were randomly collected from each camel's jugular veins and sent to a laboratory for hematological and parasitological examination. The results showed that 35% of the samples were infected with *Babesia* species. High infection rates were found in Tubrug-khuayri (70%), Ajdubiya-road (60.6%), Alhamamuh (60%), Sulanta (46.6%), and Alqabah (28.4%). Lower infection were observed in Qanduluh (19.35%) and Imsaeid (7.1%). *Babesia spp* in Camels penetrate erythrocytes at the sporozoite stage, appearing as reddish violet particles inside blood cells. The study also showed that 56 camel blood samples were infected by babesiosis, with complete blood count examination revealing a deficiency in RBCs (5.43±2.33), and increase in WBCs (14.63±8.23), MCV (52.8±36.8), (22.11±9.45). MCH and MCHC (47.4±19.8). Significant differences were observed ($p<0.05$). Additionally , there was an increase in white blood cells types including neutrphilia (51.95±1.23), lymphocytes 40.30±1.23) and monocytes 5.51±0.35). in conclusion The study found a 35% prevalence of Babesiosis in camels, leading to decreased red blood cell count but increased leukocytes, neutrophils, lymphocytes, and monocytes, causing lysis and hematopoietic system depression.

Keywords: Babesia, Hematolog, Protozoa, Piroplasma, Camels, North-Eastern , Libya .

تاثير البابيزيا على بعض مكونات الدم في الإبل(ذات السنام الواحد) في شمال شرق ليبيا

المستخلص: شملت الدراسة 160 عينة من الإبل تم جمعها بشكل عشوائي من شمال شرق ليبيا في الفترة من 2021 إلى 2022 م، وتم جمع عينات الدم من الوريد الوداجي ثم أرسلت الي المختبر لفحص الطفيليات وصورة الدم، وقد أظهرت النتائج أن 35% من العينات كانت مصابة البابيزيا، وسجلت نسبة إصابة عالية في كل من طبرق الخوير (70%)، طريق إجدابيا (60.6%)، الحمامة (60%)، اسلنطة (46.6%)، القبة (28.4%)، بينما كانت أقل في كل من قندولة (19.35%) وإمساعد (7.1%).بابيزيا الأبل تخترق كريات الدم الحمراء في مرحلة السبوروزويت، وتظهر على شكل جزيئات بنفسجية محمرة داخل خلايا الدم، كما أظهرت الدراسة أن 56 عينة من دم الإبل كانت مصابة بالبابيزيا وتم فحص الصورة الكاملة للدم حيث تبين وجود نقص RBC (5.43±2.33) وارتفاع في (52.8±36.8), MCV (WBC 14.63±8.23), MCH (22.11±9.45 و MCHC (47.4±19.8 وكانت هناك فروقات معنوية عند مستوى ($p<0.05$)، وكذلك سجلت زيادة في أنواع كريات الدم البيضاء وكانت في lymphocytes (40.30±1.23) , neutrophilia (51.95±1.23) و (monocytes 5.51±0.35).

الكلمات المفتاحية: بابيزيا ، أمراض الدم ، بيروبلازما ، الجمال ، الشمال الشرقي ، ليبيا.

INTRODUCTION

Camels are a valuable source of meat, milk, textiles, and transportation due to their amazing adaption to the harsh desert climate. (Aajep, 2020; El-Naga & Barghash, 2016;Al-Naily & Jasim,2018). An extensively dispersed protozoan parasite illness transmitted by vectors, babesiosis is significant within the veterinary field (Mirahmadi et al., 2022). Different species of the *Babesia* genus, which are picomplexan parasites within erythrocytic cells, cause babesiosis. Many hard ticks from the Ixodidae family, including those belonging the genera *Dermacentor, Rhipicephalus,* and *Hyaloma*, spread the disease to both domestic and wild animals, especially dogs, cats, humens, ruminants, and rodents.(Kalani, Fakhar, & Pagheh, 2012). Many species of *babesia* exist, such *as Babesia equi* and *Babesia caballi*.(Swelum, Ismael, Khalaf, & Abouheif, 2014).

The life cycles of *Babesi*a include an asexual infective stage called sporozoites, an asexual blood stage called merozoites, and a sexual blood stage called gametocytes (Alsaad, Al-Amery, Al-Hamed, & Muhsen, 2015). Every morphological characteristic of apicomplexans is found among infected erythrocytes in variety Shapes, including ring, oval, cross, amoeboid and pear-shaped, with a lengths of 1-2 or 2.5-5 µm (Uilenberg, 2006) Babesiosis is associated with hemolytic anemia (Ord & Lobo, 2015). A smear of venous blood stained with Giemsais used as a diagnostic tool to confirm babesiosis in animals. Clinical signs during the acute phase of the disease are also assessed in conjunction with the microscopic detection of parasites. In animals that have recovered from babesiosis, subclinical infections are seen.

