https://www.mediresonline.org/

ISSN: 2836-3604

Open Access

Covid Research and Treatment

Research Article

Review On Bovine Babesiosis And Its Current Status In Ethiopia

Tizazu Assefa[1]*, Hirut Getnet[1], Mesay Tesfaye Sitote[1]

[1]Department of Veterinary Medicine, College of agricultural sciences, Woldia University, Woldia-1230, Ethiopia

***Corresponding Author:** Tizazu Assefa, Department of Veterinary Medicine, College of agricultural sciences, Woldia University, Woldia-1230, Ethiopia

Received Date: 20 June 2026; **Accepted Date:** 21 July 2026; **Published Date:** 03 August 2026

Abstract

Bovine babesiosis, also known as red water or tick fever, is the most common arthropod-borne disease affecting cattle globally, resulting in high rates of morbidity and mortality. It affects many different domestic and wild animals as well as humans on occasion. It is brought on by intra-erythrocytic protozoan parasites of the genus Babesia, which are spread by ticks. Two important Babesia species: B. bigemina and B. bovis infect cattle. They are wide spread in tropical and subtropical areas including Ethiopia and are vectored by one host tick Rhipicephalus species and transmission is manly transovarially. Babesia produces acute disease by hemolysis and circulatory disturbance mechanism. Babesia species normally finish their life cycle in three phases, Gamogony, Sporogony, and Merogony. Microscopic examination is still cheapest and fastest method used to identify Babesia parasites. But not reliable for detection of carrier animals. In these cases molecular detection methods, or serological diagnostic procedures to demonstrate specific antibodies, are required. Although some species of Babesia such as Microti can affect healthy people, cattle parasites seem to cause disease only in people who are immune-compromised. Imidocarb is the drug of choice for bovine babesiosis. Babesiosis is one of the most important diseases in Ethiopia because it occurs sometimes in acute forms with serious recognized clinical manifestations yet lowering the productive performance of the affected animals. So Active prevention and control of Babesiosis is achieved by immunization, chemoprophylaxis and vector control.

Keywords: Babesia, Bovine babesiosis, Ethiopia, Imidocarb, Rhipicephalus.

Introduction

Ethiopia has the largest number of livestock in Africa. The livestock sector has played a significant role in the country's economy and continues to show potential in supporting its economic growth [1] . The country has approximately 65 million cattle, 40 million sheep, 51 million goats, 8 million camels, and 49 million [2]. Despite having the largest number of livestock in Africa, the economic contribution of the country is still minimal due to disease, poor husbandry practices, poor genetic makeup, malnutrition, harsh environments, and lack of market infra-structure [3, 4].

Animal diseases have a major detrimental effect on the health and productivity of animals [5]. Protozoal infection are strongly linked to the presence and dispersion of their vectors. In tropical and subtropical regions of the world, including Ethiopia, these infectious blood parasites are economically significant vector-borne infections [6]. Babesiosis is the most common tick-borne disease of mammals next to trypanosome and it causes morbidity and mortality in [7, 8]. Babesiosis primarily affects cattle and buffalo, but it can also affect horses, sheep, goats, dogs, pigs, wild animals, and even humans [5].

Bovine babesiosis is also known as red water disease, Texas fever, Cattle tick fever and Piroplasmosis [9]. Bovine babesiosis is disease in cattle caused by a protozoan parasite called Babesia, which is transmitted by ticks [10]. This disease can lead to serious illness and death in affected animals. The primary Babesia species that impact cattle include B. bigemina, B. bovis, B. divergens, and B. major. The impact of two species, B. bigemina and B. bovis, on the health and productivity of cattle is significant in tropical and subtropical countries B. bovis infections are characterized by excessive fever, ataxia, anorexia, time-honored circulatory shock, and once in a while also nervous symptoms as a result of sequestration of infected erythrocytes in cerebral capillaries. This disease causes anemia and hemoglobinuria especially in the later stage of the disease [4].

Animals that have been infected with Babesia develop stronger immunity against reinfection with the same species for the rest of their lives [11]. Animals that are previously immune to B. bigemina also show some level of protection against B. bovis infections [12]. In Ethiopia, there has been a lack of focus on livestock diseases, specifically bovine babesiosis, even though it has a significant impact on cattle and other animals [13]. Bovine babesiosis is a significant disease in the country as it can manifest in severe acute forms with noticeable clinical symptoms, impacting the productivity of the affected animals [3]. Bovine babesiosis is typically considered as one of the major diseases that significantly impede cattle production in Ethiopia [13]. The disease is common throughout the country, but there is a shortage of well documented information. Understanding of this circumstance motivated the review author. The objective of this paper is therefore to review Bovine babesiosis, with a focus on the current status of the disease in Ethiopia.

2. Bovine Babesiosis and Babesiosis and its Current Status in Ethiopia

1. Etiology and Taxonomy

Babesiosis is a tick-borne parasitic disease caused by genus the B. bovis, B.bigemina and B. divergens. Other Babesia parasites that can infect cattle include B. major, B. ovate, B. oculatus, and B. Jakimovi [14, 5]. Taxonomically, Babesia belongs to protozoan parasites of the genus Babesia, order Piroplasmida, subphylum Apicomplexa (figure 1), commonly referred to as 'piroplasmas' due to the pear-like shaped merozoites which live as small parasites inside Red Blood Cell of mammals [12-5].

