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College of Veterinary Medicine

A Study of some Hemoprotozoa parasite in Camels

A Graduation Project Submitted to the Department Council of the Internal and Preventive Medicine-College of Veterinary Medicine/ University of Al-Qadisiyah in a partial fulfillment of the requirements for the Degree of Bachelor of Science in Veterinary Medicine and Surgery.

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((فَتَعَالَى اللَّهُ الْمَلِكُ الْحَقُّ ۗ وَلَا تَعْجَلْ بِالْقُرْآنِ مِنْ قَبْلِ أَنْ يُقْضَىٰ إِلَيْكَ وَحْيُهُ ۖ وَقُلْ رَبِّ زِدْنِي عِلْمًا))

صدق الله العظيم

سورة طه _الآية 114

Certificate of Supervisor

I certify that the project entitled (**Astudy of some Hemoprotozoa parasite in Camels)** was prepared by under my supervision at the College of Veterinary Medicine / University of Al-Qadisiyah. It is part of the requirements for obtaining a bachelor's degree in internal medicine and surgery sciences / internal medicine and preventive veterinary medicine

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Dr. Dhafar Rashid Hamid Saeed

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9 / 6 / 2021

Dedication

To those who reach the message, the Valley of Trust and advise the nation and the light of the worlds

, the greatest Messenger Muhammad (may God bless him and his family and grant them peace)

And to the pure family (Ahl elbait), peace be upon them

To those who reap the thorns from my path to pave the way for science and its great role in my life as my support and the greatest man in the universe.

"Dear father"

To whom was heaven under her feet and the candle of my life that illuminates my path and the source of my strength.

"Dear mother"

To moral motivation, a source of hope and optimism.

"My brothers and sisters"

Acknowledgement

In the name of God the gracious, the merciful, the first who deserves all thanks and
Appreciation for granting me with well, strength, patience and help with which this
Research has been accomplished.
I am very grateful to Dr. Dhafar Rashid Hamid for providing time to proceeding
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This work.
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Veterinary Medicine/ Al- Qadissiya University.

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Summary

The camel is considered to be one of the best animals that can tolerate the world.Because of their unique adaptive harshconditions in the arid parts of the physiological characteristics Thereforei ithas an important economic role and breeding, which requires good Management and control programs of diseases. Camel is an important multi-use animal used for transportation and Production of since ancient times. milk, meat and wool. Many diseases and parasites can infect the camels and thus affect their health and cause them many like anemia ,wasting, fever and death in heavy Infection, therefore, camel medicine has a long history in the world and Iraq.

These diseases are transmitted from camel to Camel by vectors such as hard ticks and number of species of Hematophagous biting flies including Tetanus, Stomoxys, and Lyperosia and Haematobia which transmitted blood parasites.

There are many parasites of blood in camels that cause diseases among them **Trypanosoma evansi** is the main cause of the surra disease in camels and is one of the most important blood parasites that causes severe losses of Economic, so it is considered the most important economic aspect in the camel breeding fields in the world . Surra disease transmitted byTabanus and Stomoxys caused high morbidity and mortality. The acute form of the Trypanosomiasis is almost always fatal during a fewweeks, while the common chronic form is evidenced by anemia, emaciation, frequent fever, edema, conjunctivitis Abortions, enlargement of the lymph nodes and lacrimation.

Babesia caballi infections have effect on Domestic animals and some wildlife species are the first to record the infection of

Camels with Babesia spp specially Babesia caballi in Egypt and in Iraq. Babesia spp is a hemoprotozoal that is transmitted by Anocentor nitens

ticks The typical signs of Babesiosis are fever, anemia, icterus, gastro-intestinal stasis and Hemoglobinuria and Babesia DNA was identified in infected camels.

Theileria camelensis is an important blood parasitic disease of animals

Inducing a variety of clinical appearance fever, superficial lymph node Swelling, lacrimation, a sudden loss of condition and loss of appetite ranging From a subclinical to a fatal disease depending on the animal species, host Age and the species of the parasite .

Chapter One

Introduction

Camels is an important multi purpose animals in arid and semi-arid areas of the world, (Wernery and Kaaden,2002). could be infected with different infectious diseases, since knowledge of diseases that affected camels and how to treated and prevented them as well as general health monitoring remains limited in camels world. It is an essential animal Used for production meat, milk, wool and also used in the world transporting (Kamani et al.,2008)

Camels are infected with and including many blood parasites such as

Trypanosoma (Surra disease) is one of the most important and dangerous infectious diseases that affect camels. It is caused by a protozoan parasite that lives in the blood of infected camel This parasite is transmitted by blood-sucking insects, Sazmand et al.,2011).Infection ،especially Tabanus or Stomoxys (Salim et al.,2010 with virulence abounds during the spring and summer.

The symptoms Loss of appetite, Anemia,(Juyal, 2002 ; Maudlin et al.,2003). A fever that lasts for several days or weeks, Nasal and tear secretions, corneal opacity and whiteness, diarrhea and sexual irritation,Swelling (odema) can be observed in the lower body of the animal,Neurological symptoms such as paraplegia, paralysis , or convulsions May occur with the increase in cold sweat before death, Becomes very weak,stumbles upon walking and has difficulty getting up.In the last stages of the disease, the animal.

Theileria is one of the most common tick-borne diseases, which

Have reported in a wide range of ruminants such as sheep, cattle and goats

But Only a few literatures were distributed in camels . In animal Theileriosis is protozoal disease caused by blood Parasites belonging of the genus

Theileria

Theileria are tick-transmitted, obligate intracellular parasite that are important Pathogens of livestock in the tropical and subtropical regions of the world (Metenawy, 2000)

The main clinical finding of camels infected by Theileria are fever, sever Emaciation, ocular discharge, diarrhea in the form of intermittent bouts, as well As systemic signs, enlargement of superficial lymph node (Shaikh,

2004;Tageldin et al., 2005;Hamed et al., 2011)

Babesia Camels babesiosis were an acute, or chronic infectious disease, distributed over most of the world specially in camel grazing areas (Aktas et al., 2012) .The disease were responsible for deteriorates effects, high morbidity rate and high remarkable and economic losses, caused by the tick-borne hemo-parasitic protozoan.Piroplasmosis of camel is as well, a synonym refers to as Camel's In general, camel's piroplasmosis is manifested by continuous fever, Babesiosis in appetence,(Talkhan et al., 2010;Ziapour et al., 2011 progressive haemolytic anaemia, haemoglobinuria (with the passing of coffee like urine), and paleness and/ or icteric mucosa, gastro-intestinal disorders, Moreover, emaciation and death is the end stage of the disease.

Aims of study

1_Knowledge blood protozoa infected camels.

2_The current knowledge covering epidemiology ,pathogenesis clinical findings and treatment and control of each blood parasite infected camels.

3_Detection of blood parasites present in camels and studying the effect of age and sex on infection rate.

4_Knowing the traditional and modern diagnostic methods for each parasite.

