Annals of Arid Zone 64(4): 665-672, 2025

Therapeutic Assessment of Diminazene Aceturate and Imidocarb Dipropionate against Bovine Babesiosis

Patteda Dhanamjayan, Bhavanam Sudhakara Reddy[1]*, Bollam Shobhamani[1] and Sirigireddy Sivajothi[2]

[1]*Department of Veterinary Medicine, Sri Venkateswara Veterinary University, Tirupati, Andhra Pradesh 517 502, India*

[2]*Department of Veterinary Parasitology, Sri Venkateswara Veterinary University, Tirupati, Andhra Pradesh 517 502, India*

Received: September 26, 2025 Accepted: November 03, 2025

Abstract: The goal of the current study was to document the effectiveness of various antiparasitic medications in treating babesiosis in cattle from January 2023 and December 2024. Microscopic examination of stained blood smears revealed an overall prevalence of babesiosis was 21.87% (105/480), while the PCR, which targeted the 18s rRNA gene by creating an amplified product of 733 bp, revealed an overall prevalence of 38.54% (185/480). Thirty cattle with babesiosis were split into three groups and in each group ten cattle for the purpose of therapeutic evaluation. Cattle under Group 1 received injection of diminazene aceturate, under Group 2 received injection of imidocarb dipropionate, and under Group 3 received injections of both diminazene aceturate and imidocarb dipropionate in addition to comparable symptomatic and supportive therapy. On the first, third, seventh, and fourteenth days of treatment, post-therapeutic evaluations were conducted. When evaluating the clinical examination, hematological and biochemical analysis, no notable differences were observed in between the groups. However, a noteworthy distinction was observed in the decrease of parasitemia status both with-in the groups and in-between groups. Cattle under Group 3 which received both diminazene aceturate and imidocarb dipropionate, recovered earlier than cattle in other two groups which received single anti parasitic medication. Additionally, no recurrence was observed in cattle receiving combination therapy as opposed to those receiving either medication alone.

Key words: Babesia, cattle, treatment, diminazene aceturate, imidocarb dipropionate.

***Correspondence**
Bhavanam Sudhakara Reddy
bhavanamvet@gmail.com

Citation
Dhanamjayan, P., Reddy, B.S., Shobhamani, B. and Sivajothi, S. 2025. Therapeutic Assessment of Diminazene Aceturate and Imidocarb Dipropionate Against Bovine Babesiosis. Arid Zone 64(4): 665-662

https://doi.org/10.56093/aaz.v64i4.172091

https://epubs.icar.org.in/index.php/AAZ/article/view/172091

Babesiosis is a haemoprotozoan disease that is prevalent in tropical and subtropical regions, including India and is transmitted by vectors (Salih *et al.,* 2015). It is caused by an intra-erythrocytic protozoan parasite that infects many domestic and wild animals. Chemotherapy is used to treat bovine babesiosis, and several drugs and drug combinations have been found to effectively combat is a parasite (Li *et al.,* 2021; Rizak *et al.,* 2023).

