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Hematological Parameters of Saanen × Bach Thao Crossbred Goats Fed Corn Stover Silage

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ABSTRACT: This study evaluated the effects of corn stover silage on hematological parameters of Saanen × Bach Thao crossbred goats under semi-intensive management conditions. Forty-five six-month-old goats (average body weight 12 kg) were randomly allocated to three dietary treatments in a completely randomized design with three replicates (five animals per replicate). The control group (CON) was fed fresh elephant grass and 1.0 kg/head/day of concentrate. Treatment 1 (T1) and Treatment 2 (T2) were fed corn stover silage combined with elephant grass and reduced concentrate levels of 0.5 and 0.2 kg/head/day, respectively. The experimental period lasted 90 days following a two-week adaptation phase. Blood samples were collected at four time points: before the trial, at day 45, at day 90, and one week post-trial. Hematological indices were analyzed using an automated hematology analyzer, and data were processed using descriptive statistics and T-tests at $\alpha = 0.05$. Results indicated that most hematological parameters, including white blood cells (WBC), red blood cells (RBC), hemoglobin (HGB), hematocrit (HCT), and platelet indices (PLT), remained within physiological reference ranges throughout the experimental period. No significant adverse effects of corn stover silage inclusion were observed. Minor fluctuations among treatments were detected but were not biologically meaningful. These findings suggest that corn stover silage can be effectively incorporated into diets of Saanen × Bach Thao crossbred goats without compromising hematological health status.

KEYWORDS: alternative feed resources; blood physiology; corn stover silage; hematology; Saanen × Bach Thao crossbred goats.

I. INTRODUCTION

Goat production plays an increasingly important role in diversified livestock systems in tropical and subtropical regions, particularly under conditions of limited grazing land and rising feed costs. In Vietnam, crossbreeding programs between Saanen and Bach Thao goats have been promoted to combine the high growth potential and dairy aptitude of Saanen with the heat tolerance, disease resistance, and adaptability of the indigenous Bach Thao breed. The resulting Saanen × Bach Thao crossbred goats exhibit improved productive performance while maintaining resilience under semi-intensive management systems. However, nutritional management remains a critical determinant of their productivity and health status.

Rapid urbanization, land-use conversion, and climate variability—especially prolonged dry seasons—have significantly reduced the availability of natural pastures and green forages. Consequently, sustainable goat production increasingly depends on alternative feed resources and effective feed preservation strategies. Among these, silage technology represents a scientifically validated method for conserving forages while minimizing nutrient losses through controlled lactic acid fermentation. Although widely adopted in cattle production, the use of silage in goat feeding systems remains comparatively limited, largely due to traditional grazing practices and insufficient technical dissemination.

Corn (*Zea mays L.*) is one of the most widely cultivated cereal crops globally, generating substantial quantities of crop residues after grain harvest. Corn stover—which includes stems, leaves, and remaining structural tissues—is characterized by moderate dry matter content, considerable fiber fractions (neutral detergent fiber and acid detergent fiber), and appreciable residual energy. Importantly, this material differs fundamentally from corn by-products such as corn pulp or processing residues; corn stover refers specifically to the above-ground vegetative portion of the maize plant remaining after ear harvest. As an abundant and underutilized agricultural by-product, corn stover represents a promising roughage source for ruminants, particularly when preserved as silage.

Ensiling corn stover enhances its feeding value by improving palatability, stabilizing nutrients, reducing anti-nutritional factors, and increasing microbial accessibility of structural carbohydrates. Fermentation-derived organic acids contribute to preservation

and may positively influence rumen microbial ecology. Nevertheless, the relatively high fiber and moderate protein content of corn stover silage necessitate evaluation of its physiological impact when used to partially replace concentrate feeds in growing goats. While performance parameters such as weight gain are commonly assessed, hematological indices provide a more sensitive and objective measure of systemic physiological responses to dietary modification.

Hematological parameters—including leukocyte counts, erythrocyte indices, hemoglobin concentration, and platelet profiles—serve as critical biomarkers of immune competence, oxygen transport capacity, metabolic status, and overall health in small ruminants. These indices are generally stable traits influenced by genetics, age, nutrition, and environmental stressors. Nutritional imbalances, subclinical inflammation, or metabolic stress can manifest as alterations in white blood cell counts, anemia-related indices, or thrombopoietic activity. Therefore, monitoring blood physiological parameters offers a rigorous approach to assessing the safety and biological adequacy of alternative feed resources.

Despite the agronomic abundance of corn stover in maize-producing regions, limited information is available regarding its long-term physiological effects when ensiled and incorporated into diets of crossbred goats under semi-intensive systems. In particular, there is a paucity of data evaluating hematological responses to graded reductions in concentrate supplementation when corn stover silage is included in the ration. Accordingly, this study was conducted to investigate the effects of corn stover silage inclusion at different concentrate replacement levels on hematological parameters of Saanen × Bach Thao crossbred goats over a 90-day feeding period. By integrating nutritional strategy with physiological assessment, the study aims to provide scientific evidence supporting the safe and sustainable utilization of corn stover silage in goat production systems facing increasing feed resource constraints.

II. MATERIALS AND METHODS

A. Experimental Animals and Design

The experiment was conducted using 45 Saanen × Bach Thao crossbred goats (6 months old; average body weight 12 kg). Animals were individually housed in pens measuring 1.5 × 1.0 m. After vaccination and a two-week adaptation period, goats were randomly assigned to three treatments in a completely randomized design:

Control (CON): Fresh elephant grass + 1.0 kg concentrate/head/day.