Chapter Two

Literature Review

2_1_Trypanosoma spp

Is one of the most important blood parasites that causes severe Economic, so it is considered losses of the most important economic aspect in the (Sazmand and Joachim ,2017) Camel breeding fields in the world (Desquesnes et al.,2013; Fong. Surra disease transmitted by Sazmand et ‹Tabanus And Stomoxys caused high morbidity and mortality (Salim et al.,2010 al.,2011)

History of disease and presence :

Trypansoma evansi was the first pathogenic species of the parasite to be discovered, as it was discovered in 1880 in India, and it was discovered in Egypt a long time ago as well.

Surra disease is found in various and wide climatic regions and conditions. The disease is found in North Africa, including Egypt (in the regions north of the tsetse fly belt), as well as in Asia and the Far East, as well as Central and South America . The prevalence areas of Trypanosoma evansai in Africa may overlap with the prevalence areas of the tsetse fly, making It difficult to distinguish between it and Trypanosoma brosai. Seasonally, the disease spreads in Africa and Asia in damp, humid climates that help the growth and reproduction of disease flies.Surra is one of the most important health problems In camels, and it is likely that this disease is the most prevalent economically important disease among camels in Africa and Asia. The disease causes significant economic losses in its endemic areas, especially in Sudan, as a result of low productivity of infected animals and mortality, as well as the costs of treatment and disease resistance. http://osp.mans.edu.eg/elsawalhy/inf-dis/%D8%B3%D8%A7%D8%B1%D8%A7.htm#111

2_1_1_ Classification : Trypanosoma evansi is a salivarian trypanosoma and unicellular Flagellated kinetoplastid protozoa belonging to Trypanosoma, it is the Causative agent of trypanosomasis (Laha & Sasmal ,2008; Desquesnes al., 2009) .

It is long slender trypanosoma with a prominent undulating membrane and long free flagellum (Abera et al .,2015).

Kingdom: Protista
Subkingdom: Protazoa
Phylum: Sarcomastigophora
Subphylum : Mastigophora
Class: Zoomastigophorea
Order: Kinetoplastidae
Suborder: Trypanosomatina

Family: Trypansomatidae
Genus: Trypanosoma
Species : Trypanosoma evansi (ruminants, horses, dogs)
Trypanosoma brucei (ruminants)
T. equiperdum (horses)

2_1_2_ Morphology

Trypanosoma evansi is similar in shape in all mammals just Different in size, Trypanosoma have a leaf-like or rounded body Containing a vesicular nucleus ,and a varying number of sub pellicular Microtubules lying beneath the outer membrane, There is a single free Flagellum arising from a kinetosome or basal granule (Laha & sasmal,2008; Abera et al .,2015).

An undulating membrane is present in Some genera and the flagellum lies on its outer border, Posterior to the Kinetosome is a rod-shaped or spherical kinetoplast containing DNA Members of this family were originally parasites of the intestinal tract of Insects, and many are still found in insects (Taylor et al., 2007) . Members Of the genus Trypanosoma are characterized by four developmental stage (amastigote, promastigote, epimastigote and trypomastigote stages) in Their life cycle and can be differentiation between them according to Morphological feature under microscopic examination (Raoofi et al.,2009). In some species only trypomastigote forms are found in the Vertebrate host; in others, presumably more primitive species,both Amastigote and trypomastigote forms are present (Desquesnes et Al., 2013). In the Trypomastigote form, the kinetoplast and kinetosome are Close to the posterior end and the flagellum forms the border of an Undulating membrane that extends along the side of the body to the Anterior end (Desquesnes et al.,2009) .

In the epimastigote form, the Kinetoplast nucleus and kinetosome are just posterior to the Undulating membrane runs forward from there and the promastigote form The kinetoplast and kinetosome are still further anterior in the body and There is no undulating membrane(Radostits et al.,(2007) . In the Amastigote form, the body is rounded and the flagellum emerges from the Body through a wide, funnel-shaped reservoir.(Taylor et al., 2007).

2_1_3_Epidemiology

Host range and geographic distribution

Although trypanosomiasis is often referred to as African Trypanosomiasis, certain trypanosomes do cause Infections outside this continent. T. evansi, the causative Agent of surra occurs not only in Africa, but also in Central and South America, the Middle East, and spectrum, the main host species Asia Surra has a wide host Varies with the geographical region In Africa, beyond the Northernmost limits of the tsetse fly belt, and in parts of East Africa camels are the most important host, whilst in Central and South America the horse is principally Affected (Dia et al., 1997). In Asia, a much wider range of Hosts is involved, including the Bactrian camel and Dromedaries, cattle, buffalo, horses and pigs (Pacholek et al., 2001).

This is contrary to observations in Africa and South America, where there is little evidence to suggest That domesticated livestock other than camels and

Horses, respectively, are clinically affected or infected With T. evansi (El-Sawalhy and Seed, 1999). The disease is most severe in horse, donkeys, mules Camels, dogs and cats. Camels, horses, dogs and Asian Elephant are more susceptible than sheep and goat and are more susceptible than bovines and pigs. Rats And mice are highly susceptible as experimental hosts for Detecting subclinical (non patent) infection (Reid and Husein, 2001). It has been suggested that, unlike in Tsetse-transmitted trypanosomiasis, wildlife reservoirs of infection are unimportant with T. evansi,

although it is Possible that South American coatis and capybaras are An exception to this (Herrera and Dvila , 2004). The Ability to be transmitted by blood-sucking insects other Than Glossina, has enabled T. evansi to extend its range Into African areas north of the Sahara desert, into Asia, Minor, Pakistan, India, the USSR, China, Sumatra, Java The Philippines, Mauritius, Madagascar, and South and Central America. It was introduced by camels into Australia, North America and South-West Africa

Prevalence of camel Trypanosomosis in some countries based on Serological testes .Nigeria 27% Losos et al. (1980), Mauritania 24% Dia et al. (1997), Niger 29% Pacholek et al. (2001),Kenya 28% Njiru et al. (2001),Ethiopia 21% Zeleke et al. (2001), Jordan 33% Al-Rawashdeh et al. (2000), India 22% Pathak et al. (1993),Sudan 33% El-amin et al. (1999), Iran 10% Zarif-Fard et al. (2001). In Iraq, Al-Amery et al., (2017) recorded the prevalence of Trypanosoma spp. By blood smears As 31.87 %. In Egypt, studies showed Soma spp. . Prevalence was 4.5% -74.4%(Abdel-Rady 2006; Zayed et al, 2010; ElhaIg et al, - that Trypano 2013; Barghash et al, 2014). **FIVE DIFFERENT REGIONS OF SAUDI Arabia Molecular analysis was performed using ITS1-PCR**

which showed that the highest prevalence of trypanosomes was observed in Al-Qaseem province (50.1%) followed Riyadh province (49%), whereas in Hail and the Northern Borders. (.there were fewer infections with trypanosomes (28.4% &17.6%), respectively.

2_1_4_ Modes of transmission of the disease

‹This parasite is transmitted by blood-sucking insects, especially Tabanus or Stomoxys, (Salim Sazmand et al.,2011) which spread in wet areas, and the disease spreads in the rainy seasons, especially with the beginning of March, when the vector flies increase and multiply.

Infection with virulence abounds during the **spring** and **summer**, when there are more flies that transmit the disease

2_1_5_ The effect of age and sex on infection of trypanosoma in camels

Effects of sex and age on the prevalence of Trypanosoma evansi using microscopic examination of blood Smears.