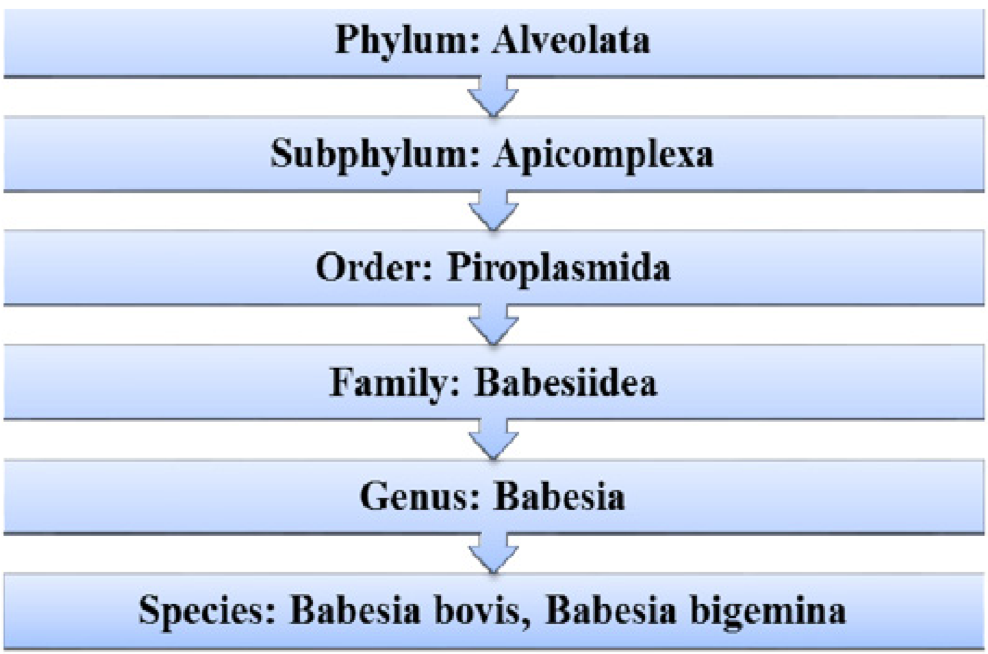

Figure 1: Taxonomy of the genus Babesia. Adopted from Pohl, 2013.

2. Morphological Features of the Organism

The parasite's morphology is usually pyriform, although it can also take the form of a tetrad, round, rod-shaped, elongated and cigar shaped organism. Babesia is unique in that it has tetrad morphology, which is visible with giemsa staining of thin blood smear and serves as a distinguishing factor from Plasmodium falciparum, a similar-morphology protozoan that causes malaria [15]. The different morphological forms of bovine babesiosis are shown in Figure 2. Adopted from [16].

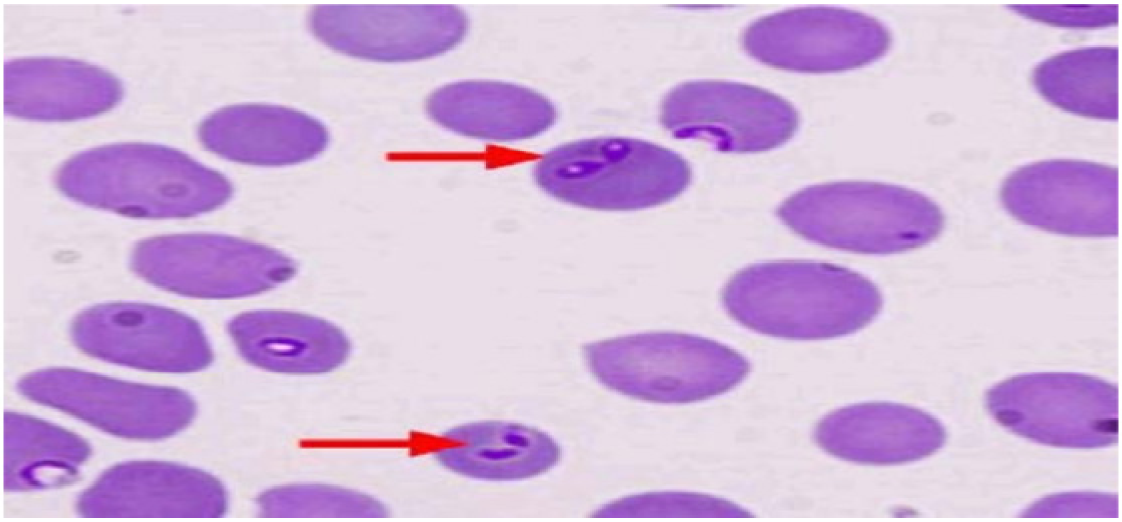

Figure 2: Morphology of bovine babesiosis.

3. Life Cycle and Development of Babesia

The life cycle of all Babesia species is roughly identical, although there is a little variation since transovarial transmission occurs in certain species but not in others (Babesia microti) [17]. Babesia species normally finish their life cycle in three phases, Gamogony (the fusion, and synthesis of gametes in the tick gut), Sporogony (asexual reproduction in the salivary glands), and Merogony (asexual reproduction in vertebrates) [17].

