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Evaluation of therapeutic efficacy of *Dalbergia sissoo* (Shisham) in calf diarrhoea

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Abstract

Calf diarrhoea is one of the most important causes of morbidity, mortality and economic losses in the dairy industry. The present study was undertaken to evaluate the therapeutic efficacy of *Dalbergia sissoo* (Shisham) in cattle calves suffering from diarrhoea. During the study period from November 2025 to April 2026, a total of 100 cattle calves were screened for the presence of diarrhoea at the Veterinary Clinical Complex, Livestock Farm Complex, organized dairy sectors and unorganized dairy sectors of Jabalpur. Out of these, 32 calves (32.00%) were found positive for diarrhoea. From the affected calves, 18 diarrhoeic calves were selected randomly and allocated into three treatment groups comprising six calves each. Group I (G1) received *Dalbergia sissoo* leaf powder at 1 g/kg body weight orally twice daily for five days, Group II (G2) received aqueous extract of *Dalbergia sissoo* leaves at 0.5 ml/kg body weight orally twice daily for five days, while Group III (G3) received a combination of ofloxacin (10 mg/kg body weight) and ornidazole (20 mg/kg body weight) orally twice daily for five days. Additionally, six apparently healthy calves were maintained as the healthy control group (G4). Supportive treatment, including fluid therapy, was administered to all affected calves according to their clinical condition. Therapeutic efficacy was evaluated on (day 0) before the start of treatment and on (Day 6) after treatment on the basis of clinical parameters, faecal consistency score, dehydration score and depression score, along with haematological and biochemical alterations before and after treatment. All treatment groups exhibited significant ($p < 0.05$) improvement in clinical, haematological and biochemical parameters following therapy.

Keywords: Calf diarrhoea, *Dalbergia sissoo*, haematological and biochemical alterations, faecal consistency score

Introduction

Calves represent the future replacement stock of both dairy and beef herds and their health during the first few months of life directly influences the profitability of the livestock industry. Among the diseases affecting calves, diarrhoea, commonly referred to as calf scours, is recognised as the most widespread and economically devastating problem worldwide (Muktar *et al.*, 2015) [14]. Calf Diarrhoea is a multifactorial syndrome that typically affects calves and is considered the leading cause of morbidity and mortality in this age group. Reports suggest that diarrhoeal diseases are responsible for up to 75% of deaths in calves, making it the single most important cause of calf mortality (Constable, 2004). Even in cases where calves survive, diarrhoea has long-term consequences, including stunted growth, delayed maturity, reduced milk yield and increased susceptibility to other infections, thereby exerting a prolonged economic burden on farmers. The etiology of calf diarrhoea is complex and involves an interaction of the calf's immune status, environmental, managemental factors and infectious agents. Inadequate colostrum intake, unhygienic housing, overcrowding, nutritional errors and stress predispose calves to disease. The major cause of diarrhoea in calves during the early weeks of life is *E. coli*. In slightly older calves upto 12 weeks, *Salmonella* spp., especially *S. typhimurium* and *S. dublin*, are responsible for diarrhoea (Cho and Yoon, 2014) [3]. Clinically, affected calves present with watery diarrhoea, dehydration, anorexia, depression, electrolyte imbalance and metabolic acidosis. Severe cases often lead to progressive weakness, hypovolemic shock and death if timely intervention is not provided. Ethnoveterinary practices, particularly the use of medicinal plants with antidiarrhoeal, antimicrobial and immunomodulatory properties, have shown promise in managing diarrhoea in livestock.

Phytochemical studies of *Dalbergia sissoo* leaves show the presence of alkaloids, glycosides, flavanols, tannins and saponins, which contribute to its strong medicinal value. The plant exhibits antidiarrhoeal, antimicrobial, anti-inflammatory and antioxidant activities, making it highly suitable for treating calf diarrhoea. Its astringent and gut-protective properties help reduce intestinal irritation and support faster recovery, highlighting its potential as a safe and effective herbal therapy for calf diarrhoea (Hossen *et al.*, 2023) ^[10]. Traditional ethnoveterinary medicines are a less expensive, easier and longer-lasting alternative to manufactured drugs and pharmaceuticals (Xiong and Long, 2020) ^[20]. The plant *Dalbergia sissoo* (Roxb) ex DC (known as sisu, shisham, tahli, jag and rosewood tree) is a significant medicinal plant. It is indigenous to the Indian subcontinent (El-Azzazy *et al.*, 2024) ^[6].

