SHORT COMMUNICATION

Effect of *Tinospora cordifolia* on Haematological Parameters in Twin-Bearing Periparturient Surti Goats

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Abstract

The present study investigated 12 clinically healthy pregnant Surti goats carrying twin foetuses which were randomly allocated into two groups (n=6 each): a control group (routine diet) and a supplemented group (routine diet supplemented with *Tinospora cordifolia* [Giloy] stem powder at 6% of the total concentrate mixture for 30 days prepartum to 30 days postpartum). Blood samples were collected on days -30, -20, -10, -5 before kidding, on the day of kidding (0) on days +5, +10, +20, +30 after kidding to evaluate haematological parameters. Results indicated that erythrocytic parameters (TEC, Hb and PCV) followed physiological peri-parturient fluctuations with no significant differences between groups. However, *Tinospora cordifolia* supplementation significantly ($p<0.05$) improved leukocyte dynamics, evidenced by higher total leukocyte, neutrophil and lymphocyte counts and a significantly ($p<0.05$) lower neutrophil-to-lymphocyte ratio around kidding, suggesting enhanced immune competence and reduced stress response. In conclusion, *Tinospora cordifolia* supplementation exerted beneficial immunomodulatory effects during the periparturient period, supporting its potential use as a natural phytogenic supplement to enhance physiological resilience in twin-bearing Surti goats.

Keywords: Haematology, Leukocyte dynamics, Periparturient period, Surti goats, *Tinospora cordifolia*.

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Introduction

The transition period, spanning from three weeks prepartum to three weeks postpartum, represents a particularly critical phase for both production and health. During this period, animals frequently experience pronounced negative energy balance accompanied by reduced serum or plasma concentrations of essential minerals and vitamins, indicative of compromised metabolic and health status (Goff, 2006). Early lactation is therefore associated with impaired immune competence and increased disease susceptibility, primarily driven by the imbalance between energy requirements and energy availability (Sordillo, 2016). In this context, the exploration of effective nutritional and therapeutic interventions to support metabolic and immune function during the transition period is of considerable interest.

Traditional veterinary medicinal plants, widely used by indigenous communities, represent a valuable yet under-documented resource in this regard. Concurrently, modern medicine continues to seek novel bioactive agents to replace or complement fewer effective therapies (Pattanayak *et al*., 2016). Among these, *Tinospora cordifolia* (Giloy), also known as *Guduchi*, occupies a prominent position in "*Ayurvedic Materia Medica*" and is classified as a '*Rasayana*' owing to its rejuvenating and immunomodulatory properties. The therapeutic potential of this plant is extensively documented in classical Ayurvedic texts, including the *Charaka Samhita* and *Sushruta Samhita*, supporting its relevance as a natural intervention for improving health and productivity during physiologically demanding periods (Bhattacharyya and Bhattacharya, 2013). Keeping these beneficiary properties into consideration, the present study was planned to investigate the effect of *Tinospora cordifolia* supplementation on haematological parameters in twin-bearing periparturient Surti goats.

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Materials and Methods

A total of 12 clinically healthy advanced pregnant Surti goats carrying twin foetuses were selected for the study which were selected and maintained at maintained at the Pashupalan Sanshodhan Kendra, College of Veterinary

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Science and Animal Husbandry, Kamdhenu University, Ramna Muvada, Gujarat, India. Twin pregnancy was confirmed by ultrasonographic examination. All the procedures involving animals were approved by the Institutional Animal Ethics Committee (F. No.483/VPB/2025) and were conducted in accordance with institutional guidelines for the care and use of animals in research.

The selected animals were randomly allotted into two equal groups, each comprising six goats. Group I served as the control and received routine diet, while Group II served as as treatment group was supplemented with *Tinospora cordifolia* stem powder at 6% of the total concentrate mixture. The supplementation was provided from 30 days before to 30 days after kidding. All goats were maintained under uniform housing, feeding and management conditions.

Whole blood samples were collected at regular intervals, specifically on days –30, –20, –10 and –5 before kidding, on the day of kidding and on days 5, 10, 20 and 30 after kidding. Approximately 2 mL of blood was collected in EDTA vacutainers from the jugular vein of each animal. Haematological parameters, including total erythrocyte count, haemoglobin concentration, packed cell volume, total leukocyte count, absolute lymphocyte count, neutrophil count and neutrophil-to-lymphocyte (N:L) ratio, were analysed using an automated haematology analyser following standard laboratory procedures.

The data obtained were statistically analysed using independent (unpaired) sample t-test and one-way analysis of variance (ANOVA). Statistical procedures were performed according to the methods described by Snedecor and Cochran (2014).