Feeding ticks infect cattle by inoculating sporozoites, which penetrate erythrocytes, and change into trophozoites, which divide by binary fission (merogony). The erythrocyte membrane degrades, and the merozoites liberated penetrate new cells, resulting in an intra-erythrocytic cycle. After a tick blood meal, gametocytes form in the tick gut, and unite to generate diploid zygotes. Zygotes infiltrate digestive cells, and perhaps basophilic cells, where they undergo several rounds of multiplication until emerging as haploid kinetic. Kinetics moves to a variety of organs, including the ovaries, where they divide further. After the egg hatches, the kinetics travel to the salivary gland, where they change into multi-nucleated stages (sporogony), which subsequently generate sporozoites The life cycle of Babesia bovis is illustrated in Figure [18].

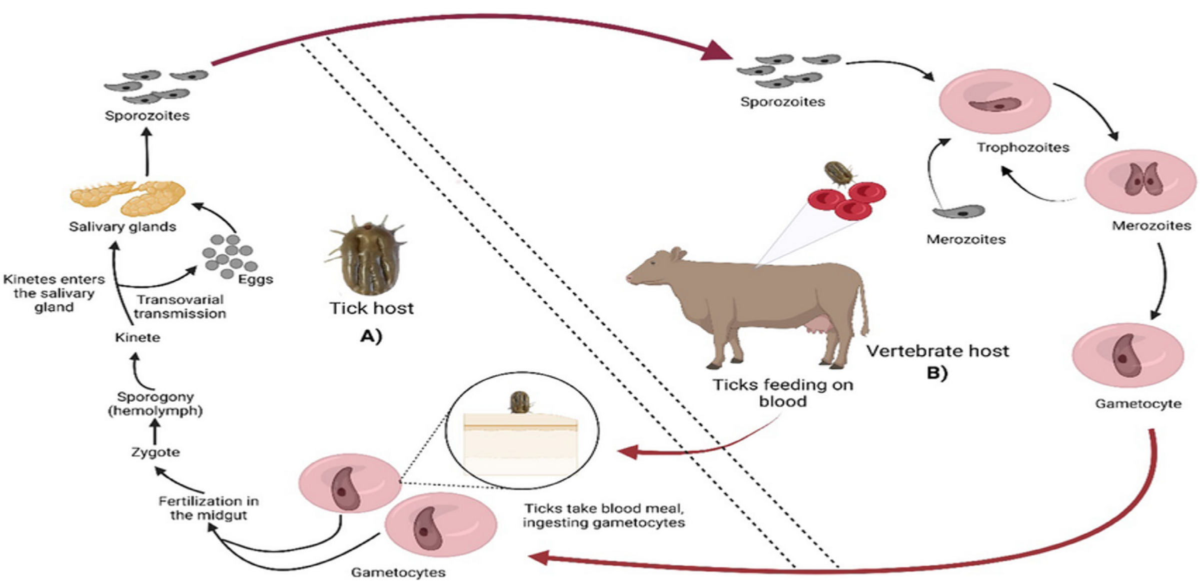

Figure 3: Life cycle of Babesia bovis. Adopted from [19].

A. The sexual cycle takes place in the tick host.
B. The asexual cycle occurs in the mammalian (vertebrate) host.

4. Epidemiology

1. Geographical distribution

B. bovis and B. bigemina are found in most parts of the world, with the greatest prevalence between 32°N, and 30°S, where their Boophilus tick vector is prevalent (Pohl, 2013). They are especially significant in Asia, Africa, Central, and South America, as well as regions of southern Europe, and Australia. Although B.bovis is normally found in the same broad geographic region as B. bigemina, these two species are dispersed by slightly distinct groups of ticks, and there are some variances in their distribution. In Africa, for example, B. bigemina is more common than B. Bovis due to the potential of B.decoloratus, and B.evertsi to function as vectors for this species [20-21]. The geographical distribution of the major bovine Babesia species is summarized in Table 1.

Babesia species	Animals affected	Geographical distribution
Babesia bigemina	Cattle Zebu, Water buffalo, Deer, Wild ruminants	Central and South America, Australia, Africa Southern Europe, China
Babesia bovis	Cattle, deer, Water buffalo, wild ruminants	Southern Europe, Asia Africa, America, Australia
Babesia diverges	Cattle	Northern Europe
Babesia major	Cattle	West and South Europe, Africa, China

Table 1: Geographical distribution of Bovine babesia, Source: [22].

2. Host range

There are around 100 known species of Babesia that infect many types of mammalian host, out of them, 18 species are known to infect domestic animals. Bovines, sheep, goats, horses, pigs, dogs, cats, and infrequently humans are susceptible to Babesiosis [23]. B. bovis and B. bigemina are found in cattle, which are the main reservoir hosts. They also affect water buffalo and African buffalo. Recently discovered in white-tailed deer in Mexico [24]. More susceptible breeds include European, Sanga, and Zebu, and all develop latent infections after recovery [3].

3. Risk factors associated with babesia infections

Host factors: Age, breed, stress, indoor and outdoor keeping and immune status are the major host factors of Bovine babesiosis disease [11]. Bos indicus breeds of cattle are more resistance to Babesiosis than Bos Taurus [25]. In endemic area two features are important in determining the risk of clinical disease; calves have a degree of immunity related both the colostrums derived antibodies and age that persists for 6 months and animals that recover from babesia infection are generally immune for life [26-27-15].

Pathogen Factor:

The pathogenicity of strains varies greatly. Generally speaking, B.bovis is more pathogenic than B. bigemina and B. divergens [24]. Rapid antigenic change allows many intra erythrocyte hemo parasites to evade the host immune system; this is the case with B. bovis and B. bigemina [11].