Table 1. Dose and frequency of drugs used in the present study

Groups	Drug	Composition	Dose
Group-I	Inj. Berenil VET 7%	Diminazene aceturate (70 mg)	3.5 mg kg^{-1}. Intramuscularly once weekly three doses
Group-II	Inj. Imizol	Imidocarb dipropionate (120 mg mL^{-1})	2 mg kg^{-1}. Intramuscularly, once weekly three doses
Group-III	Inj. Berenil VET 7% and Inj. Imizol	Diminazene aceturate and Imidocarb dipropionate	Both total of three doses
Supportive therapy for all groups animals	Inj. Megludyne	Flunixin meglumine (83 mg mL^{-1})	1.1 to 2.2 mg kg^{-1} intramuscularly, for 3days
	Inj. Ferritas	Each 1 mL contains Iron Sorbitol citric acid-50 mg Folic acid-500 mcg Hydroxocobalamin acetate-50 mcg	10 mL $cattle^{-1}$, Intramuscularly, once in 3 days
	Inj. Anistamin	Chlorphenamine maleate (Each 1 mL contains 10 mg)	0.35 mg kg^{-1} every 24 hours intramuscularly, for 3days
	Inj. Tribivet	Each 1 mL contains Thiamine hydrochloride-50 mg, Pyridoxine hydrochloride-50 mg, Cynacobalamin-500 mg	10 mL/cattle Intramuscularly, for 3 days
	Dip. Liquid Amitraj (AKMITRAJ)	Amitraz 12.5%w/v	20 mLmixed with 10 liters of water and spraying, 7-14 day intervals
	Liv.52 Protec Liquid	Bhumyaamlaki, Yavatikta, Caper Bush (Himsra), Chicory (Kasani)	50 g twice daily orally for 15 days
	Sharkoferrol Vet	Each 21 g contains: Malt Extract 4.52 g, Calcium Gluconate-360 mg, Ferric Ammonium Citrate 300 mg, Copper Sulfate 100 mg, Cobalt Chloride 1.5 mg, Cholecalciferol 3600 IU, Niacinamide 45 mg, Biotin 75 µg, Folic Acid 1.5 mg, Cyanocobalamin 15 mcg.	50 g daily twice for 15 days
	Puls. Agrimin forte	Vitamin A, Vitamin D3, Vitamin E, Cobalt, Copper, Iodine, Iron, Magnesium, Manganese, Potassium, Sodium, Sulfur, Zinc, DL-Methionine, Calcium, Phosphorus	50 g daily per cattle for 15 days

Treatment success depends on several factors including early diagnosis, disease severity, appropriate drug dosage, timing of treatment initiation, and the duration of drug exposure necessary to effectively eliminate the parasite (Sivajothi *et al.,* 2023). No single treatment can be relied upon to provide a definitive cure, even though larger *Babesia* species, such as *Babesia bigemina*, are more sensitive to antiprotozoal medications than smaller species, such as *Babesia bovis* (Vial and Gorenflot, 2006). Therefore, the present study was carried out to evaluate the therapeutic efficacy of antiprotozoal agents against babesiosis in cattle.

Materials and Methods

The study was carried out on cattle in and around YSR Kadapa district of Andhra Pradesh from January 2023 to December 2024 to assess the therapeutic effectiveness of antiparasitic agents against babesiosis (Institutional Animal Ethical No. S.No.14 of Proc No.281/go/ReBi/S/2000/ CPCSEA/CVSc/TPTY/057/Medicine2022 Dated: 19.11.2022). Ten apparently healthy adult cattle were randomly selected from the cases brought for regular check-up and artificial insemination -were taken as normal group to obtaining normal reference data for comparison of parameters under study. Cattle presented with clinical signs of haemoprotozoan diseases including pyrexia, anaemia, tick infestation, lymphadenopathy and haemoglobinuria were included in the present study. Selection of cattle was based on history of tick infestation, haemoglobinuria, pale mucus membranes, chronic emaciation and babesiosis was confirmed by stained blood smear examination and