Results and Discussion

Total erythrocyte count, haemoglobin and packed cell volume increased toward kidding in both groups ,peaked on the day of kidding and declined postpartum; however, between-group differences were non-significant (p>0.05) throughout experimental period. Total leukocyte count and neutrophil counts showed a periparturient rise, with significantly (p<0.05) higher TLC and neutrophils in *Tinospora cordifolia* supplemented goats on day 0 and day +5. Lymphocyte counts declined at kidding in controls but remained comparatively higher in supplemented goats, with significant (p<0.05) differences on day 0 and day +5. The neutrophil-to-lymphocyte ratio increased at kidding in both groups but was significantly (p<0.05) lower in the supplemented group on the day of kidding. The peripartum values of different haematological parameters are presented in Table 1.

The haematological changes observed in the present study broadly aligned with earlier reports, though some variations were evident. Unlike Iriadam (2007), who reported a significant decline in RBCs count with advancing pregnancy followed by a sharp rise at parturition in Kilis goats, only partial

Table 1: Mean ± SE values for the hematological parameters of *Tinospora cordifolia* supplemented and non-supplemented periparturient Surti Goats

Haematological Parameters	Groups	Experimental Days peripartum								
		-30	-20	-10	-5	0	5	10	20	30
TEC (10^6/µL)	Control	$13.72^{a}\pm0.67$	$13.54^{ab}\pm1.12$	$14.63^{ab}\pm0.42$	$14.12^{bc}\pm1.39$	$17.29^{c}\pm0.93$	$13.53^{ab}\pm1.15$	$13.13^{ab}\pm1.43$	$11.23^{ab}\pm1.11$	$12.19^{ab}\pm1.71$
	Supplemented	$12.86^{a}\pm0.82$	$14.00^{ab}\pm0.42$	$13.18^{ab}\pm1.06$	$16.18^{bc}\pm1.10$	$17.20^{c}\pm1.28$	$13.71^{ab}\pm0.79$	$13.21^{ab}\pm1.24$	$13.06^{ab}\pm1.00$	$13.65^{ab}\pm0.84$
Hb (g/dL)	Control	$8.93^{a}\pm0.22$	$8.78^{a}\pm0.25$	$9.23^{a}\pm0.26$	$8.87^{a}\pm0.23$	$11.27^{b}\pm0.48$	$9.30^{a}\pm0.41$	$9.07^{a}\pm0.39$	$9.48^{a}\pm0.41$	$9.23^{a}\pm0.41$
	Supplemented	$8.83^{a}\pm0.38$	$9.56^{a}\pm0.41$	$8.97^{a}\pm0.62$	$10.12^{b}\pm0.40^{*}$	$11.52^{b}\pm0.52^{b}$	$9.87^{a}\pm0.47$	$9.10^{a}\pm0.38$	$9.20^{a}\pm0.65$	$9.25^{a}\pm0.55$
PCV (%)	Control	$22.83^{a}\pm1.08$	$22.33^{a}\pm0.49$	$24.17^{ab}\pm0.95$	$26.33^{bc}\pm1.05$	$28.33^{c}\pm0.76$	$24.00^{ab}\pm1.21$	$23.50^{ab}\pm0.76$	$22.33^{a}\pm1.12$	$22.00^{a}\pm1.06$
	Supplemented	$22.67^{a}\pm1.23$	$23.67^{ab}\pm0.88$	$24.17^{ab}\pm1.19$	$26.83^{bc}\pm1.72$	$27.83^{b}\pm1.08$	$24.83^{ab}\pm1.35$	$23.83^{ab}\pm0.60^{a}$	$23.67^{a}\pm0.42$	$22.67^{a}\pm0.88$
TLC (10^3/µL)	Control	$6.72^{ab}\pm0.33$	$8.57^{ab}\pm0.90$	$11.6^{bc}\pm1.95$	$10.37^{c}\pm1.71$	$12.37^{c}\pm1.01$	$12.71^{d}\pm1.55$	$11.0^{abc}\pm2.33$	$8.21^{a}\pm1.08$	$7.13^{ab}\pm1.24$
	Supplemented	$7.04^{ab}\pm1.13$	$7.36^{ab}\pm0.75$	$10.56^{bc}\pm1.72$	$11.98^{c}\pm1.70$	$17.84^{d}\pm1.94^{*}$	$9.78^{abc}\pm1.46^{*}$	$9.26^{abc}\pm1.43$	$5.73^{a}\pm0.52$	$6.47^{ab}\pm0.26$
Neutrophils (10^3/µL)	Control	$3.70^{a}\pm0.43$	$4.93^{ab}\pm0.57$	$6.53^{c}\pm1.92$	$6.70^{bc}\pm0.42$	$7.44^{c}\pm0.36$	$6.78^{c}\pm0.41$	$5.15^{bc}\pm2.51$	$3.85^{a}\pm0.32$	$3.75^{a}\pm1.28$
	Supplemented	$3.93^{a}\pm0.51$	$4.75^{ab}\pm0.22$	$6.70^{c}\pm0.47$	$7.78^{d}\pm0.39^{*}$	$8.37^{d}\pm0.59^{*}$	$8.38^{d}\pm0.24^{*}$	$6.15^{bc}\pm1.05$	$4.14^{a}\pm0.31$	$3.46^{a}\pm0.22$
Lymphocytes (10^3/µL)	Control	$5.27^{a}\pm0.55$	$4.53^{a}\pm0.20$	$4.47^{a}\pm0.49$	$4.25^{a}\pm0.55$	$3.50^{b}\pm0.39$	$3.96^{b}\pm0.49$	$5.30^{a}\pm0.58$	$5.05^{a}\pm1.12$	$4.74^{a}\pm1.10$
	Supplemented	$5.73^{a}\pm0.40$	$5.48^{a}\pm0.51$	$5.10^{a}\pm0.37$	$5.09^{a}\pm0.60$	$5.16^{a}\pm0.75^{*}$	$6.15^{a}\pm0.87^{*}$	$5.87^{a}\pm0.63$	$5.72^{a}\pm0.51$	$5.74^{a}\pm0.42$
N:L ratio	Control	$0.73^{a}\pm0.10$	$1.11^{a}\pm0.15$	$1.48^{abc}\pm0.25$	$1.73^{bc}\pm0.61$	$2.63^{d}\pm0.15$	$1.81^{bc}\pm0.74$	$0.91^{ab}\pm0.44$	$1.14^{a}\pm0.41$	$1.35^{a}\pm0.83$
	Supplemented	$0.68^{a}\pm0.07$	$0.90^{a}\pm0.09$	$1.33^{abc}\pm0.10$	$1.47^{abc}\pm0.31$	$2.10^{c}\pm0.14^{*}$	$1.95^{ab}\pm0.47$	$1.16^{ab}\pm0.28$	$0.76^{a}\pm0.10$	$0.62^{a}\pm0.06$