Environmental Factor:

Seasonal variation, which is also influenced by the peak tick population, can affect the prevalence of clinical babesiosis. The highest prevalence is observed right after the tick population peaks. When it comes to weather conditions, temperature has the biggest impact on tick activity. A rise in temperature has been linked to an increase in disease cases [28]. Summer time is the peak time for cattle infections [29, 30]. Because of tick populations are mostly fluctuating and dependent on environmental factors, places with marginal disease occurrence tend to suffer from the greatest economic lossest [27].

4. Transmissions

Hard ticks are primarily responsible for the transmission of bovine babesiosis. Rhipicephalus microplus (Boophilus microplus) and Rhipicephalus annulatus (Boophilus annulatus) are the tick vectors of Babesia bigemina and Babesia bovis. B. bigemina is spread through the feeding of adult and nymphal stages of Rhipicephalus species ticks on a single host. Ticks that feed on the larval stages of single-host Rhipicephalus species carry B. Bovis. All three stages of I. ricinus can transmit B. divergens [24, 31]. Ticks pick up parasites from the blood of cattle that are infected and become infected themselves, in an infected tick, the babesia parasite develops and spreads throughout the tick's organs, eventually invading the salivary glands or eggs [31, 13]. Babesia species are readily passed to the next generation of ticks passed transovarially, via the egg, although this varies with the species of Babesia and the species of tick [20]. Babesia species can also spread by direct blood inoculation, biting flies, and fomites contaminated by infected blood. Even if this route of transmission is believed to be of minor significance [24].

5. Pathogenesis and Clinical Signs

Babesia produces acute disease by two principal mechanisms; hemolysis, and circulatory disturbance. During the tick bite, sporozoites are injected into the Babesia sporozoites, and develop into piroplasms inside the infected erythrocyte resulting in two or sometimes four daughter cells that leave the host cell to infect other erythrocytes [32]. It invades the erythrocyte, and causes intravascular and extravascular hemolysis. The rapidly proliferating parasites in the red cells cause erythrocyte destruction, which is accompanied by haemoglobinaemia, hemoglobinuria, and fever. This might be severe enough to cause death within a few days if the packed cell volume goes below 20%, resulting in anemia. Depending on the type of Babesia, the parasitemia, which is generally visible until the clinical indications develop, may include 0.2% to 45% of the red cells [27].

The basic cause is intravascular hemolysis (resulting in anemia, hypoxia, and secondary inflammatory diseases in many organs, including the liver, and kidneys). Electrolyte imbalances complement activation, coagulation abnormalities, and the release of pharmacologically active chemicals all contribute to vascular dysfunction, and hypotensive shock [26]. The clinical indicators differ depending on the animal's age, species, and parasite strain. The majority of babesiosis infections are found in adults; animals less than nine months are generally asymptomatic [13]. The primary complications of the condition include anemia from hemolysis, methemoglobinemia, hemoglobinuria, and icterus. Affected animals had a significant increase in body temperature (fever), lack of appetite, cessation of rumination, laborious breathing, emaciation, and progressive hemolytic anemia [33, 34]. The clinical sign of babesiosis is coffee-colored urine [35]. Gross lesions produced by Babesia spp. in cattle include enlargement of spleen and liver, distention of the gall bladder, congestion and dark-colored kidneys, anemia, jaundice, general congestion, petechial hemorrhages, edema in the lungs; and pink coloration of the gray matter of the brain [25].

6. Diagnosis

Identification of the agent

Direct microscopic examination- It is still cheapest and fastest methods used to identify Babesia parasites [27]. There are thin and thick blood smear and those smears are done by giemsa stained smears of capillary blood. Thick blood smears are 10x more sensitive and are more reliable for the detection of low level B. bovis infection, Species differentiation is good in thin films [13]. This technique is usually adequate for detection of acute infections but not for detection of carriers where the parasitaemias are mostly very low [10]. In vitro culture methods- used to demonstrate presence of carrier infections of Babesia species. B. bovis has also been cloned in culture. Minimum parasitaemia detectable by this method depends on the facilities available and the skills of the operator [10, 13].

Serological tests

Serological tests including indirect fluorescent antibody test (IFAT) and enzyme linked Immuno-sorbent assays (ELISA) are capable of detecting antibodies of Babesia in sub-clinical infections [36]. Drawbacks of these tests are the occurrence of false-positive and false-negative results involving cross-reactive antibodies and/or typical specific immune responses [36]. IFAT is also the most widely used test for the detection of antibodies to B. bovis and B. bigemina [37].

Molecular diagnosis

Molecular methods aimed to detect nucleic acids have been very useful when immunological methods do not work. Polymerase chain reaction (PCR) assays can detect and differentiate Babesia species, and are particularly useful in carriers [24]. PCR is more sensitive and specific technique and it allows identification of the parasite in the early stage of disease which enables early diagnosis, implementation of therapy and avoidance of complications [38]. Detecting nucleic acids is an indirect way of detecting the parasite so they are still considered indirect methods [37].

Differential diagnosis

Babesiosis resembles other conditions that cause fever and hemolytic anemia. The differential diagnosis includes: Anaplasmosis haemoglobinuria is not seen in uncomplicated A. marginale infections and the color of urine is often brown due to the presence of bile pigments, respiratory distress particularly after exercise and rapid deterioration of the physical condition. Trypanosomiasis: erection of hair adenopathy. Theileriosis: superficial lymph node greatly swollen, painful and hot during palpation and urine is straw yellow color. The others are bacillary hemoglobinuria, leptospirosis, rapeseed poisoning, chronic copper poisoning [16]. Rabies and other encephalitis's can also be considered in cattle with CNS signs [39].