There have been reports of camel babesiosis in several parts of the world, with *B. caballi* being among the most important *Babesia* species (Abd-Elmaleck, Abed, & Mandourt, 2014; Ibrahim, Kadle, & Nyingilili, 2017; Jasim, Azzal, & Othman, 2015; Khamesipour et al., 2015). Infected camels experience fever, anemia, jaundice, and edema during acute phase of illness. It can occasionally result in death, causing significant financial losses for the camel industry.(Taktaz-Hafshejani & Khamesipour, 2017). Over the past ten years Libyans have been consuming more camel meat and dairy products in the last ten years, so preventing infectious diseases is crucial to the food safety of camel products. Taking into account the lack of information regarding the genetic diversity and spread of the parasite Babesiosis in camels in northern Libya.The study's goal was to determine the prevalence of *Babesias pp*. .associated with infection-related haematological changes in camels.

MATERIALS AND METHODS

Animals in the study area:
The study involved 160 camels of the local breed, raised in northeastern Libya, ranging in age from less than one to twenty-five years old, during the period from 2021-2022. The areas included in this study were Tubrug-khuayri, AL-qubah, AL-hamamuh,Sulanta ,Qanduluh , Ajdubiya road and Imsaeid.

Collection of Blood Samples:
After the area had been properly cleansed with 70% alcohol, samples were taken from each camel's jugular veins using a disposable 5-milliliter syringe with a 19–20 gauge needle. Three milliliters of blood were added to an anticoagulant tetra acetic acid (EDTA)-containing tube for hematological and parasitological investigation. Each tube was accurately labeled with the animal's identification number. All blood samples were shipped on ice to Faculty of Veterinary Medicine at the University of Omer Al-mukhtar's in Al-Beida, Libya.

Parasitological Examinations:
For the preparation of blood films for analysis, fresh whole blood was used to create blood Smears on tiny glass slides. These smears that were then dried, fixed in methanol, and stained with Giemsa's dye. *Babesia* was examined by direct microscopic inspection using a compound microscope equipped with X100 oil immersion lenses (Olympus, USA) Babesiosis can be identified through direct diagnosis by looking for parasites in blood according to **(**Chagas, Binkienė *et al*., 2020).

Analyzing blood smears is beneficial for thin films but less effective for more sensitive thick films. This approach is generally useful for diagnosing acute infections, but is not effective for identifying carriers when parasitemia are frequently very low.

Hematological Examinations:
Blood samples were mixed with EDTA and used to determine the Total erythrocyte count (RBC), hemoglobin concentration (Hb), Packed cell volume (PCV),Total platelet count, (MCV)mean corpuscular volume, and mean corpuscular hemoglobin concentration(MCHC). The blood samples were placed into tubes and transported to the laboratory for analysis. Differential leukocyte counts were also examined**.**

Statistical analysis :
IBM SPSS Statistics 20 (USA) was used for data management. Descriptive statistics for data summaries were generated with mean and standard deviation The variance analysis (ANOVA) test was used to assess group comparisons. All statistics were deemed significant When $p < 0.05$.

RESULTS:

The results showed that out of 160 camels' blood samples examined microscopically, 35% of the samples were infected with *Babesia* species. According to the seven regions the highest infection rate were found Tubrug-khuayri (70%), Ajdubiya -road (60.6%), Alhamamuh (60%), Sulanta (46.6%) and Alqabah (28.4%). The lower infection rate were observed in Qanduluh (19.35%) and Imsaeid (7.1%). See Figure (1) and (2).