Table 2. Post therapeutic assessment of cattle with babesiosis by

Clinical findings	Group 1 (n=10)			Group 2 (n=10)			Group 3 (n=10)		
	0th day	7th day	14th day	0th day	7th day	14th day	0th day	7th day	14th day
Anorexia	90% (9/10)	70% (7/10)	30% (3/10)	90% (9/10)	70% (7/10)	30% (3/10)	90% (9/10)	50% (5/10)	10% (1/10)
Absence of rumination	90% (9/10)	50% (5/10)	20% (2/10)	90% (9/10)	50% (5/10)	30% (3/10)	90% (9/10)	40% (4/10)	0% (0/10)
Loss of milk yield	90% (9/10)	80% (8/10)	70% (7/10)	90% (9/10)	70% (7/10)	70% (7/10)	90% (9/10)	60% (6/10)	50% (5/10)
Hyperthermia	80% (8/10)	20% (2/10)	0% (0/10)	80% (8/10)	20% (2/10)	0% (0/10)	80% (8/10)	10% (1/10)	0% (0/10)
Depressed demeanor	70% (7/10)	60% (6/10)	20% (2/10)	80% (8/10)	60% (6/10)	20% (2/10)	80% (8/10)	30% (3/10)	0% (0/10)
Pale mucus membranes	40% (4/10)	40% (4/10)	30% (3/10)	50% (5/10)	40% (4/10)	30% (3/10)	50% (5/10)	30% (3/10)	10% (1/10)
Hemoglobinuria	40% (4/10)	30% (3/10)	0% (0/10)	50% (5/10)	30% (3/10)	0% (0/10)	50% (5/10)	10% (1/10)	0% (0/10)

Standardized column headers by replacing "Cattle with babesiosis (Group-I) (10)" with "Group-I (n=10)" for clarity and conciseness. The sample size (n=10) is now clearly indicated in the header.

further confirmed by polymerase chain reaction (PCR). Clinical signs and haemato-biochemical changes in cattle with babesiosis were recorded. Therapeutic evaluation and effectiveness of the anti-parasitic agents was assessed post-treatment on days 0, 7 and 14. Five millilitres of blood was collected from the jugular vein of cattle using sterile disposable syringes and transferred into vacutainers containing EDTA as anticoagulant. For separation of serum, 5 mL of blood was collected in clot activator vacutainer. Cattle with babesiosis were treated with specific antiparasitic drugs shown in the Table 1 (Singh *et al.*, 2021) along with supportive and symptomatic therapy. The present study involved the use of various drugs and supportive therapies, categorized into treatment groups and additional supportive care protocols. Group 1: cattle under this group were administered with injection diminazene aceturate at a dosage of 3.5 mg kg^{-1} body weight, intramuscularly at weekly intervals for a total of three doses. Group 2: this group consisted of cattle that were administered imidocarb dipropionate at a dosage of 2 mg kg^{-1} body weight via intramuscular injection at weekly intervals, for a total of three doses. Group 3: cattle under the group were administered with combination of diminazene aceturate (3.5 mg kg^{-1} body weight) and imidocarb dipropionate (2 mg kg^{-1} body weight), intramuscularly at 24 hours interval together. Combination of the medications were given for three doses at weekly interval. Cattle in all the groups were administered with similar supportive and symptomatic therapy. Post therapeutic assessment was done on day on 0, 3, 7, 14 days of therapy. The results obtained were subjected to statistical analysis as per the methods using SPSS Version 23.0

Results and Discussion

For assessment of therapeutic efficacy of the antiparasitic drugs, 30 cattle were chosen randomly and examined on 0th, 7th and 14th day of post therapy by recording the percentage of clinical signs, status of intensity of parasitemia, haematological and serum biochemical parameters and diagnosis of reinfection after complete clinical recovery.

Post therapeutic assessment of cattle with babesiosis by clinical examination is mentioned in Table 2. No significant differences were observed among the three groups of cattle in terms of regression of clinical signs during the post-therapeutic assessment period. Clinical findings recorded on days 0, 3, 7 and 14 post-treatment showed similar patterns across all groups, indicating that the resolution of clinical signs was comparable regardless of the treatment administered.