7. Public Health and Economic Significance of Bovine Babesiosis

Public health significance

Human babesiosis was first described in 1957 but is now known to have worldwide distribution, it is caused by different babesia spp. that have distinct geographic distribution based on the presence of competent host. Persons who have frequent contact with animal are highly prone to the disease (Menegesha, 2020; Yadhav et al., 2015). B. divergens and B. microti are the most known zoonotic bovine babesia parasites. Babesia divergens is the primary cause of human babesiosis in Europe resulting in fatality rates of 42% among persons who have been spleenoectomized and 5% among those with intact spleen [40]. It is characterized by the acute onset of severe hemolysis, hemoglobinuria, jaundice, persistent high fever, chills and sweats, headache, myalgia, lumbar and abdominal pain, and sometimes vomiting and diarrhea. Immuno compromised people should exercise caution when visiting areas where babesiosis is endemic, particularly during the tick season, to avoid contracting B. divergens. By using tick repellents and wearing appropriate clothing, one can avoid coming into contact with ticks. After spending time outside, one should check their skin and clothing for ticks and remove any that are discovered [20].

Economic significance

Bovine Babesiosis causes most serious economic loss to the livestock industry, endangering half a billion cattle across the world [41]. Babesiosis, especially in cattle has great economic importance, because unlike many other parasitic diseases, it affects adults more severely than young cattle, leading to direct losses through death and restriction of movement of cattle for trade by quarantine laws. Many animals die or undergo a long period of covalence entailing, loss of meat and milk, treatment and control costs [17-11]. The disease is also a barrier to improving productivity of local cattle by cross-breeding due to the high mortality of genetically superior [11].

8. Treatment

Treatment of babesoisis is most likely to be successful if the disease is diagnosed early; it may fail if the animal has been weakened by anemia [24]. Imidocarb are the drug of choice for bovine babesiosis, which can prevent clinical infection up to 2 months and also Diminazene aceturate (3.5 mg/kg B.wt deep I/M) which is widely used currently in the tropics as a Babesiacide [27-17-35].In addition, supportive therapy such as blood transfusions, anti-inflammatory drugs, tick removal, iron preparations, dextrose, vitamins (B complex), purgatives and fluid replacements, is necessary in severe cases of babesiosis (Bezu, 2020). Human babesiosis can be treated with anti-malarial drugs such as chloroquine, quinine. A mild infection was resolved after the use of pentamidine and cotrimoxazole [13-24-15].

9. Prevention and Control

A crucial component of controlling babesiosis is epidemiological surveillance. Immunization, chemoprophylaxis, and vector control are the three main strategies used to actively prevent and control babesiosis [42]. Major strategies for controlling vectors include the use of acaricides, controlled range burning, cultivation, long pasture rests, the use of repellents, stock movement control, and raising tick-resistant cattle. Chlorinated hydrocarbons, carbamates, organophosphate, natural and synthetic pyrethrins, and avermectin (spray or dips) are common acaricides [43].

Parasite control measures include immunization of susceptible stocks, chemo prophylaxis treatment of infected animals (primarily with imidocarb), and vaccination, or a combination of these are used in endemic regions [44]. In non-endemic areas vaccination is crucial to control babesiosis. Tick control through acaricidal treatment of the host, chemotherapy of the infected host, test and slaughter of infected animals, and quarantine of infected animals are the general strategies used to control tick-borne babesiosis [15-35-11].

10. Status of Bovine Babesiosis in Ethiopia

Ethiopia is rife with tick-borne illnesses and the vectors that carry them. Numerous factors, including growth rate, milk production, fertility, hide value, and mortality, have an impact on production [13]. Babesiosis is one of the most significant illnesses in Ethiopia since it can occasionally manifest acutely with severe clinical symptoms that reduce the productive capacity of the afflicted animals [45]. The prevalence of bovine babesiosis in various regions of Ethiopia has been reported by various researchers (table 2).

A study carried out in the Lay Armachiho districts in the central Gondar administrative zone of northwest Ethiopia found that the overall prevalence of bovine babesiosis is 5.73%, with 2% being B. bovis and 3.73% being Babesia bigemina [46]. According to the study conducted in the Western Ethiopian Benishangul Gumuz Regional State, in Assosa zone the overall prevalence was 1.5%, of which B. bovis and B. bigemina were found to be 1.24% and 0.248%, respectively. Additionally, the analyzed research showed that the autumn season had the greatest prevalence (2.99%), with the winter season having the lowest prevalence (0.88%) [47]. Another research works in western Ethiopia around east Welega zone indicates the prevalence of Bovine babesia is 5.2% [48].

Furthermore another study conducted in and around Jimma town, South-West Ethiopia, reported that, the overall prevalence rate of B. babesiosis was 23%; of these, 8% were B.bovis and 15% were B. bigemina [8]. Additionally, B. bigemina and B.bovis were found to have equal prevalence (0.3) in the study conducted in Bishoftu, Central Ethiopia, which reported a total prevalence of 0.6% [49].

Another study from Southern Ethiopia in Teltele District, Borena Zone, indicated the overall prevalence of 16.9% out of which two species of Babesia comprising of B. bovis (9.9%) and B .bigemina (7%) [12]. A more recent study from Southern Ethiopia's Dasenech and Salamago Districts, in the South Omo Zone, upon microscopic examination, revealed an overall prevalence of 21.7%, of which two species of Babesia were found: B. bovis (6.17%) and B. bigemina (15.53%) [4]. The prevalence of bovine babesiosis reported from different regions of Ethiopia is summarized and presented in Table 2.