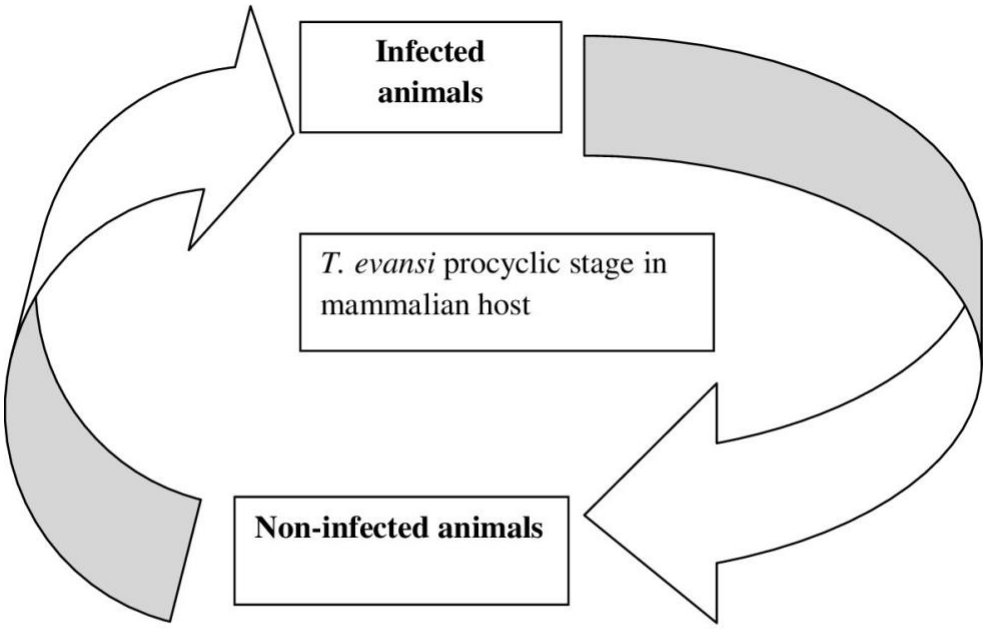
Prevalence of camel trypanosomosis and its vectors in Fentale South East Shoa Zone, Ethiopia .From September 2008 to January 2009

A comparison of the prevalence of Trypanosoma evansi between different age groups And sex is shown in the number of male camels examined was lower Due to the low number of breeding male animals kept by pastoralists in the study area The prevalence was relatively higher **(6.8%)** as compared to the females **(4%)** but not Statistically signifi cant (P>0.05). Young age groups were found to be more affected

than adult camels **(4%)** relatively,while all examined calves were found negative **(7.7%)**
However, the difference in prevalence between the age groups was not statistically Signifi cant (P>0.05)

2_1_6 Life cycle

Replication of the trypanosome occurs by longitudinal Binary fission both in the host and in the vector with the Flagellum and kinetoplast dividing together (Liu-Liu et al., 2005).
Developmental stages were not observed in any of the but in the noncyclically transmuted T. evansi Mechanical vectors. Consequently a procyclic or insect Stage (epimastigotes) does not exist in T. evansi which is Attributed to lack of maxi circles
in the kinetoplast DNA Ellie et al., 1999) (Figure 1). The non-cyclical transmission
of trypanosomes is aided by biting flies and thus, in The absence of Glossina,
the transmission is maintained In the ecosystem. Biting flies, such as Tabanids
(horse Flies), Stomoxys and Hippoboscids transmit T. evansi Mechanically through their mouthparts when they feed on more than one host within a short interval
Because the Trypanosomes remain infective for only a short period (Evans et al., 1995)



Tabanids

Figure 2_1 Life cycle of trypanosoma spp
https://images.app.goo.gl/TdX2Dnvi7y8QV5en9

2_1_7_ Pathogenesis

Infected tsetse inoculate metacyclic trypanosomes into the skin of animals, where the trypanosomes reside for a few days and cause localized inflammation (chancres). They enter the lymph and lymph nodes, then the bloodstream, where they divide rapidly by binary fission. In T congolense infection, the organisms attach to endothelial cells and localize in capillaries and small blood vessels. T brucei species and T vivax invade tissues and cause tissue damage in several organs.The immune response is vigorous, and immune complexes cause inflammation, which contributes to fever and other signs and lesions of the disease. Antibodies against the surface-coat glycoproteins kill the trypanosomes. However, trypanosomes have a large family of genes that code for variable surface-coat glycoproteins that are switched in response to the antibody response, evading immunity. This antigenic variation results in persistence of the organism. Antigenic variation has prevented development of a protective vaccine and permits reinfections when animals are exposed to a new antigenic type.
https://www.msdvetmanual.com/circulatory-system/blood-parasites/trypanosomiasis#:~:text=animal%20to%20another.-.,Pathogenesis%3A,divide%20rapidly%20by%20binary%20fission

2_1_8_ Clinical signs

Illness in camels may come in an acute form or a chronic form The incubation period (the period from infection to the onset of symptoms) ranges between 7_ 15 days, the infection rate (infected animals out of all animals) may reach 20% , and the Mortality rate (animals that died due to disease out of the total affected animals) may reach 100 If not treated, and parasites are found in the blood in acute cases, while in chronic case they are monitored sporadically and to a lesser extent. The symptoms of a camel infection may Appear in two main forms:

First: the acute form: which is more dangerous than the chronic Form and may be fatal in a short period ranging from several weeks to a few months. This form is characterized by the A fever‹following basic symptoms Loss of appetite.
Gradual weight loss. ‹Nasal and tear secretions ‹ that lasts for several days or weeks
Swelling (odema) ‹Excessive watering and hemorrhagic spots, Conjunctiva of the eye‹Anemia‹ can be observed in the lower body of
the animal . Especially the lower abdomen, hind legs, scrotum and penis
Abortion at any time during pregnancy. ‹The milk yield is greatly reduced ‹sheath in males ‹Urine has a distinctive smell.And may turn brown
Neurological symptoms such as paraplegia, paralysis, or convulsions, May occur with the increase in cold sweat before death. Spontaneous healing is rare.

Second The chronic form: the symptoms in this form are less severe and the progression of the Previous symptoms is slower, so this pathology may last for several years. It is the most Common, and its basic symptoms are in addition to what was previously mentioned in the acute Form:
Fever is intermittent and repetitive in the form of seizures that last One of them For 5_7days
Hair is often coarse, matte or opaque and easy to pull ‹

Other symptoms may. Appear in chronic cases, such as corneal opacity and whiteness, ‹off The animal's immunity to disease decreases.‹diarrhea and sexual irritation.

In the last stages of the disease, the animal Becomes very weak, stumbles upon walking, and has difficulty getting up.

http://osp.mans.edu.eg/elsawalhy/inf-dis/%D8%B3%D8%A7%D8%B1%D8%A7.htm#111

2_1_9_ Necropsy findings

Liver The histological section of the liver in the acute stage of trypanosomiasis shows coagulative necrosis, hemosiderin infiltration and billrubin, fatty degeneration in hepatic cells around the central vein . In the chronic stage shows infiltration of fibrous tissue and connective tissue between the lobules of the liver(liver cirrhosis) and decrease number of hepatic cells with hemorrhage, red blood cells among the hepatic cell

Spleen The spleen in the acute stage of trypanosomiasis shows hemorrhagic and active lymphoid follicles .Clumping of trypanosoma In spleen surrounded by inflammatory cells. Clumping of trypanosome in spleen occurred due to immune responses and noticed these clumping were under magnification was surrounded by inflammatory cells.