Post therapeutic assessment of cattle with babesiosis by parasitemia status is mentioned in Table-3. Status of parasitemia (number of babesia affected cells per field) was 4.78, 4.01, 2.16 and 0.21 in cattle under Group 1; it was 4.81, 3.92, 1.84 and 0.13 in Group 2 cattle; it was 4.12, 2.82, 1.09 and 0.01 in Group 3 cattle. Significant differences were observed in the reduction of the status of parasitemia in between the groups and within the groups while comparing on the 0th day, 3rd day, 7th day and 14th day of post therapy. There was

Table 3. Status of parasitemia on post therapeutic assessment in cattle infected with Babesia

Cattle with babesiosis	0th day	3rd day	7th day	14th day	Level of significance (p)
Group-1	4.78[a]**±0.38**	4.01[b]**±0.02**	2.16[b]**±0.**03	0.21[b]**±0.0**2	0.038
Group-2	4.81[a]**±0.20**	3.92[b]**±0.05**	1.84[b]**±0.06**	0.13[b]**±0.02**	0.032
Group-3	4.12[a]**±0.21**	2.82[a]**±0.06**	1.09[a]**±0.08**	0.01[a]**±0.01**	0.019
t-test, Level of significance (p)	1.92 (0.39) [NS]	4.12 (0.047) [*]	3.77 (0.033) [*]	2.93 (0.038) [*]	

*Significant (P<0.05), **Highly significant (P<0.01) and NS-Non significant (P>0.05). [ab]Columns bearing different superscripts differ significantly

significant reduction in the parasitemia status on third day of therapy (P=0.047), seventh day of therapy (P=0.033), and fourteenth day of therapy (P=0.038) when compared the cattle under Group 1, Group 2 with the cattle under Group 3 which indicative of early therapeutic response was noticed in cattle under Group 3.

Post therapeutic assessment of cattle with babesiosis by hematological examination mentioned in Table 4. In Group-I, significant decrease (P<0.05) in percentage of lymphocyte, percentage of eosinophils and monocytes and significant increase in (P<0.05) in haemoglobin, total erythrocyte count, and packed cell volume, total leucocyte count and percentage of neutrophils on the 14th day of examination compare to 0th day of examination of cattle. But still there was reduction in the haemoglobin, total erythrocyte count, and packed cell volume levels on the 14th day of examination of cattle with babesiosis when compare with the apparently healthy cattle under the study. Cattle under Group 2, a significant decrease (P<0.05) in percentage of lymphocyte, percentage of eosinophils and monocytes and significant increase in (P<0.05) in haemoglobin, total erythrocyte count, and packed cell volume, total leucocyte count and percentage of neutrophils on the 14th day of examination compare to the 0th day of examination of cattle. But still there was reduction in the haemoglobin, total erythrocyte count, and packed cell volume levels on the 14th day of examination of cattle with babesiosis compared to the apparently healthy cattle under the study. Cattle under Group 3, a significant decrease (P<0.05) in percentage of lymphocyte, percentage of eosinophils and monocytes and significant increase in (P<0.05) in haemoglobin, total erythrocyte count, and packed cell volume, total leucocyte count and percentage of neutrophils on the 14th day of examination when compared with the 0th day of examination of cattle. But still there was reduction in the haemoglobin, total erythrocyte count, and packed cell volume levels on the 14th day of examination of cattle with babesiosis compared to apparently healthy cattle under the study.

Post therapeutic assessment of cattle with babesiosis by serum biochemical analysis mentioned in Table 5. Cattle under Group 1, there was a significant (P<0.05) elevation of serum total protein, albumin and globulin levels; significant reduction (P<0.05) in the serum aspartate aminotransferase, alkaline phosphatase, bilirubin, indirect bilirubin, blood urea nitrogen, creatinine levels and there was no significant difference was noticed in the bilirubin levels on the 14th day of examination when compared with the 0th day of examination. Reduced levels of albumin-to-globulin ratio, increased levels of globulin, aspartate aminotransferase, alkaline phosphatase, creatinine even after completion of 14 days of therapy in cattle with babesiosis when compared with the apparently healthy cattle in the present study. Cattle under Group 2, there was a significant (P<0.05) elevation of serum total protein, albumin and globulin levels; significant reduction (P<0.05) in the serum aspartate aminotransferase, alkaline phosphatase, bilirubin, indirect bilirubin, blood urea nitrogen, creatinine levels and there was no significant difference was noticed in the bilirubin levels on the 14th day of examination when compared with the day 0 of examination. Reduced levels of albumin-to-globulin ratio, increased levels of globulin, aspartate aminotransferase, alkaline phosphatase, creatinine even after completion of 14 days of therapy in cattle with babesiosis when compared with the apparently healthy cattle in the present study. Cattle under Group 3, there was a significant (P<0.05) elevation of serum total protein, albumin and globulin levels; significant reduction (P<0.05) in the