Materials and Methods

The present study was conducted at the Department of veterinary medicine of Nanaji Deshmukh Veterinary Science University, Jabalpur, during a period of six months i.e., from November 2025 to April 2026. A total of 100 cattle calves were screened at Veterinary clinical complex, south civil lines, Livestock Farm Complex, Adhartal, Organised dairy sectors and Unorganised dairy sectors of Jabalpur. Out of these, 32 calves (32.00%) were found positive for diarrhoea. From the affected calves, 18 diarrhoeic calves were selected randomly and allocated into three treatment groups comprising six calves each. Group I (G1) received *Dalbergia sissoo* leaf powder at 1 g/kg body weight orally twice daily for five days, Group II (G2) received aqueous extract of *Dalbergia sissoo* leaves at 0.5 ml/kg body weight orally twice daily for five days, while Group III (G3) received a combination of ofloxacin (10 mg/kg body weight) and ornidazole (20 mg/kg body weight) orally twice daily for five days.

Animals

The calves were examined for clinical parameters such as rectal temperature, heart rate, respiration rate. clinical signs such as altered faecal consistency and increased frequency of voiding faeces, along with lethargy, depression and signs of dehydration.

Blood samples

Approximately 3 ml of blood sample was collected aseptically from the jugular vein of each diarrhoeic calf. Out of this sample, 1 ml of blood was collected in a vial containing EDTA for standard routine haematology and the remaining 2 ml of the blood sample was collected in clot activator vials for serum biochemical analysis on (day 0) before treatment and on (Day 6) after treatment.

Preparation of Medicaments

The fully matured fresh leaves of *Dalbergia sissoo* were obtained from the field and local markets in Jabalpur, M.P. The plant material was identified and authenticated by the Department of Botany, Jawaharlal Nehru Krishi Vishwavidyalaya, Adhartal, Jabalpur. The leaves were washed thoroughly with tap water and shade-dried to retain their active constituents. The dried leaves were then finely powdered to prepare the herbal formulation (Agrawal *et al.*, 2022) ^[1].

Preparation of Aqueous Extracts (decoction)

For the preparation of aqueous extracts (decoction). The leaves were washed thoroughly with tap water and shade-dried to retain their active constituents. The dried leaves were then finely powdered then 100 gram of plant leaf powder was boiled in 500 ml of water for 30 minutes and the mixture was filtered through a muslin cloth. The filtrate obtained was then adjusted to 100 ml with distilled water (Amrutkar *et al.*, 2016) ^[2].

Statistical analysis

Statistical analysis of data was carried out by using Minitab® Statistical Software (Version 22.5.0.). Quantitative parameters were analysed by applying one-way ANOVA followed by Fisher's least significant difference (LSD) test. Non-parametric parameters including faecal consistency, dehydration and depression scores were analysed using Kruskal-Wallis Test and Wilcoxon Signed Rank Test. The results were expressed as Mean $\pm$ SE and differences were considered significant at $p < 0.05$.

Results and Discussion

Table 1: Mean values of clinical parameters in diarrhoeic calves in different treatment groups at different intervals

S. No.	Parameters	Treatment Groups	Mean $\pm$ SE	
			Day-0	Day-6
1	Rectal temperature (°F)	G1	103.50 ^{aA} $\pm$ 0.09	101.46 ^{bB} $\pm$ 0.10
		G2	103.45 ^{aA} $\pm$ 0.07	101.78 ^{aB} $\pm$ 0.04
		G3	103.65 ^{aA} $\pm$ 0.07	101.41 ^{bB} $\pm$ 0.10
		G4	101.21 ^{bB} $\pm$ 0.06	101.35 ^{bA} $\pm$ 0.07
2	Heart rate (beats/minute)	G1	118.66 ^{aA} $\pm$ 0.88	115.66 ^{aB} $\pm$ 0.66
		G2	118.50 ^{aA} $\pm$ 1.33	114.00 ^{aB} $\pm$ 1.88
		G3	119.33 ^{aA} $\pm$ 0.66	113.83 ^{aB} $\pm$ 0.60
		G4	113.16 ^{bA} $\pm$ 2.67	110.33 ^{aB} $\pm$ 2.18
3	Respiration rate (breath/minute)	G1	22.16 ^{aA} $\pm$ 0.60	19.66 ^{aB} $\pm$ 0.49
		G2	22.66 ^{aA} $\pm$ 0.49	18.83 ^{abB} $\pm$ 0.60
		G3	23.16 ^{aA} $\pm$ 0.30	16.83 ^{cb} $\pm$ 0.30
		G4	16.33 ^{bB} $\pm$ 0.49	17.83 ^{bca} $\pm$ 0.47

Means with different lowercase superscripts within a column (groups within a day) and different uppercase superscripts within a row (days within a group) differ significantly ($p \leq 0.05$).