Kidney The histopathological section from kidney In the chronic stage of trypanosomiasis show glomerulus suffer from glomerulonephritis, precipitation homogenous acidic material(red coulor) in lumen of Bowman's capsule, hemorrhage inside and outside the glomerulus, epithelial cells are fullen in the center of urinary tubule .In the chronic stage the glumerulonepheritic showed, precipitation of immune complexes as homogenous material full all the space of Bowman′s capsule and calcified glomerulus also was noticed due to precipitation calcium .glomerulus with very thick Bowman's capsule and shrinkage of the tuft of capillaries. (**AL-Qadisiya Journal of Vet.Med.Sci. 2013)**

2_1_10_ Diagnosis

The diagnosis of the disease depends on :

Clear clinical symptoms in infected camels

Microscopic examination of a blood smear from the infected camel's ear after dyeing it with Mesa, especially when the body temperature of the affected animal has risen Using some serological tests to diagnose the disease in its chronic form, including (gelatinous formula .test – mercury chloride test)

Micro Haematocrit centrifugation technique (MHCT)(Adams, 2015 ; El-Naga & Barghash, 2016), as it is considered more accurate, as the parasite can be detected In a period less than the period of its questionnaire by direct examination of blood by 6-10 days

Serological diagnosis: These tests depend on the detection of the presence of immune bodies (anibodies) in the blood serum of the affected animal, and the most important of these tests are (CAT) Card Agglutination Test for T. evasi

The conjugated enzyme immunoassay (ELISA) test

Immunoassay (IFAT) - (Brown and Torres, 2008, Zayed et al., 2010)

Polymerase chain reaction (PCR) technique. Injecting laboratory animals (Smuts, 2009)

2_1_11_ Treatment of the camels

Giving protective effect to animals exposed to infection in the season of the vector flies, such as the injection of quinapiramine procalt (Intercideprosalt) at a dose of 5 mg / kg subcutaneously 3-4 weeks after the start of the rainy season
Treatment of sick animals. B. Sarmen: 10% intravenously (1 mg per 10 kg) and injected intravenously or intramuscularly into the neck at a rate of 25 ° F. Mg / kg of animal weight from a 5W solution. % It is preferable to give an additional dose a week after the first dose, or Prenyl or Tricoin.
Giving glucose solutions, antipyretics and anti-inflammatory drugs such as diclofen and dexamethasone to treat swellings. Using trypanosomal antagonists for prevention
, in January and February of each year.
http://osp.mans.edu.eg/elsawalhy/inf-dis/%D8%B3%D8%A7%D8%B1%D8%A7.htm#111

2_1_12_ Control and prevention

The methods of controlling the disease often depend on Avoid endemic areas of the disease, especially wet lands, swamp areas, and stagnant water,
where vector flies multiply Moving camel herds at night away from jungles and river basins during the seasons of the spread of vector flies. Getting rid of the collected droppings that the flies live on Protecting the target animals from flies
by smoking and using fly repellents. Camels must be watered in the hottest hours of the day, where insect activity is below.
Camels should be watered in limited numbers so that they do not remain for a long time exposed to flies around water wells. http://osp.mans.edu.eg/elsawalhy/inf-dis/%D8%B3%D8%A7%D8%B1%D8%A7.htm#111

2_2_ Theileria spp

Theileriosis is considered to be the second most important Hemoprotozoal disease following Trypanosomosis affecting dromedary Camels and domestic
ruminants in the tropical and subtropical regions of the world (Mazyad, and Khalaf, 2002 ;Sivakumar et al., 2014) Theileria is one of the most devastating blood
parasites affecting Cattle in Saudi Arabia,
causing lethal infections in exotic cattle (El Imam et al., 2015). The thileriosis in cattle caused by the parasite TheileriaObligate intracellular blood parasite) and transmitted by ticks, but very Little is known about this disease in camels
(Duh et al., 2008 ;Silva et al., 2010) . Theileria spp. That have been reported in camels include Theileria Camelensis and T. dromedarii. (El-Metenawy, 2000).diseaseis transmitted by the tick species Hyaloma dromedarii in
Camels, its main host, but it is also found on the skin of cattle, sheep, Goats, horses (Hamidinejat et al., 2008) . Koch in 1901,was the first who studied the outbreak of endemic disease in South Africa which known later East Cost Fever ,he noted intra-lymphatic stage Or called schizont which known for long timeKoch's
blue bodies, then cited by Stephens and Christopher in (1903) were described the causative parasite which Known later piroplasm Koch After that, cited by Arnold Theileria

. in 1904 called the Parasite piroplasm parvum which become accredit scientific name in references which gradually change to Theileria parvam cited by
Bettencourt , (Lainso, 2007) T. annulata was reported as the first named piroplasma annulatum in 1907 In Transcaucasian cattle in (1904), it had been reclassified as Theileria annulata After the schizont stage recognition in its life cycle
(Weir, 2006) It also appeared between 1912
and 1922 in Zambia, Malawi and Mozambique (Province of The Tete), theileriosis continues to distribute in these Countries and causes economic
losses for livestock-oriented communities (Yusufmia et al., 2010). The first reported it in camels in Russia in 1917. So far, two Species camelensis and T. Dromedarii
Of this parasite, and since it has of Theileria have been reported in the world T. (Borji et al., 2009). As there is insufficient information on the Microschizont
stage been observed only Its piroplasm stage in erythrocytes (Elghali and Hassan, 2010). For .instance, there is inadequate information about the microschizont phase
Of Theileria, and Since its has been observed only piroplasm phase in erythrocyte (Elghali and Hassan ,2010). (Al-Fatlawi and Al-Fatlawi, (2019) reported T lestoquardi
and T. annulata in cattle in Al-Diwaniyah city of Iraq.

2_2_1_ Classification : (Radostits et al., 2007)

Kingdom : Animalia
Subkingdom : protozoa
Phylum : Apicomplexa
Class : Aconoidasida
Order : Piroplasmoirda
Family : Theileriidae
Genus : Theileria
Species : Theileria parva(cattle)
T.annulata (cattle)
T.ovis (sheep, goat)
T.camelensis (camels)
T. equi (horses)

2_2_2_ Morphology

There are various developmental stages of different shapes and Forms of Theileria spp.Which infected cattle ,baffuloes ,goats ,sheep and Camels were in the form of ring form, slender spine-like form, an Elongated structure or round form measuring 3.75 μm in diameter, and Enclosing centrally located nucleus surrounded by a cloud-like
dispersedcytoplasm (Hamed et al., 2011) . Theileria spp occur inside R.B.Cs has Two forms the first form is (Erythrocyte form) which the parasite present. In blood inside R.B.Cs and its take several shapes like ring , comma, rod And oval shape while the second form is (lymphocyte form) which the Parasite present in lymph node and
called a koch‘s blue bodies which Represented the schizont of parasite and
appear in two form Macroschizont which consist of 8-12 nuclie and microschizont
which Consist of 50-100 nuclei. (Telford et al., 2002 ;Shaw, 2003 :Mans et al., 2015).