Table 4. Post therapeutic assessment cattle with babesiosis by hematological examination

Parameters	Apparently healthy cattle (10)	Cattle with babesiosis (Group-I) (10)			Cattle with babesiosis (Group-II) (10)			Cattle with babesiosis (Group-III) (10)			P
		0th day	7th day	14th day	0th day	7th day	14th day	0th day	7th day	14th day	
Haemoglobin (g/dL)	11.84±0.52	8.84±0.14	8.89±0.09	9.74±0.13	8.94±0.13	7.53±0.12	7.92±0.09	8.61±0.15	7.88±0.11	8.84±0.13	0.064
Packed cell volume (%)	35.04±1.26	26.80±0.40	29.90±0.60	30.20±0.90	26.88±0.77	28.10±0.42	31.13±0.29	27.10±0.10	29.18±0.29	30.17±0.32	0.120
TEC ($\times 10^6/\mu L$)	5.88±0.16	4.41±0.15	4.57±0.13	4.77±0.12	4.31±0.15	3.17±0.18	4.67±0.21	4.48±0.15	3.27±0.20	4.87±0.21	0.064
MCV (fL)	68.97±1.87	60.77±0.92	60.36±0.64	61.36±0.39	60.67±0.42	58.66±0.82	60.16±0.91	60.69±0.80	59.36±0.67	60.36±0.82	0.230
MCH (pg)	20.13±0.93	20.04±0.62	17.80±0.09	18.10±0.06	20.06±0.63	17.60±0.22	18.20±0.32	20.14±0.32	17.90±0.52	18.40±0.22	0.309
MCHC (g/dL)	33.78±1.04	32.98±3.13	30.92±0.08	30.10±0.30	32.58±2.05	30.80±3.23	30.20±3.03	32.68±3.33	30.90±3.14	30.70±3.17	0.104
TLC ($\times 10^3/\mu L$)	10.34±0.39	9.99±0.24	10.55±0.16	10.92±0.14	9.89±0.90	10.21±0.65	10.72±0.27	9.94±0.30	10.02±0.09	10.1±0.10	0.069
Neutrophils (%)	31.98±0.87	24.21±0.48	27.67±0.41	28.92±0.38	24.38±0.43	26.88±0.36	27.68±0.32	24.58±0.09	26.68±0.07	28.68±0.6	0.077
Lymphocytes (%)	62.95±3.90	63.79±3.10	62.81±2.56	61.84±2.12	63.69±3.08	62.74±3.20	61.81±3.12	63.89±3.15	62.79±3.14	61.79±3.11	0.208
Eosinophils (%)	4.04±0.66	8.05±0.34	6.13±0.29	5.73±0.31	8.02±0.35	6.75±0.25	5.25±0.45	8.09±0.35	6.65±0.29	5.35±0.24	0.118
Monocytes (%)	2.28±0.61	4.28±0.37	3.52±0.31	3.19±0.22	4.48±0.37	3.72±0.09	3.18±0.07	4.38±0.32	3.79±0.27	3.28±0.14	0.122

*Significant (P<0.05), **Highly significant (P<0.01) and NS-Non significant (P>0.05). [ab]Columns bearing different superscripts differ significantly.