Area	Diagnostic methods	Prevalence	References
North west Ethiopia	Microscopic examination	5.73%	(Desalegn et al.,2024)
Western Ethiopia Assosa zone	Microscopic examination	1.5%	(Wodajnew et al., 2015)
East welega zone		5.2%	(Namomsa et al., 2023)
Central Ethiopia	Microscopic examination	0.6%	(Sitotaw et al., 2014)
South western Ethiopia	Microscopic examination	23%	(Lemma et al.,2015)
South Ethiopia South omo zon	Microscopic examination	21.7%	(Haben et al., 2022)
Borena zone		16.9%	(Hamsho et al., 2015)

Table 2: prevalence of bovine babesiosis from different area of Ethiopia

The highest prevalence (23%) of B. babesiosis was reported in and around Jimma town, south west Ethiopia compared to other studies [8] and the lowest prevalence (0.6%) was reported from Central Ethiopia, Bishoftu [49].

3. Conclusion and Recomandations

Bovine babesiosis is the most important tick-borne disease of cattle worldwide that causes major economic losses, morbidity and mortality. It impair the export and import trade of live animal and animal products (Meat, milk, hide and skin) by down grading their quality and fear of the co-traders. The most prevalent species, B. bovis and B. bigemina, are found throughout most tropical and subtropical regions including Ethiopia. All Babesia are transmitted by ticks with a limited host range. The principal vectors of B. bovis and B.bigemina are Rhipicephalus species. Calves are virtually resistant to the Babesia. B.bovis causes more severe clinical signs as compared to B. bigemina. B. babesiosis causes most serious economic loss to the livestock industry, endangering half a billion cattle across the world. The disease is obstacle to improving productivity of local cattle by crossbreeding due to the high mortality of genetically superior but highly susceptible cattle. Introduction of effective prophylactic treatment and vaccination could enables for decline of the disease. There are different control strategies which vary from region to region as well as from area to area include tick control, vaccines (Against ticks and parasites) and drugs. Babesiosis is one of the most important diseases in Ethiopia because it occurs sometimes in acute forms with serious recognized clinical manifestations yet lowering the productive performance of the affected animals [45]. Currently bovine babesiosis is widespread in Ethiopia with most prevalent species being B. bovis and B. bigemina.

Therefore based on the above conclusion the following recommendations are forwarded:

- Veterinarians, private and government sectors should create awareness for stakeholders about the disease characteristics and management strategies for their animals and themselves as well.
- Ethiopia should develop and implement surveillance systems and action plans to control and prevent the spread of Bovine babesiosis.
- The concerned sectors and organizations should give special attention for the control and prevention of babesiosis in Ethiopia and minimize the vast economic losses.
- To avoid resistance and environmental contamination, environmentally friend control mechanisms should be used in the control mechanisms of babesiosis.

Competing Interests

I declare that they have no competing interests.

Data Availability Statement

No new data were created or analyzed in this study. Data sharing is not applicable to this article as no datasets were generated or analyzed during the current study.

4. References

1. Leta, Samson, and Frehiwot Mesele. "Spatial analysis of cattle and shoat population in Ethiopia: growth trend, distribution and market access." SpringerPlus 3, no. 1 (2014): 310.