2_2_3_ Epidemiology

Epidemiological studies on tropical theileriosis (Theileria annulata infection of cattle) in Kurdistan Region, Iraq (2010)The results indicated that the seroprevalence was 77.9%, and PCR reported an infection rate of 68.9% in the Kurdistan Region of Iraq, Molecular Detection of Theileria species in Cattle from Jilin Province, China (2017) Results revealed that 19.7% and 10.9% (15/137) were found to be infected with Theileria sinensis, Theileria (27/137), 17.5% (24/137) orientalis, respectively. Mixed infection was found in 8.8% (12/137). The overall Detection rates of Baishan, Yanji, Jilin and Liaoyuan districts was 60.0%, 17.5%, 5.3% and 0%, Respectively.

PREVALENCE OF THEILERIOSIS IN SHEEP IN AL-KUT PROVINCE IN Iraq Noaman N. A'aiz*,Yas A. Dhaim (2014)

PCR analysis showed that there are 63%, 71.2% and 48.2% of examined blood samples wer given a positive result for T.ovis, T.annulataandT.lestoquardirespectively in addition to 45% were recorded a mixed infection.

2_2_4_ Mode of Transmission

Theileria camelensis was described from most of the area, the camels being Elevated and transmitted by Hylomma dromedaries (common camel vector)

Methods of infection: - Infection is carried out in one of the following ways by ticks through contaminated tools and needles. When the parasite enters the body of the animal, it begins to invade the lymphocytes, which are a type of white blood cells, and they grow and multiply inside them and form what is known as the blue hut bodies and when the lymph cell is filled it explodes to exit these bodies and infect Red blood cells.

https://m.facebook.com/story.php?story_fbid=2751501755134563&id=1499142717037146

2_2_5_ The effect of age and sex on infection of Theileria in camels

Traditional and Molecular Diagnosis of Theileria Species In Camels in Al-Diwaniyah Province (2020)

Infection rate of Theileria spp. In camels according to sex

Regarding to the effect of animal sex the result referred to the highest rate Of Theileria infection in females (111/37) (33.33%), whereas the low rate of Infection in males (39/12) (30.7%) from total 150 samples, without significant Difference at ($P<0.05$) between male and female camels.

Infection rate of Theileria spp. In camels according to age

According to effect of age of animal, the result revealed that the highest Percentage of infection in age is 5-7 years (33/79) (41.77%), while the lowest of Infection (19.35%) in more than <7 years. There was significant difference at ($P>0.05$)

2_2_6_ Life cycle

Theileria spp is transmitted to the animal by ticks, which are a type of insect that parasitizes the animal by sucking blood

Where it is in the salivary glands of the tick and then it is in the sporozite stage

The mites are by injecting the sporozite into the animal's blood through the saliva of the insect's salivary food while feeding on the animal's blood

The sporozoite attacks the lymphocytes, and the schizont component multiplies in them. The lymphocyte transforms from a lymphocyte to a lymphoplast, and then localizes in it, and .lymphocyte proliferation occurs
After 14 days of infection, the shizont turns into mirogny, which turns into mirozoite, which attacks red blood cells
When mirozoite attacks the red blood cells, they turn into piroplasm
Insects (ticks) feed on them, where sexual reproduction of the piroplasm of the zygote component takes place inside the intestine of ticks
The zygote turns into a motile keniti stage, which attacks the cells of the salivary glands and transforms into the sporoblast and then into the sporozoites.
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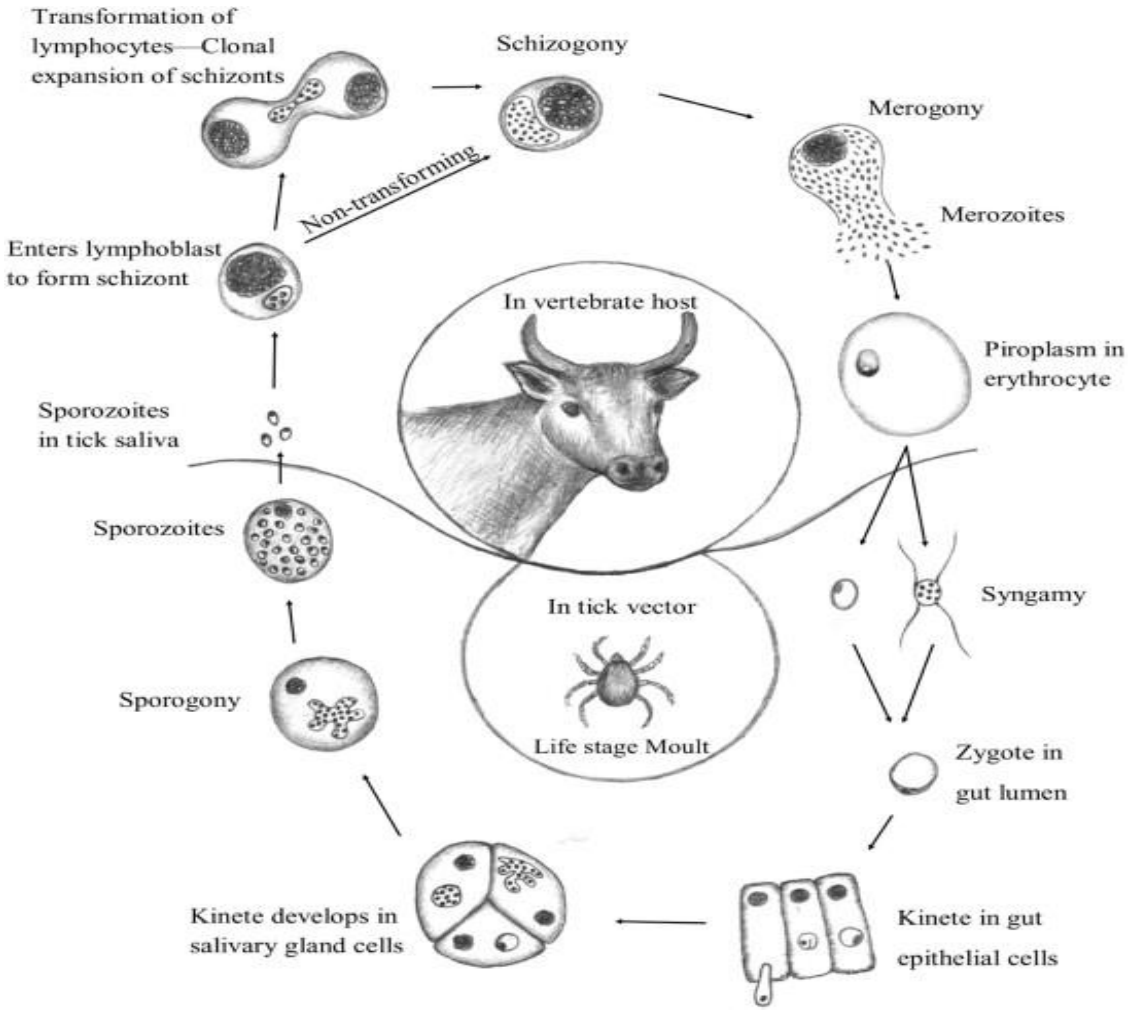

Figure 2_2 lifecycle for the Theileria spp
https://images.app.goo.gl/uTLWxx5PUapzMysA6

2_2_7_ Clinical Signs and pathogenesis

The incubation period ranges from 9 to 25 days, and the animal may spend 4 days after the appearance of signs of disease

The first symptom that appears on the affected animal is the enlargement of the lymph nodes near the areas of attachment of the tick, then the rest of the glands begin to swell, especially the lymph nodes in front of the scapula ,The temperature rises from 40 to 41 degrees Celsius

Profuse tears, swollen eyelids, and increased salivation,

Loss of appetite and severe emaciation and rapid weakness of the anima,

Opacity of the cornea so that the animal cannot see Dyspnea, in which breathing is labored with strenuous effort with each breathing ,Diarrhea and bloody urine often with paleness and yellowing of the mucous membranes Trembling of the animal, especially its legs, as if it was paralyze After all these symptoms appear, the animal falls and dies .