Table 5. Post therapeutic assessment of cattle with babesiosis by serum biochemical analysis

Parameters	Apparently healthy cattle (10)	Cattle with babesiosis (Group-I) (10)			Cattle with babesiosis (Group-II) (10)			Cattle with babesiosis (Group-III) (10)			P
		0th day	7th day	14th day	0th day	7th day	14th day	0th day	7th day	14th day	
Total protein (g/dL)	6.38±0.22	5.34±0.32	5.48±0.22	6.12±0.14	5.38±0.32	5.58±0.09	6.22±0.19	5.37±0.16	5.98[a]±0.28	6.27[a]±0.29	0.109
Albumin (g/dL)	2.92±0.24	1.76±0.06	1.86±0.02	2.30±0.08	1.75±0.04	1.96±0.03	2.40±0.05	1.78±0.07	2.76±0.04	3.01±0.04	0.079
Globulin (g/dL)	3.46±0.10	3.58±0.09	3.62±0.20	3.82±0.04	3.63±0.05	3.62±0.08	3.82±0.10	3.59±0.11	3.22±0.13	3.26±0.08	0.208
A/G ratio	0.84±0.08	0.49±0.07	0.51±0.03	0.60±0.05	0.48±0.10	0.54±0.09	0.62±0.06	0.49±0.03	0.85±0.08	0.92±0.12	0.411
AST (IU/L)	58.7±4.10	409.1±38.19	369.4±27.41	208.3±21.13	409.3±38.20	367.3±25.40	204.3±28.60	399.2±38.2	267.3±31.8	104.3±12.30	0.120
ALP (IU/L)	64.3±3.21	411.8±14.9	307.7±12.50	152.7±11.39	421.8±12.50	317.7±14.30	182.7±11.20	418.8±13.9	329.7±12.3	129.7±11.9	0.208
Bilirubin (mg/dL)	1.23±0.09	2.84±0.08	2.15±0.06	1.28±0.09	2.86±0.06	2.31±0.04	1.08±0.07	2.88±0.04	1.08±0.05	1.12±0.06	0.312
Direct bilirubin (mg/dL	0.60±0.08	0.67±0.09	0.61±0.06	0.58±0.08	0.69±0.09	0.71±0.03	0.63±0.12	0.69±0.09	0.67±0.06	0.69±0.03	0.402
Indirect bilirubin (mg/dL	0.63±0.01	2.17±0.31	1.54±0.05	0.70±0.04	2.17±0.21	1.60±0.06	0.45±0.11	2.19±0.41	0.41±0.13	0.43±0.11	0.271
Blood urea nitrogen (mg/dL)	26.21±1.09	47.21±1.89	35.34±1.59	31.32±1.80	46.29±1.89	37.42±1.92	30.32±2.01	47.89±1.76	39.29±1.73	32.29±1.59	0.308
Creatinine (mg/dL)	1.22±0.23	2.64±0.21	2.79±0.18	2.09±0.33	2.54±0.18	2.59±0.26	1.99±0.13	2.74±0.18	1.89±0.21	1.79±0.12	0.402

*Significant (P<0.05), **Highly significant (P<0.01) and NS No-significant (P>0.05). [ab]Columns bearing different superscripts differ significantly

serum aspartate aminotransferase, alkaline phosphatase, bilirubin, indirect bilirubin, blood urea nitrogen, creatinine levels and there was no significant difference was noticed in the bilirubin levels on the 14th day of examination when compared with the 0th day of examination. Reduced levels of albumin-to-globulin ratio, increased levels of globulin, aspartate aminotransferase, alkaline phosphatase, creatinine even after completion of 14 days of therapy in cattle with babesiosis when compared with the apparently healthy cattle in the present study. The examination of all thirty cattle under treatment was conducted over a one-year period. Babesiosis recurrence was observed in two cattle under Group 1 after 60 to 110 days of therapy, in cattle under Group 2 after 82 to 140 days of therapy, but no recurrence was observed in cattle under Group 3. By comparing the results, both diminazene aceturate and imidocarb dipropionate together have the early recovery when compared with the single drug. It was assessed by the status of parasitemia and reduction in the serum creatinine levels and inhibition of reinfection compared to Group 1 and 2.