Mean values with different superscript letters (a, b, c, d) within a row indicates statistically significant (p<0.05) differences between sampling days within a group. Whereas, * indicate significant differences between two groups within the same column at p<0.05.

agreement was observed, likely due to differences in breed, nutritional management and experimental conditions. In contrast to Samui *et al*. (2023), who documented a progressive postpartum increase in haemoglobin concentration in Black Bengal goats, the present haemoglobin pattern differed, possibly reflecting differences in physiological adaptation and sampling design. The observed increase in packed cell volume was consistent with Farrag (2024), who reported improved erythrocytic indices in *Moringa oleifera* supplemented Baladi goats, suggesting a beneficial effect of phytogenic supplementation. The significant rise in total leukocyte count corroborated with the findings of Mallick and Prakash (2011), who demonstrated enhanced leukocyte response following *Guduchi &* supplementation, indicating immunostimulatory activity of *Tinospora cordifolia*. The increase in neutrophil counts during the early postpartum period was consistent with the findings of Tharwat *et al*. (2015) and reflected parturition-associated stress and immune adaptation. Additionally, the observed leukocytosis accompanied by relative lymphopenia on the day of kidding supported the findings of Azab and Maksoud (1999), indicative of stress-mediated haematological shifts. The significant alteration in neutrophil-lymphocyte ratio further aligned with Mallick and Prakash (2011), reinforcing the role of *Tinospora cordifolia* in modulating immune responses during the peri-parturient period.

In conclusion, during the periparturient period, goats exhibited marked physiological alterations in haematological parameters, reflecting adaptive responses to metabolic and immunological stress associated with parturition. Compared with the control group, goats supplemented with *Tinospora cordifolia* demonstrated relatively improved erythrocytic indices and a more stable leukocyte profile, along with a moderated neutrophil-to-lymphocyte ratio. These findings indicate that although haematological fluctuations are inherent to this transition phase, *Tinospora cordifolia* supplementation may confer immunomodulatory benefits, thereby enhancing physiological resilience and maintaining systemic homeostasis during late gestation and early lactation.

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