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2_2_8_ Diagnosis

The appearance of symptoms of the disease and the presence of the types of ticks that transmit the animal.

The laboratory examination by making swabs from the blood of the animal suspected of being infected with theileria parasite and staining it with the gemsa stain and finding the parasite inside the red blood cells, as well as the bodies of a hut in the lymphocytes

Lymph nodes are pricked, swabs and stained with the same type of dye as before, to find Koch's blue bodies

https://m.facebook.com/story.php?story_fbid=2751501755134563&id=1499142717037146

The light microscopy was used for determine the presence of Heamoprotozoal parasites during the acute phase of the disease give the Best result (Chaudhrib and Gupta, 2003)

The direct method involves Identifying the parasite in Giemsa's-stained blood smears Or lymph-node Biopsy samples but it This method is reliable for diagnosing clinical acut cases is very subjective in pre-immunity and long-lasting carrier.

Serological diagnosis

Serological diagnostic tools for the major tick-borne protozoan Diseases of livestock were reviewed and include The Indirect Fluorescent Antibody Test (IFAT) and ELISA (Bakheit et al., 2007) The Indirect Fluorescent Antibody Test (IFAT) based on schizont. Or piroplasms antigen to detect the circulating antibodies against Theileria has been developed The Enzyme-Linked Immunosorbent Assay (ELISA) for (Salih et al., 2003;Taha et al., 2003).

Molecular Diagnosis

Molecular techniques include sequencing, PCR would allow direct Specific and sensitive detection of parasites, and rapid, simultaneous Detection and differentiation of different Theileria infecting a given Animal (Schnittger et al., 2004). Polymerase chain reaction (PCR) has Been developed for detecting Theileria spp. Infection with high sensitivity

And specificity (Altay et al., 2008 ;Ranjbar., 2012). Sequencing the 18Sr DNA gene is one of the best molecular methods for determining the Strains of this parasite.

2_2_9_ Treatment of the camels

Isolation of affected animals, and it is treated with: - Diminazine 70 mg / ml (1 cm / 30 kg intramuscularly); emesol (120 mg / ml) at a dose of 1 cm / 100 kg (the dose should be adhered to and not increased).

Injections into the muscles (buparvaquone (butalex) at a dose of 1 ml / 20 kg, and in case of severe injuries, the dose is repeated 48-72 hours after the first dose. Give antipyretics such as Metalgin or Novalgex at a dose of 50 cm intravenously. About infection. Giving iron compounds after animal cures to treat anemia. Treating other symptoms by giving anti-inflammatories and giving vitamins such as injection of vitamin AD3E or giving it by drinking and 5% clucose intravenously in case of bloody urine or symptoms of anemia /https://www.facebook.com/346797513293376/posts/408473427125784

2_2_10_ Control and prevention

The control measures against tick-borne diseases, it is essential to Detect the prevalence of tick borne pathogens in target populations of Animals by using insecticide through dipping of animals

(Oura et al., 2004) In addition, immunoprophylaxis trials of cell line vaccines haveBeen successfully carried out in Iraq, Iran and in Sudan (Ahmed et al., 2013).

Quarantine and tested of in ported animals and slaughter of carrier And emaciated animals .

Treated the infected animals By theilericidal drugs lick

menoctone , chlotetracycline or oxytetracycline (Mirzaiedehaghi, 2006;

Derakhshanfar and Mirzaei, 2008).

2_3_ Babesia spp

Babesia species are tick-borne hemoprotozoan parasites that infects Red blood cells leading to anemia in the host (Aktas et al., 2012). Numerous different species exist by varying host specificity and are Found all over Asia, the Middle East, Europe, Africa and North America (Altay et al., 2008 Heidarpour Bami et al., 2009;Razmi et al., 2013).

Infection occurs in domestic animals, including cattle, camel, horse, Sheep, goats, pigs and dogs (Bock et al., 2004 ;Aktas et al., 2007). Bovine babesiosis is a major tick-borne disease of cattle caused by Six Babesia species that have an important effect on livestock health and Productivity, two species, Babesia bovis and B. bigemina have the highest Impact (Ghirbi et al., 2008) . B. bigemina can cause massive destruction of The red blood cells leading to severe anemia and hemoglobinuria, this Appear red urine (due to hemoglobin in urine).

And the disease can kill Cattle through a week (Uilenberg, 2006 ;Adham et al., 2009)

Babesia bovis is more dangerous than B. bigemina because it is Less sensitive to some babesiacidal compounds, Thus causing a problem In treating infected animals (Abera, 2015)

Animals that survive a Babesia Infection generally become carriers of the parasite and serve as reservoirs For transmission (Chaudhry et al., 2010). Ovine babesiosis is one of the most important disease in sheep with High mortality and morbidity, resulting in high economic losses globally It's especially where ticks are located , Rhipicephalus bursa, is present

(Aktas et al., 2007;Altay et al., 2008) . Sheep that recover from Babesiosis become asymptomatic carriers (Aktas et al., 2005). Camels were infected with Babesia caballi for the first record in The first record in Egypt (Abd – Elmaleck et al., 2014) . Babesia caballi is a Hemoparasitic protozoan that is transmitted naturally in New World by Anocentor nitens ticks. Very few reports are available about camel piroplasmosis recently In the one-humped camel zone, such as Iraq (Jasim et al., 2015) and Iran (Khamesipour et al., 2015).

2_3_1_ Classification : (Aktas et al., 2012) and (Schmidt & Robert, 2006).

Kingdom: Animalia
Subkingdom: protozoa
Phylum: apicomplexa
Class: Aconoidasida
Order:Piroplasmoirda
Family: Babesiidae
Genus: Babesia
Species: Babesia bovis (cow, Buffalo)
Babesia ovis (sheep , goat)
Babesia bigemina (cattle)
Babesia caballi (camels)
Babesia canis (dogs)
Babesia cati (cats)
Babesia microti (mice)
Babesia motasia (cattle)

2_3_2_ Morphology

Babesia species enter red blood cells (erythrocytes) at the Sporozoite stage within the red blood cell, the protozoa become cyclical And develop into a trophozoite ring (Abdullah and Mohammed, 2014). The trophozoites moult into merozoites, which have a tetrad structurecoined a Maltese-cross form (Herwaldt et al., 2003). This tetrad Morphology is seen with Giemsa staining of a thin blood smear which is Unique to Babesia and distinguishes it from Plasmodium falciparum, a Protozoan of similar morphology that causes malaria (Ahmed et al., 2002) . Trophozoite and merozoite growth ruptures the host erythrocyte Leading to the release of vermicules, the infectious parasitic bodies, which Rapidly spread the protozoa throughout the blood (Shayan & Rahbari, 2007) . Babesia appear as reddish violet particles inside the blood cells (Swelum et al., 2014) . It appears as a single or double pyriform and the Parasite has other forms depending on its type, round or oval or ring (Bai et al., 2002).