By comparing the results, cattle which were under Group 3 which were administered with both diminazene aceturate and imidocarb dipropionate together have the early recovery than compare with the diminazene aceturate or imidocarb dipropionate alone treated cattle. The examination of all thirty cattle under therapeutic effectiveness was followed for the period of 8 months of post therapeutic period. Recurrence of babesiosis was observed in two cattle under Group 1 (60 to 110 days of post therapy) and in cattle under Group 2 (82 to 140 days of post therapy), but there was no recurrence of babesiosis was noticed in cattle in Group 3 combination therapy than the single medication.

Diminazene aceturate has been used for successful management of babesiosis in cattle by different dosages which includes 4 mg kg body weight in a calf (Bhardwaj *et al.*, 2010), 5 mg kg body weight in cattle (Tufani *et al.*, 2015), 3.5 mg kg body weight (Jyothisree *et al.*, 2013); Ahmad *et al.* (2023), @ 2.5 mg kg^{-1} body weight (Chandran and Athulya, 2021) in different studies. Tufani *et al.* (2015) and Saini *et al.* (2022) stated that supportive and symptomatic therapy is very essential in addressing the babesiosis in cattle and they utilised for successful recovery. Therapeutic outcome was in cattle with babesiosis was 14 days (Bhardwaj *et al.*, 2010). Diminazene aceturate is an aromatic diamidine, and it is currently unknown how it works against *Babesia.* However, as it has been seen for *Trypanosoma* and *Leishmania* species, it was believed to impact the parasite's aerobic glycolysis and DNA synthesis (Mosqueda *et al.,* 2012). It is also suggested to disrupt, DNA synthesis and also the replication of DNA and affect the respiratory activity of mitochondria. The mode of action of imidocarb dipropionate is unknown, two potential mechanisms have been put forth: either binding to nuclear DNA in susceptible *Babesia* species, causing nucleic acid damage and preventing cellular repair and parasite replication, or blocking inositol entry into *Babesia* infected erythrocytes, resulting in parasite starvation (Rizak *et al.,* 2023) combination with damaging and inhibition of DNA replication and cell repairing. Hashem *et al.* (2018) used imidocarb dipropionate to successfully treat cattle infected with *Babesia.* The clinical and biochemical parameters showed improvement after 7 days following a single intramuscular injection at a dose of 1.7 mg kg^{-1} body weight. Combination of diminazene aceturate and imidocarb dipropionate was advised by the Rizak *et al.* (2023) in their study on experimental studies on mice in Japan and it as an effective therapeutic combination for bovines overcome the potential problems of resistance against *Babesia* infection.

There was no recurrence of babesiosis was observed in cattle receiving combination therapy as opposed to those receiving either diminazene aceturate or imidocarb dipropionate alone, and cattle receiving both medications recovered more quickly than those receiving either medication alone.

Conclusion

The study demonstrates that babesiosis in cattle remains a significant concern, with PCR-based detection (38.54%) revealing a higher prevalence than microscopy (21.87%), highlighting the importance of sensitive diagnostic methods. Therapeutic evaluation showed that combination therapy with diminazene aceturate and imidocarb dipropionate led to faster recovery and complete clearance of parasitemia, with no

recurrence, compared to monotherapy with either drug alone. These findings suggest that combination therapy is more effective for the management of babesiosis in cattle, providing a reliable treatment strategy to improve clinical outcomes and reduce the risk of reinfection.

Acknowledgement

Authors are thankful to the authorities of Sri Venkateswara Veterinary University, Tirupati for providing the facilities.

References

Ahmad, T., Tufani, N.A., Haq, A.U., Tramboo, S.R., Allaie, I.M., Malik, H.U. and Dar, A.A. 2023. Clinico-haemato biochemical changes and therapeutic efficacy of diminazene aceturate and artesunate against bovine babesiosis in Kashmir Valley. *Indian Journal of Animal Research* 1: 7: 120-124. https://doi.org/10.18805/IJAR.B-5014

Bhardwaj, R.K., Randhawa, C.S., Randhawa, S.S. and Dhaliwal, P.S. 2010. Clinico-haemato biochemical profile in chronic anemic crossbred cattle. The *Indian Journal of Animal Sciences* 80(3): 103-105.