2. CSA (2020a): Agricultural Sample Survey report on livestock and livestock characteristics (private peasant holdings). Addis Ababa, Ethiopia, 2.
3. Nejash, Abdela. "Review of important cattle tick and its control in Ethiopia." Open Access Library Journal 3, no. 03 (2016): 1.
4. Gebremeskel, Haben Fesseha, Mesfin Mathewos Abose, Eyob Eshetu Bekele, and Bereket Tefera Chido. "Bovine Babesiosis and Distribution of ixodid ticks in Dasenech and Salamago District, Southern Ethiopia." (2021).
5. Azhar, Muhammad, Javaid Ali Gadahi, Bachal Bhutto, Sambreena Tunio, Waseem Ali Vistro, Haleema Tunio, Sahar Bhutto, and Teerath Ram. "Babesiosis: current status and future perspectives in Pakistan and chemotherapy used in livestock and pet animals." Heliyon 9, no. 6 (2023).
6. Kumsa, Bersissa, Yonas Abiy, and Fufa Abunna. "Ectoparasites infesting dogs and cats in Bishoftu, central Oromia, Ethiopia." Veterinary Parasitology: Regional Studies and Reports 15 (2019): 100263.
7. Yabsley, Michael J., and Barbara C. Shock. "Natural history of zoonotic Babesia: role of wildlife reservoirs." International Journal for Parasitology: Parasites and Wildlife 2 (2013): 18-31.
8. Lemma, Fethu, Adugna Girma, and Dirsha Demam. "Prevalence of bovine babesiosis in and around Jimma Town south western Ethiopia." *Advances in biological research* 9 (2016): 338-439.
9. Sahinduran, Sima. "Protozoan diseases in farm ruminants." A Bird's-Eye View of Veterinary Medicine (2012).
10. Wodaje, Ahmed, Biyansa Adudna, and Muhammed Hamid. "A review on bovine babesiosis." *Int. J. Adv. Res. Biol. Sci* 6, no. 1 (2019): 63-70.
11. Abdullah, S. H. (2024): Bovine babesiosis: the role of vaccination in cattle protection. Unique Scientific Publishers, Faisalabad, Pakistan, Pp: 194-203.
12. Hamsho, A., Tesfamarym, G., Megersa, G and M, Megersa. (2015): A Cross sectional study parasitic protozoa. Academic Press, babesiosis in Teltele District, Borena Southern San Diego, *Calif. Ethiopia. Journal of Veterinary Science & Technology,* 6: 230.
13. Bezu, B. W. (2020): Review on Occurrence Bovine babesiosis in Ethiopia; Gedeo Zone Dilla Town Agricultural Office, SNNPR, Dilla, Ethiopia. Advanced Research in Biological Sciences, 7(11): pp54-6.
14. Siddique, Rao Muhammad, Muhammad Sohail Sajid, Zafar Iqbal, and Muhammad Saqib. "Association of different risk factors with the prevalence of babesiosis in cattle and buffalos." Pakistan Journal of Agricultural Sciences 57, no. 2 (2020).
15. Menegesha, A. (2020): Review on Bovine Babesiosis. Gondar, Ethiopia. Veterinary medicine and animal sciences, 3(1):1028.
16. Gashaw, E., Demeke, D., Endris, A., Birhanu, E. and Samuel, A. (2018): Review on Bovine Babesiosis. Acta Parasitologica Globalis 9 (1): 15-26.
17. Faryal Saad, Faryal Saad, Kalimullah Khan Kalimullah Khan, Shandana Ali Shandana Ali, and Noor Ul Akbar Noor Ul Akbar. "Zoonotic significance and prophylactic measure against babesiosis." (2015): 938-953.
18. Jalovecka, Marie, Ondrej Hajdusek, Daniel Sojka, Petr Kopacek, and Laurence Malandrin. "The complexity of piroplasms life cycles." Frontiers in cellular and infection microbiology 8 (2018): 248.
19. Santos, John Harvey M., Hannah V. Siddle, Ali Raza, Danielle I. Stanisic, Michael F. Good, and Ala E. Tabor. "Exploring the landscape of Babesia bovis vaccines: progress, challenges, and opportunities." Parasites & Vectors 16, no. 1 (2023): 274.
20. Spickler, A. R., Roth, J.A., Dvorak, G. (2010): Emerging and exotic diseases of animals, 4th ed. CFSPH Iowa State University, Iowa USA. Pp: 102-105.
21. Pohl, Anna Elisabeth. "Epidemiology study of tick-borne diseases in cattle in Minas Gerais, Brazil." PhD diss., lmu, 2013.
22. AU-IBAR, (2013): [Available at http//www.auibar.org/babesiosis, viewed at June, 23, 2024].
23. Chaudhry, Zafar Iqbal, M. Suleman, M. Younus, and A. Aslim. "Molecular detection of Babesia bigemina and Babesia bovis in crossbred carrier cattle through PCR." Pakistan Journal of Zoology 42, no. 2 (2010).
24. CFSPH., (2008): Center for Food Security and Public Health (Bovine babesiosis, Iowa state university, Ames, Iowa.
25. Attia, Marwa M., and Marwa M. Khalifa. "Virulence of Babesia bigemina in infected cattle (Bos taurus): molecular and immunological studies." Research in Veterinary Science 156 (2023): 7-13.
26. Dominguez, Mariana, Ignacio Echaide, Susana Torioni de Echaide, Silvina Wilkowsky, Osvaldo Zabal, Juan J. Mosqueda, Leonhard Schnittger, and Monica Florin-Christensen. "Validation and field evaluation of a competitive enzyme-linked immunosorbent assay for diagnosis of Babesia bovis infections in Argentina." Clinical and Vaccine Immunology 19, no. 6 (2012): 924-928.
27. Demessie, Yitayew, and Samuel Derso. "Tick borne hemoparasitic diseases of ruminants: A review." Advances in Biological Research 9, no. 4 (2015): 210-224.
28. Menshawy, Soad M., Eman K. Bazh, and Abdelrahman A. Abou-Rawash. "Dynamics of Boophilus Ticks and its Role in Transmission of Piroplasms at Behaira District." Alexandria Journal of Veterinary Sciences 56, no. 1 (2018): 137.
29. Mohamed, G., and M. Ebied. "Epidemiological studies on bovine babesiosis and theileriosis in Qalubia governorate." BVMJ 27 (2014): 36-48.
30. El-Bahy, Nasr M., Soad M. Menshawy, Wael M. Goda, Sherif M. Nasr, Mahmoud R. AbouLaila, Eman K. Bazh, and Abdelrahman A. Abou-Rwash. "Molecular detection of Babesia bigemina and Babesia bovis in cattle in Behaira Governorate." Ejpmr 5, no. 12 (2018): 441-446.