2_3_3_ Epidemiology

The infection of babesiosis is widespread worldwide, and it is linked to the spread of the vector tick In hot and sub-hot regions and in northern Africa, including Egypt, the Middle East, southern Europe, as well as South America.
Papesia bovis was discovered by Babes in 1888 in Romania and since then many other species have been described. The disease was first recorded in Egypt in 1947
https://veterinarysci.blogspot.com/2011/10/babesiosis.html

2_3_4_ Modes of transmission

Ticks are the primary and important vector of disease, as the parasite Babesia spends part of Its life cycle inside the tick. Therefore, knowing the life cycle of ticks is very important in the prevention and control of the disease

The possibility of transmission to a healthy animal through needles and surgical tools contaminated from sick animals

The highest rate of infection with the disease occurs in animals at the age of 6-12 months, knowing that infection does not often occur in animals older than 5 years

Cattle under the age of one year often get infected with Babesia pygmina, while cattle over two years old are often infected with Babesia poufs

Often this disease occurs seasonally and is linked to an increase in the number of ticks as well as the weather

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Factors that contribute to infection

Susceptibility to infection with babesiosis decreases with increasing age, but the severity of infection increases with age

General, lean and stressed animals are the most sensitive to infection

The incidence increases seasonally in the summer, which witnesses the activity of ticks that transmit the disease

2_3_5_ The effect of age and sex on infection of Babesia in camels

Molecular study of some blood parasites in
Camels in Al-Diwaniyah province (2018)

The prevalence of Babesia spp infection in camel
According to the microscopic examination and sex

According to the sex of animals, the number of infected females
and the number of infected males (30/75) (40%) of (76/125) (60.8 %)
The total 200 samples. The results show there was significant difference at
$P \leq 0.05$ between males and female

The prevalence of Babesia spp infection in camel
According to the microscopic examination and age

According to the age of animals, the number of infected camels
Less than (<1) year (20/50)(40%) and the number of infected camels
More than (>1)year (86/150)(57.33%). The results show there was
Significant difference at $p \leq 0.05$ In this study show
Babesia spp can be infected camels in all age.

2_3_6_ Life cycle

The life cycle takes place in two stages, one inside the tick and the other inside the animal's RBCs.

First: The life cycle inside ticks

This stage begins when the tick attaches to the infected animal or the carrier of the disease and begins to absorb the blood containing the babesiosis stage inside the red blood cells. In females, the infection is transmitted to the eggs and from it to the rest of the different stages of

the tick, then to the following generations. After the babesiosis parasite spreads inside the body of the tick, it ends up invading the salivary glands and continues to multiply and become predisposed to animal infection.

Second: The life cycle inside the animal or human body

Once the tick carrying babesiosis attaches to the animal or human, babesiosis moves into the blood to invade the red blood cells and multiply within them by dividing asymmetrically, then the infected cells explode to come out of the babesiosis and infect other balls again.

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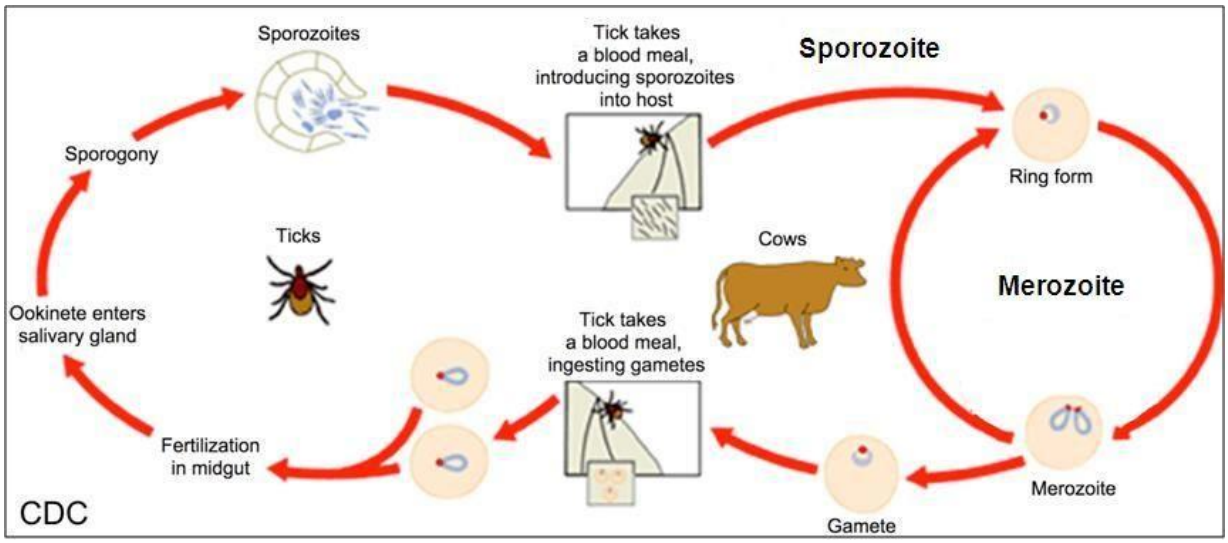

Life cycle of *Babesia*

Figure 2 3 Life cycle of Babesia spp

http://fullmal.hgc.jp/bb/icons/lifecycle.jpg

2_3_7_ Clinical signs and pathogenesis

Pathological

Babesiosis gets into the tick and turns biologically so that it is ready in the infectious phase. Then when the tick bites the animal, the babesiosis enters the blood and from there into the red blood cells, where it multiplies there

Because babesiosis excretes a toxin in the blood, the body temperature rises (fever) and when the red blood cells break down, the hemoglobin is excreted with the urine heamoglobinurea when it reaches the kidneys. In the blood, blood sighs and the animal's weight decreases, then death occurs as a result of the breaking of red blood cells that cannot carry oxygen in the lung, so suffocation occurs and the animal dies Babesiosis is transmitted from the infected mother to the fetus through the placenta.