Chandran, D. and Athulya, P.S. 2021. A study of the clinicohaematological profile and therapeutic management of acute babesiosis in a cross-bred Jersey cow–A case report. *International Journal of Pharmaceutical Sciences Review and Research.* 68(1): 60-62. https://doi.org/10.47583/ijpsrr.2021.v68i01.010

Hashem, M., Neamat-Allah, A.N. and Gheith, M.A. 2018. A study on bovine babesiosis and treatment with reference to hematobiochemical and molecular diagnosis. *Slovenian Veterinary Research* 55(20): 165-73. https://doi.org/10.26873/SVR-643-2018

Jyothisree, C., Naik, S. and Samatha, V. 2013. A study on prevalence and clinico-therapeutic management of babesiosis in HF crossbred cattle in Anantapur district of Andhra Pradesh. *International Journal of Food, Agriculture and Veterinary Sciences* 3: 88-91. 10.1080/01652176.2023.2185695

Li, Y., Luo, Y., Cao, S., Terkawi, M.A., Lan, D.T., Long, P.T. and Xuan, X. 2021. Molecular and sero-epidemiological survey of *Babesia bovis* and *Babesia bigemina* infections in cattle and water buffaloes in the central region of Vietnam. *Tropical Biomedicine.* 31(3): 406-413.

Mosqueda, J., Olvera-Ramirez, A., Aguilar-Tipacamu, G. and Canto, G.J. 2012. Current advances in detection and treatment of babesiosis. *Current Medicinal Chemistry* 19:1504-18. doi: 10.3389/fvets.2020.00364.

Rizak, M.A., El-Sayed, S.A. and Igarashi, I. 2023. Diminazene aceturate and imidocarb dipropionate-based combination therapy for babesiosis – a new paradigm. *Ticks and Tick borne Diseases* 14: 102145. https://doi.org/10.1016/j.ttbdis.2023.102145

Saini, K.K., Khinchi, R.K., Sharma, S.K., Gaurav, A. and Solanki, S. 2022. Evaluation of haemato-biochemical alterations, antioxidant status and oxidative stress in babesia infected cattle. *Journal of Animal Research* 12(6): 871-877. DOI:10.30954/2277-940X.06.2022.7

Salih, D.A., El Hussein, A.M. and Singla, L.D. 2015. Diagnostic approaches for tick-borne haemoparasitic diseases in livestock. *Journal of Veterinary Medicine and Animal Health* 7(2): 45-56. https://doi.org/10.5897/JVMAH2014.0345

Singh, A.P., Tripathi, A.K., Pandey, R.P. and Ashish, S. 2021. Therapeutic efficacy evaluation of commonly used antitrypanosomal drugs in naturally infected buffaloes. *Buffalo Bulletin* 40 (1): 19-30.

Sivajothi, S., Reddy, B.S. and Swetha 2023. Cerebrospinal fluid analysis and haemato-biochemical variations in young buffalo calves with cerebral babesiosis. *Journal of Parasitic Diseases* 47(4): 815-819. https://doi.org/10.1007/s12639-023 01628-0.

Tufani, N.A., Fazili, M.R., Malik, H.U., Beigh, S.A. and Dar, K. 2015. Clinico hematological Profile and therapeutic management of acute babesiosis in a Holstein-Friesian crossbred cow. *Veterinary Clinical Sciences* 3(3): 11-14.

Vial, H.J. and Gorenflot, A. 2006 Chemotherapy against babesiosis. *Veterinary Parasitology.* 138: 147-160. doi: 10.1016/j.vetpar.2006.01.048.

Printed in December 2025