The results of current study correlates well with the findings of Shehta *et al.* (2022) ^[18] who documented increased vital parameters in diarrhoeic calves and observed restoration

towards normal values following therapy. Similarly, Devkate *et al.* (2010) ^[5] also reported elevated rectal temperature, increased heart rate and respiration rate in

calves suffering from neonatal diarrhoea. Furthermore, Agrawal *et al.* (2022) [1] recorded elevation in temperature, pulse rate and respiratory rate in diarrhoeic calves, which correlates well with the findings of the present study. The elevation in clinical parameters is indicative of infectious origine of diarrhoea in calves.

Table 2: Mean values of haematological parameters in diarrhoeic calves in different treatment groups at different intervals

S. No.	Parameters	Group	Mean $\pm$ SE	
			Day-0	Day-6
1	Haemoglobine (g/dL)	G1	12.71 ^{aA} $\pm$ 0.04	11.86 ^{aB} $\pm$ 0.10
		G2	12.10 ^{aA} $\pm$ 0.51	11.23 ^{aB} $\pm$ 0.53
		G3	12.58 ^{aA} $\pm$ 0.30	10.80 ^{aB} $\pm$ 0.35
		G4	10.41 ^{bB} $\pm$ 0.16	10.58 ^{aA} $\pm$ 0.16
2	PCV (%)	G1	38.15 ^{aA} $\pm$ 0.14	37.23 ^{aB} $\pm$ 0.13
		G2	36.30 ^{aA} $\pm$ 1.54	33.70 ^{aB} $\pm$ 1.60
		G3	37.75 ^{aA} $\pm$ 0.91	32.40 ^{bB} $\pm$ 1.07
		G4	31.25 ^{bB} $\pm$ 0.49	31.65 ^{bA} $\pm$ 0.45
3	TEC (10 ⁶ /μL)	G1	8.88 ^{aA} $\pm$ 0.35	8.30 ^{aB} $\pm$ 0.39
		G2	8.61 ^{aA} $\pm$ 0.55	8.03 ^{aB} $\pm$ 0.38
		G3	8.87 ^{aA} $\pm$ 0.29	7.30 ^{bB} $\pm$ 0.11
		G4	7.06 ^{bB} $\pm$ 0.14	7.21 ^{bA} $\pm$ 0.15
4	TLC (10 ³ /μL)	G1	16.06 ^{aA} $\pm$ 1.07	14.14 ^{aB} $\pm$ 1.04
		G2	16.86 ^{aA} $\pm$ 0.51	13.80 ^{aB} $\pm$ 0.18
		G3	17.96 ^{aA} $\pm$ 0.41	12.28 ^{bB} $\pm$ 0.36
		G4	9.80 ^{bB} $\pm$ 0.36	10.16 ^{cA} $\pm$ 0.31

Means with different lowercase superscripts within a column (groups within a day) and different uppercase superscripts within a row (days within a group) differ significantly ($p \leq 0.05$).

Several studies have been conducted on haematological parameters in calves suffering from diarrhoea. The results of the present study are in agreement with the findings of Singh *et al.* (2014) [19], Nayak *et al.* (2025) [15] Yadav *et al.* (2021) [21] and Parikh and Nath (2022) [16], who recorded increase levels of Hb, PCV and TEC along with increased TLC in diarrhoeic calves. On the contrary Shehta *et al.* (2022) [18] recorded decreased levels of Hb, PCV and TEC in calf diarrhoea.

The results of the current study indicated increased levels of haemoglobin (Hb), packed cell volume (PCV) and total erythrocyte count (TEC) in diarrhoeic calves. The elevation in these haematological parameters may be due to dehydration associated with diarrhoea. Excessive loss of body fluids and electrolytes through frequent watery faeces might have lead to reduction in plasma volume, resulting in haemoconcentration. Due to this reduction in circulating plasma volume, the concentration of erythrocytes and haemoglobin in blood increases, thereby causing elevated Hb, PCV and TEC values. These findings suggest that dehydration and fluid imbalance are important pathological changes occurring in calves suffering from diarrhoea (Rathor *et al.*, 2022) [17].

The present study showed leucocytosis in the diarrhoea affected calves under study. Similar findings were recorded by Gupta *et al.* (2020) [8]. Leucocytosis in the affected calves might have resulted from varying intensity of microbial infection which might have cured after therapy resulting in the decreased levels of leucocytes on day 6 (post treatment) in the calves under therapeutic study.