The Clinical symptoms:

Acute cases: It is mainly characterized by a lack of movement and a desire to walk suddenly with a severe fever that may reach 40 ° C and often disappears within a day and becomes intermittent as there is prickling in the joint area above the hooves, as there may be prickling on

the head and lower abdomen, and in many cases he suffers Sick animal from colic pain.
Symptoms of anemia may appear with pale pink mucous membranes and jaundice may appear.
Hemoglobinuria may also appear and pregnant animals with a miscarriage. Severe acute cases may end in death, and mortality rates may rise to 35%
Symptoms are more severe in younger horses
The course of the disease ranges between 8-10 days, but severe acute cases may pass less than 48 hours after the onset of symptoms
Chronic cases: may live for several months, while carriers of the disease may remain so for four years
Cured animals become carriers of the disease and act as a source of infection for healthy animals. These animals do not have any effects of the disease except for the presence of antibodies and sometimes the parasite is present in the peripheral blood vessels where it can be detected microscopically
Animals carrying the disease if they are subjected to stress such as transportation or violent training, the numbers of parasite may increase to reactivate the infection.
https://m.facebook.com/story.php?story_fbid=880463732118988&id=107324199432949

2_3_8_ Necropsy findings

In acute cases
Congestion of most organs inside the body with bleeding in the tissues of these organs and may accompany jaundice in the mucous membranes The spleen is visibly enlarged, and it may sometimes reach several times its size, and It is fragile, easily friable, dark in color, and when cracked, the cutting surface looks like raspberry jam, and its flesh is very soft
The liver is enlarged and lumpy, and the gallbladder vesicle is filled with a thick bile juice with a dark color. There may also be bleeding on its mucous membrane. The kidneys are enlarged, congested and dark in color.There are hemolytic changes in the kidneys, liver and urinary bladder, which are often filled with urine of red to dark brown
colorThe fourth mucous membrane of the stomach, abomasum, and intestine may be yellowish in . The lungs are often congested and abscesse color and contain hemorrhage
The presence beneath the serous membranes The pericardium is filled with fluid and is bleeding of hemorrhagic spots on the heart and brain In subacute and chronic cases The animal carcass is scanty and the presence of jaundice
https://veterinarysci.blogspot.com/2011/10/babesiosis.html

2_3_9_ Diagnosis

Symptoms that include fever, anemia, jaundice, and urine containing hemoglobin, as well as enlargement of the spleen and a darkening color in places where the disease is endemic, and the vector tick indicates an initial diagnosis of the disease, and this initial diagnosis is confirmed by monitoring the parasite in slab swabs or by positive serological tests or those related to transmission Infection experimentally in susceptible animals Samples needed for laboratory Test From a live animal: thin and dense strip swabs should be prepared, preferably from the capillaries of the ear or the back of the tail, and whole blood samples should be collected on EDTA for blood tests, and serum samples should be collected during the acute phase and .convalescence phase of the serological tests

When performing the anatomical characteristic of animals that did not pass more than 24 · hours of death, strip swabs should be made from the heart muscles, kidneys, liver, and brain, and from one of the peripheral blood vessels "such as the bottom of the legs Samples should be ".collected from the vector ticks present on the sick animals or in the infected pens
The most common method used to confirm the diagnosis is microscopic examination of smears from blood or organs of recently diseased or dead animals
In severe cases, the parasite can usually be detected in thin strip blood smears stained with the Jamesa stain. The thick swabs increase the chance of spotting the parasite, but it becomes difficult to distinguish the details characteristic of the parasite's shape. In cases of BabesiaOffice that are characterized by a low percentage of infected cells swimming in the blood, it is necessary to take brain biopsies to maximize the opportunity to detect the parasite and diagnose the infection.In chronic cases following an acute infection, where the parasite is hidden or present in very small numbers, the diagnosis usually depends on monitoring the parasite's antibodies through various serological tests.

Serological tests

that are used to confirm the diagnosis or for more details about the diagnosis include: The indirect fluorescent test (IFAT), which will detect antibodies to both Babesia bovis and Babizia .bjimna (as well as to Thyleria bovilli, Babesia or Thyleria Equi)
The ELISA test will detect the antibodies of Babesia bovis and Babesia bijimna (in addition to Enaplasma centrally). The ELISA test for Babesia bovis is considered a screening diagnostic test in the case of large numbers of samples, and it is an indirect test (in which a raw Papizia bovis antigen is used over which the precise titration dishes are covered). Microtitre plates are used for fine titration DNA probes that are able to detect the least presence of the parasite, as is .the case in cases carrying carrier animals. They have been used, but have not yet entered into Swabs from hemolymph as well as eggs from eggs of ticks, egg smears, may be used to detect general infection with ticks Experimental transmission of infection testing for use infectious animals, especially in heifers, with splenectomy, is considered a useful procedure and is used to confirm infection in chronic cases (and infectious cases) that are difficult to diagnose as the symptoms are opaque in the absence of hemoglobin urine and a low percentage of infected red blood cells. This procedure is done by injecting about 500 ml of the suspected animal's blood and then monitoring it for signs of infection Clinical tests of the blood will reveal a significant decrease in the number of red blood cells, as well as a decrease in the volume of packed cells, a decrease in the concentration of hemoglobin, as well as an increase in the bleeding time and an increase in the rate of erythrocyte sedimentation. https://veterinarysci.blogspot.com/2011/10/babesiosis.html

2_3_10_ Treatment of the camels

Symptomatic treatment as antipyretic agent and broad-spectrum antibiotic to reduce secondary bacterial infection, Using an effective drug to treat babesiosis is as using
Quinuronium sulfate (1 ml / 50 kg b.w _s / c)
.Diminazene aceturate is given I / m at 3-5 mg / kg b.w
Acaprin, babesan, piroparv, piroplasmin given s / c at 1ml / 50 kg b.w. with maximum dose of 6 ml, Imizol given I / m at 2mg / kg b.w
https://veterinarysci.blogspot.com/2011/10/babesiosis.html
Administration of antipyretics such as Metalgin or Novalgex at a dose of 50 cm intravenously
It is preferable to give iron compounds with vitamin **B12** after the animal is cured to treat
/https://www.facebook.com/693977414137689/posts/1511929845675771

2_3_11_ Control and prevention

Control of ticks using insecticides, vaccination of susceptible flocks, and prevention with chemoprophylaxis. In addition to treating sick cases and controlling the movement of tick-bearing flocks and infection, tick-resistant strains can also be selected for breeding. One or more of the previous procedures may be used depending on the epidemiological situation of the area commonly used acaricides for controlling ticks include Chlorinated hydrocarbons, Carbamates, Organophosphates, Natural and Synthetic Pyrethrins, as well as injection drugs such as Avermectins. Tick pesticides are often used by immersion or spraying, although dipping is the most effective. Recently, in the past few years, other methods of using acaricides have been used, such as pour-ons, where the pesticide is poured on the animal's back and is absorbed or applied to a limited spot on its back, "spot-ons", where the drug is absorbed through it.
https://veterinarysci.blogspot.com/2011/10/babesiosis.html

Chapter three

Conclusions

1_ Babesia spp can be infected camels in all age.
2_ Trypanosoma spp Infection with virulence abounds during the spring and summer, when there are more flies that transmit the disease.
3_ Trypanosoma spp which spread in wet areas, and the disease spreads in the rainy seasons, especially with the beginning of March, when the vector flies increase and multiply.

Recommendations

1_ Following the scientific methods that would develop the Production of livestock to raise the economic level of the country Through the production of vaccines and the use of Preventive Treatments to prevent the spread of these diseases.
2_ Should be use control program for eradicate of tick because it is the primary Vector to prevalence and transmission of disease, the prevent by use Effectiveness insecticides.
3_ Blood parasites can infect camels in both sex .
4_ Recommending work on studies to manufacture or develop vaccines to treat blood parasites.

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