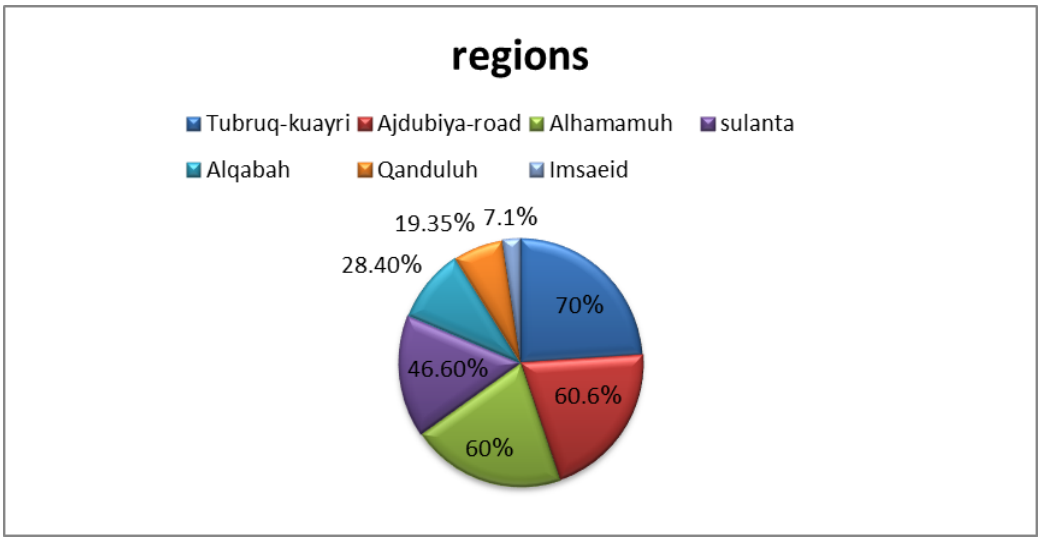

Figure (1). Prevalence of *Babesia spp.* in Camels According to different seven regions:

Morphological OF *Babesia spp*

Babesiaspp penetrates erythrocytes at the sporozoite stage. When a thin blood smear is stained with Giemsa, the tetrad shape is observed. *Babesia* appear as reddish-violet particles inside the blood cells. They may present as a single or double pyriform and the parasite can also take other shapes depending on its type, round, oval or ring forms.

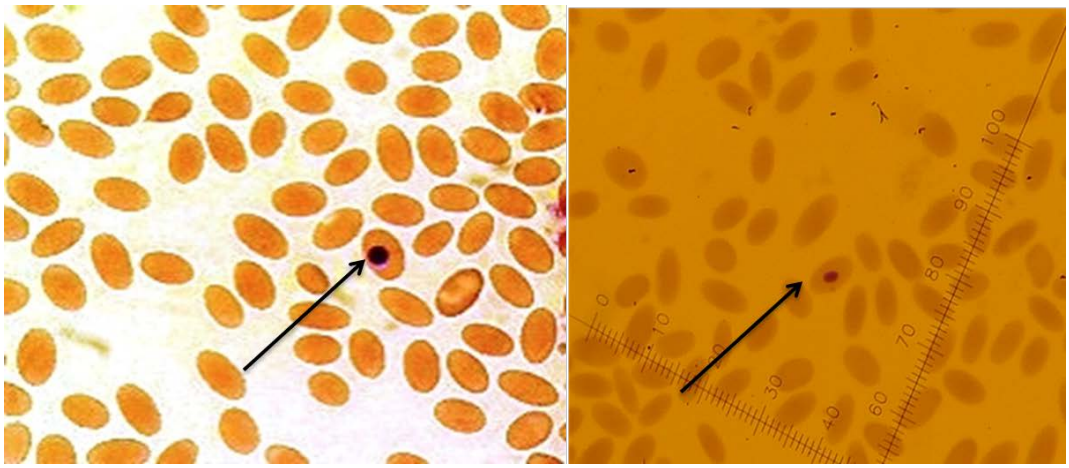

Figure (2). Smear of blood from a dromedary camel naturally infected with *Babesia spp.* (A) oval, (B) pear-shaped close to the contaminated RBC border (Giemsa, 100×).

Blood parameters of camels infected:

A total of 56 out of160 camel blood samples were subjected to complete blood count (CBC). The results showed the following percentage: WBC (41.0%), RBC(83.9%), HGB(51.7%) ,HCT(35.7%),MCV(100%),MCH(35.7%),MCHC(28.5%),plt(89.2%),neutrophilia(69.6%).lymphocytes(23.2%), monocytes(26.0%),eosinophils(5.3%).**Table (1)**

Table (1). Blood parameters of camels infected and References normal with *Babesia spp*, date presented as mean± STD

Parameters	Infected	References normal
WBCs*10^9/L	14.63±8.23	7.0-16.0
*RBC count × 1012/L	5.43±2.33	7.5-12.0
HGBg/dl	10.36± 2.16	10.2-16.0
HCT%	26.0± 13.2	25.35
MCV fl	52.8±36.8	27.0-33.0
MCH pq	22.11±9.45	12.5-16.5
MCHC q/dl	47.4±19.8	42.0-49.6
PLT × 109/L	275± 110	150-450
NEUT*%	51.95±1.23	30.0-60.0
LUMPH*%	40.30±1.23	30.0-55.0
MONO*%	5.51±0.35	2.0-6.0
EOSINO %	2.11±0.20	2.0-8.0
BASO %	0.37±0.0.07	Up to2.0

DISCUSSION

The one-humped camel, Camel dromedarius is highly adaptated to withstand harsh environments, and is a widely distributed domestic animal in arid and semi-arid regions of Arabic

lands, Africa, and Western Asia. Moreover, one of the biggest problems facing the livestock sector in developing countries is tick infestation, which causes babesiosis.