Table 3: Mean values of biochemical parameters in diarrhoeic calves in different treatment groups at different intervals

S. No.	Parameters	Treatment Groups	Mean $\pm$ SE	
			Day-0	Day-6
1	Total protein (TP) (g/dL)	G1	7.85 ^{aA} $\pm$ 0.04	6.75 ^{aB} $\pm$ 0.21
		G2	7.84 ^{aA} $\pm$ 0.03	6.60 ^{aB} $\pm$ 0.21
		G3	7.78 ^{aA} $\pm$ 0.07	6.39 ^{aB} $\pm$ 0.11
		G4	6.73 ^{bA} $\pm$ 0.14	6.68 ^{aA} $\pm$ 0.14
2	Albumin (g/dL)	G1	3.91 ^{bA} $\pm$ 0.17	3.83 ^{aB} $\pm$ 0.17
		G2	4.07 ^{abA} $\pm$ 0.17	3.84 ^{aB} $\pm$ 0.16
		G3	4.30 ^{aA} $\pm$ 0.04	3.35 ^{bB} $\pm$ 0.04
		G4	3.10 ^{cB} $\pm$ 0.06	3.14 ^{bA} $\pm$ 0.05
3	Serum Glutamic Pyruvic Transaminase (U/L)	G1	39.84 ^{aA} $\pm$ 1.06	38.78 ^{aB} $\pm$ 1.11
		G2	38.71 ^{aA} $\pm$ 0.54	36.78 ^{abB} $\pm$ 0.70
		G3	39.36 ^{aA} $\pm$ 0.70	35.34 ^{bB} $\pm$ 1.16
4	Serum Glutamic Oxaloacetic Transaminase (U/L)	G1	87.63 ^{aA} $\pm$ 0.47	86.58 ^{aB} $\pm$ 0.31
		G2	87.38 ^{aA} $\pm$ 1.77	85.32 ^{abB} $\pm$ 1.77
		G3	87.68 ^{aA} $\pm$ 2.68	81.07 ^{bB} $\pm$ 2.35
		G4	71.28 ^{bB} $\pm$ 0.30	71.45 ^{cA} $\pm$ 0.29

Means with different lowercase superscripts within a column (groups within a day) and different uppercase superscripts within a row (days within a group) differ significantly ($p \leq 0.05$).

Several scientists have estimated the biochemical parameters in calves affected with diarrhoea. The results showed increased levels of total protein and Albumin. In the present study which are in agreement with the findings of Yadav *et al.* (2021) [21], Agrawal *et al.* (2022) [1]. On the contrary, Shehta *et al.* (2022) [18] and Abed *et al.* (2020) [13] recorded decreased levels of total protein and Albumin in calf diarrhoea.

Increased in the total protein and albumin concentration observed in diarrhoeic calves may be attributed to dehydration and haemoconcentration associated with excessive loss of water and electrolytes through watery faeces. Reduction in plasma water volume causes concentration of blood constituents, resulting in an apparent increase in serum total protein and albumin levels. In addition, elevated total protein may also be associated with inflammatory and infectious conditions caused by enteric pathogens such as *Escherichia coli*.

In the present study, only marginal elevation of SGPT and SGOT values have suggested the absence of hepatic damage (Singh *et al.*, 2014) [19].

Table 4: Mean faecal consistency score (0-3) in diarrhoeic calves in different treatment groups at different intervals

Day	Groups	Mean $\pm$ SE	Kruskal-Wallis Test, H and P-values
Day-0	Group-1	2.33 $\pm$ 0.21	H = 15.61, P = 0.001 Significant
	Group-2	2.33 $\pm$ 0.21	
	Group-3	2.66 $\pm$ 0.21	
	Group-4*	0.00 $\pm$ 0.00	
Day-6	Group-1	1.16 $\pm$ 0.30	H = 9.70, P = 0.021 Significant
	Group-2	1.00 $\pm$ 0.36	
	Group-3	0.33 $\pm$ 0.21	
	Group-4*	0.00 $\pm$ 0.00	

* Apparently healthy calves (without diarrhoea)

Table 5: Day-wise frequency of voiding faeces in different groups

Frequency of defaecation	No. and% of animals	Group-1		Group-2		Group-3		Group-4		Total
		Day-0	Day-6	Day-0	Day-6	Day-0	Day-6	Day-0	Day-6	
0	N	0	1	0	2	0	5	6	6	20
	%	0.00	2.08	0.00	4.17	0.00	10.42	12.50	12.50	41.67
1	N	0	3	0	3	0	1	0	0	7
	%	0.00	6.25	0.00	6.25	0.00	2.08	0.00	0.00	14.58
2	N	3	2	4	1	3	0	0	0	13
	%	6.25	4.17	8.33	2.08	6.25	0.00	0.00	0.00	27.08
3	N	3	0	2	0	3	0	0	0	8
	%	6.25	0.00	4.17	0.00	6.25	0.00	0.00	0.00	16.67