31. Yadhav, C. P., Chandana,M,V., Sailalithkumar Y, N., Sujitha,M., Lavanya,C.h. and Madhavilatha, C. h. (2015): An overview of Babesiosis. *International journal of pharmaceutical sciences research*, 3(1): 287-295.
32. Elsworth, Brendan, and Manoj T. Duraisingh. “A framework for signaling throughout the life cycle of Babesia species.” Molecular microbiology 115, no. 5 (2021): 882-890.
33. Alvarez, J. Antonio, Carmen Rojas, and Julio V. Figueroa. “Diagnostic tools for the identification of Babesia sp. in persistently infected cattle.” Pathogens 8, no. 3 (2019): 143.
34. Almazán, Consuelo, Ruth C. Scimeca, Mason V. Reichard, and Juan Mosqueda. “Babesiosis and theileriosis in North America.” Pathogens 11, no. 2 (2022): 168.
35. Mohanambal, K., Sumathi, D., Elavarasan, M., Ravi, R., Sivaraman, S. and Ponnu Swamy, K. K. (2024): Babesiosis in Cattle: Management and Control Srategies. Tamil Nadu Veterinary and Animal Sciences, 18: 04.
36. Esmaeil, N., Tavassoli, M., Asri-Rezaei, S., DalirNaghadeh, B., Mardan, D. (2015): Determination of prevalence and risk factors of infection with babesiaovis in small ruminants from west Azerbaijan province, Iran by Polymerase chain reaction. J. Arthropod-Borne Disease, 9: 246-252.
37. Mosqueda, Juan, Andrea Olvera-Ramírez, Gabriela Aguilar-Tipacamu, and G. J Canto. “Current advances in detection and treatment of babesiosis.” *Current medicinal chemistry* 19, no. 10 (2012): 1504-1518.
38. Orasmo, Gleice Ribeiro, and Mariluce Gonçalves Fonseca. “Molecular-Genetic Approaches to Protozoa and Their Pathogenicity.” In Microbial Genetics, pp. 345-363. CRC Press, 2024.
39. Ali, K. N., and H. Marif. “Babesiosis in cattle.” One Health Triad 3 (2023): 114-121.
40. Anke, H., Anke, H., Annetta, Z., Estrella, M., Klaus-Peter Hunfeld and Jeremy, G. (2021): *Human Babesiosis in Europe. MDPI.,* 10(9), 1165.
41. He, Lan, Reginaldo G. Bastos, Yali Sun, Guohua Hua, Guiquan Guan, Junlong Zhao, and Carlos E. Suarez. “Babesiosis as a potential threat for bovine production in China.” Parasites & vectors 14, no. 1 (2021): 460.
42. Yusuf, J. J. (2017): Review on Bovine babesiosis and its economic importance.Jimma, Ethiopia. Austin Journal of Veterinary Science & Animal Husbandry, 4(2): id1035.
43. Onoja, I. I., P. Malachy, W. P. Mshelia, S. O. Okaiyeto, S. Danbirni, and G. Kwanashie. “Prevalence of babesiosis in cattle and goats at Zaria Abattoir, Nigeria.” *Journal of Veterinary Advances* 3, no. 7 (2013): 211-214.
44. Khaluhi, Leonard Muchenditsi, Erick Ouma Mungube, James M. Wanjohi, and Sebastian K. Waruri. “Bovine Babesioses and Control.” In Combating and Controlling Nagana and Tick-Borne Diseases in Livestock, pp. 263-287. IGI Global Scientific Publishing, 2021.
45. Zahoor, A., R. Z. Abbas, A. Khurram, A. Aslam, A. Mateen, A. Aslam, S. B. H. Rizvi, G. Murtaza, S. Shahid, and S. A. Akbar. “Vector-borne zoonotic diseases.” Zoonosis, Unique Scientific Publishers, Faisalabad, Pakistan 2 (2023): 12-36.
46. Wodajnew, Bihonegn, Haimanot Disassa, Tadele Kabeta, Tilahun Zenebe, and Girma Kebede. “Study on the prevalence of bovine babesiosis and its associated risk factors in and around Assosa Woreda, Benishangul Gumuz regional state, western Ethiopia.” Researcher 7, no. 8 (2015): 33-39.
47. Wodajnew, Bihonegn, Haimanot Disassa, Tadele Kabeta, Tilahun Zenebe, and Girma Kebede. “Study on the prevalence of bovine babesiosis and its associated risk factors in and around Assosa Woreda, Benishangul Gumuz regional state, western Ethiopia.” Researcher 7, no. 8 (2015): 33-39.
48. Namomsa, Ishetu, Jiregna Gari, and Amare Eshetu. “Prevalence of Bovine Babesiosis in Selected District of East Wollega Zone, Western Ethiopia.” *Microbes, Infection and Chemotherapy* 3 (2023): e1856-e1856.
49. Sitotaw, Tirualem, Fikru Regassa, Fikre Zeru, and Abraha Gebregziabher Kahsay. “Epidemiological significance of major hemoparasites of ruminants in and around Debre-Zeit, Central Ethiopia.” *Journal of Parasitology and Vector Biology* 6, no. 2 (2014): 16-22.
50. Gray, Elizabeth B., and Barbara L. Herwaldt. “Babesiosis surveillance—united States, 2011–2015.” MMWR. Surveillance Summaries 68 (2019).
51. Mesele Abera, Mesele Abera, Tirazu Mohammed Tirazu Mohammed, Rahmeto Abebe Rahmeto Abebe, Kassaye Aragaw Kassaye Aragaw, and Jemere Bekele Jemere Bekele. “Survey of ixodid ticks in domestic ruminants in Bedelle district, Southwestern Ethiopia.” (2010): 1677-1683.

Citation: Tizazu Assefa Yiheys, Hirut Getnet Tegegn, Mesay Tesfaye Sitote, Review On Bovine Babesiosis And Its Current Status In Ethiopia, *COVID Res. Treat.* Vol 4, Iss 2. (2026). DOI: 10.58489/2836-3604/018