The current study found an overall frequency of (56/160) 35% of babesiosis in camels in north-eastern Libya. This prevalence is lower than the rate recorded by (Abd-Elmaleck et al., 2014) 46.9% in Egypt and (El-Alfy et al., 2024) at 43.6% in Sudan. However, some other reports found lower rates of *babesia* infection 19.5%, 17.5%, and 25% in Iraq (Farhan & Hameed, 2017); (Al-Amery, Faraj, &Majeed, 2017); (Al-Mialy, Hatem, & AL-Abedi, 2018), and 24.3% in Nigeria; (Wakil et al., 2016). The lowest infection rate of (1.0%) was reported in Tunisia by Selmi et al. (2019) and 10% in Iran by Mirahmadi et al. (2022).

Many factors, contribute to these differences in prevalence such as the lack of veterinary services, environmental- variations, specific geographic and strategic features of the study locations and the quantity of samples gathered. In our study, the highest prevalence rate was recorded in Tubrug-khuayri (70%), followed by Ajdubiya (60.6%), Alhamamuh(60%), Sultana (46.6%), Alqabah, (28.57%), Qanduluh (19.35%) and Imsaeid (7.1%). The highest rate in Tubrugkhuayri area (70%). Can be attributed to the high temperature, humid conditions and an environment suitable for the growth and reproduction of ticks vectors. According to the examination of the stained blood smears, the *babesia spp* in various shapes, including large, pear-shaped, oval and circular. The trophozoites were recognized as oval or elliptical shape, whereas merozoites were pear-shaped and most commonly found inside the erythrocytes as described by (Alsaad et al. (2015). However, the identification of *Babesia* spp cannot be determined with absolute confidence because the size and shape of Babesia's -vary throughout its maturation stages in the red blood cells. Additionally, certain *piroplasmid* species that infect distinct vertebrate hosts may vary in size and form (Swelum, Ismael et al., 2014).

The simplest, fastest, and most widely available technique for diagnosing clinical cases of babesiosis is the microscopic detection of *Babesia spp*. through analysis of blood smears stained by Giemsa.

Our results indicated changes in the blood profile of camel infected with *Babesia spp*. The mean values of the total RBC count showed a significant decrease ($p<0.05$), to (5.43±2.33) in infected camels but there was a significant increase in the mean values of MCV (52.8±36.8), MCH (22.11±9.45) and MCHC (47.4± 19.8). There were also an increase in the leukocytes count (WBC), with increase in neutrophils (51.95±1.23), lymphocytes (40.30±1.23), and monocytes (5.51±0.35). Similar results were obtained by Al-Obaidi, Hasan *et al*., (2021) in Iraq, who recorded a decrease in erythrocytes but a significant increase in lymphocytes. Farhan and Hameed (2017) also observed a decrease in RBCs.

A study by (Alsaad, Al-Amery *et al*., (2015**)** recorded a decrease in erythrocyte rate, along with an increase in lymphocytes, the total leukocytes count and increase in (MCV). Another study by Swelum, Ismael *et al*.,(2014) in Saudi Arabia found an increase in the total leukocyte count and a decrease in erythrocyte rate. The reduction in erythrocytes is due to the direct parasitic effect on the erythrocytes, causing their lysis, and depression of the haematopoietic system's. Furthermore, erythrocyte phagocytosis by macrophages red blood cell damage caused by parasites and a change in anti-erythrocytic autoantibodies within the bone marrow are considered signs of bone marrow depression. Several studies found that leukocytosis occurred as a result of lymphocytosis in infected camels, supporting the findings of (Egbe-Nwiyi, (1994) and Uilenberg (2006), who explained that the stimulation of stem cells and lymphoid tissues in the bone mar-

row is the primary source of leucocytosis in blood parasite infection.Moreover, our results were consistent with those of Mahran (2004) and Mohammed, Sackey, Tekdek, &Gefu (2007), who suggested that a rise in leukocyte counts may be anticipated as a result of lymphoid depletion and disorganization with large lymphocytes.

CONCLUSION

Babesiosis is a tick infestation, significantly impact livestock, particularly the one-humped camel (Camelus dromedaries). In this study a prevalence of 35% were reported in northeastern Libya for camels infected with *Babesia spp,*The highest prevalence rate in Tubrug-khuayri, Aj-dubiya, Alhamamuh, and Sultana. *Babesia spp*. is large, pear-shaped, oval, and circular organ-isms found inside erythrocytes. The simplest and fastest method for diagnosing babesiosis is the microscopic detection of *Babesia* spp. The study results indicated a significant decrease in total red blood cell count in infected camels. attributed to the parasitic effect on erythrocytes. Addi-tionally, there was an increase in leukocyte count, neutrophils, lymphocytes, and monocytes., causing lysis and hematopoietic system depression**.**

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