Table 6: Mean dehydration score (0-3) in diarrhoeic calves in different treatment groups at different intervals

Day	Groups	Mean $\pm$ SE	Kruskal-Wallis Test, H and P-values
Day-0	Group-1	2.33 $\pm$ 0.21	H = 16.07, P = 0.001 Significant
	Group-2	2.16 $\pm$ 0.16	
	Group-3	2.33 $\pm$ 0.21	
	Group-4*	0.00 $\pm$ 0.00	
Day-6	Group-1	1.16 $\pm$ 0.30	H = 8.93, P = 0.030 Significant
	Group-2	0.66 $\pm$ 0.33	
	Group-3	0.33 $\pm$ 0.21	
	Group-4*	0.00 $\pm$ 0.00	

* Apparently healthy calves (without diarrhoea)

Table 7: Mean depression score (0-3) in diarrhoeic calves in different treatment groups at different intervals

Day	Groups	Mean $\pm$ SE	Kruskal-Wallis Test, H and P-values
Day-0	Group-1	2.00 $\pm$ 0.25	H = 14.33, P = 0.002 Significant
	Group-2	2.00 $\pm$ 0.25	
	Group-3	2.00 $\pm$ 0.36	
	Group-4*	0.00 $\pm$ 0.00	
Day-6	Group-1	1.00 $\pm$ 0.25	H = 9.46, P = 0.0 Significant
	Group-2	0.83 $\pm$ 0.30	
	Group-3	0.33 $\pm$ 0.21	
	Group-4*	0.00 $\pm$ 0.00	

* Apparently healthy calves (without diarrhoea)

In present study, calves suffering from diarrhoea exhibited notable alterations in faecal consistency, frequency of defaecation, dehydration score, depression score and suckling reflex. The faecal consistency score ranged between 0 to 3. Score 1 indicating normal well formed faeces and score 3 indicating severe watery diarrhoea. The diarrhoeic faeces were typically yellowish, foul-smelling, and varied in texture depending on severity. These changes reflected pronounced enteric disturbance and excessive fluid loss associated with diarrhoeal infection.

The evaluation of defaecation frequency demonstrated the efficacy of treatment in reducing diarrhoeic episodes in calves. By Day-6, 41.67% of calves regained normal defaecation frequency (score 0), with the most notable recovery observed in G-3 (10.42%) followed by Group G2 where 4.17% of calves recovered. These findings confirm that all treatment regimens improved bowel function in Group-3.

The degree of dehydration, assessed through skin tenting, ranged from mild to severe. Mild dehydration was characterized by a skin tenting time of less than 3 seconds, while severe dehydration showed prolonged tenting exceeding 8 seconds. Moderate dehydration (4-8%) was associated with weak suckling reflex, dry mucous membranes, warm oral cavity and partial loss of muscle tone. In cases of severe dehydration ($\geq 10\%$), calves were unable to stand, exhibited complete loss of suckling reflex.

The results of current study correlates well with the findings of Gupta *et al.* (2020) [8], Guzelbektes *et al.* (2007) [9] and Kumar *et al.* (2010) [11].

The dehydration in the calves in the present study might due to loss of body fluid has a result of diarrhoea. Moreover, fecal bicarbonate losses might have resulted in metabolic acidosis. Reduced nutrient intake on account of illness and impaired intestinal absorption might have resulted in hypoglycemia in the affected calves. Therefore, dehydration, hypoglycemia and metabolic acidosis might have contributed in the weak suckling reflex in the affected calves.

Conclusion

The response of therapy in different treatment groups was evaluated on the basis of improvement in clinical parameter, haemato-biochemical parameters on day 06 post treatment. The mean clinical parameters, haematobiochemical values in all the treatment groups on day 0 (pre-treatment) were significantly increased as compared to the apparently healthy control group. Following treatment, this values showed a significant decrease in all the treatment groups and returned towards normalcy in all the groups. In the present study a combination of ofloxacin and ornidazole was given in calves of group (G3) Treatment protocol was found most effective, followed by group II (G2) aqueous extract of *Dalbergia sissoo* leaves then group 1 (G1) *Dalbergia sissoo* leaf powder.

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