Treatment 1 (T1): Corn stover silage + elephant grass + 0.5 kg concentrate/head/day.

Treatment 2 (T2): Corn stover silage + elephant grass + 0.2 kg concentrate/head/day.

Each treatment included three replicates of five goats. Feeding was conducted four times daily (06:00, 10:00, 14:00, and 16:00). Clean water was provided ad libitum. The experimental period lasted 90 days.

B. Blood Sampling and Analysis

Blood samples were collected from the jugular vein between 08:00 and 10:00 h, following morning feeding, under stable weather conditions. Approximately 5 mL of blood was drawn into EDTA anticoagulant tubes using sterile 18G needles. Samples were gently mixed, stored in a cooled container, and analyzed within 2 hours.

Hematological parameters were measured using an automated hematology analyzer (Hemacreen). The following indices were evaluated: White blood cells (WBC), lymphocytes (LYM), monocytes (MONO), neutrophils (NEUT), Red blood cells (RBC), hemoglobin (HGB), hematocrit (HCT), Mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), mean corpuscular hemoglobin concentration (MCHC), Red cell distribution width (RDW-SD, RDW-CV), Platelet count (PLT), mean platelet volume (MPV), platelet distribution width (PDW), plateletcrit (PCT), platelet large cell ratio (P-LCR)

Sampling was conducted at four time points: One week before the trial; Day 45; Day 90 (end of trial); One week post-trial

C. Statistical Analysis

Data were processed using Microsoft Excel. Descriptive statistics (mean ± SD) were calculated. Differences among treatmentswere evaluated using T-tests with a significance level of $\alpha = 0.05$.

III. RESULTS

A. Baseline Hematological Parameters

The results of monitoring the physiological indicators of goats before the experiment were presented in Table 1. Before dietary treatments, hematological values did not differ substantially among groups, indicating homogeneity of experimental animals. Baseline WBC ranged from 15.38 to 16.35 $\times 10^9$/L, RBC from 1.69 to 2.51 $\times 10^{12}$/L, and HGB from 7.58 to 7.63 g/dL.

Hematological Parameters of Saanen × Bach Thao Crossbred Goats Fed Corn Stover Silage

Table 1. Blood Physiological Parameters of Saanen x Bach Thao Crossbred Goats one Week before the Experiment

Parameter	CON	T1	T2
WBC (10^9/L)	15,38±0,38	16,35±0,39	15,41±0,37
LYM (10^9/L)	10,23±1,13	10,53±0,99	10,95±0,77
MONO (10^9/L)	1,19±0,72	1,23±1,38	1,31±1,33
NEUT (10^9/L)	3,35±1,10	3,68±2,86	3,20±3,58
RBC (10^{12}/L)	2,51±0,43	1,69±1,07	2,07±0,07
HGB (g/dL)	7,58±1,58	7,63±2,25	7,60±2,10
HCT (%)	1,50±1,27	1,65±1,50	1,15±1,19
MCV (fL)	34,13±6,42	34,98±6,22	31,45±5,41
MCH (pg)	32,33±4,22	31,45±3,90	32,23±4,13
MCHC (g/dL)	70,33±5,18	68,95±7,90	67,30±9,29
RDW-SD (fL)	24,90±5,16	23,80±4,96	23,85±5,40
RDW-CV (%)	13,90±1,52	13,87±0,81	13,68±0,92
PLT (10^9/L)	687,63±30,89	698,50±75,79	635,50±41,90
MPV (fL)	10,05±5,17	11,60±6,12	11,35±5,53
PDW (%)	14,75±3,67	16,15±2,87	13,40±2,28
PCT (%)	0,69±0,80	0,83±0,42	0,97±0,37
P-LCR (%)	66,73±4,61	66,83±5,31	65,73±4,54

B. Hematological Changes at Day 45

After 45 days, WBC values ranged from 16.43 to 17.38 ×10^9/L across treatments. RBC values showed slight increases in silage-fed groups (2.22–2.33 ×10^{12}/L) compared to control (2.16 ×10^{12}/L). HGB concentrations remained stable (~7.16–7.18 g/dL). Platelet counts (736–768 ×10^9/L) were comparable among treatments (Table 2). These results indicate that inclusion of corn stover silage did not induce inflammatory responses or anemia.

Table 2. Blood Physiological Parameters of Saanen x Bach Thao Crossbred Goats on day 45 of the Experiment

Parameter	CON	T1	T2
WBC (10^9/L)	17,38±0,22	16,43±0,37	17,38±0,29
LYM (10^9/L)	12,20±2,34	11,93±1,65	12,43±1,19
MONO (10^9/L)	1,90±1,24	1,80±0,95	1,74±1,13
NEUT (10^9/L)	3,23±2,24	2,63±2,56	3,13±2,28
RBC (10^{12}/L)	2,16±0,61	2,22±0,35	2,33±0,74
HGB (g/dL)	7,17±3,82	7,18±3,65	7,16±3,64
HCT (%)	1,40±1,15	1,58±1,13	1,32±1,17
MCV (fL)	39,51±8,14	39,95±7,66	40,68±8,75
MCH (pg)	32,40±4,53	33,98±5,45	32,90±4,63
MCHC (g/dL)	73,81±4,27	73,28±5,71	72,20±6,32
RDW-SD (fL)	25,83±7,06	24,40±7,63	23,25±6,74
RDW-CV (%)	14,34±1,36	13,55±1,33	12,93±0,90
PLT (10^9/L)	736,00±42,32	756,75±48,62	767,75±47,25
MPV (fL)	11,38±0,23	12,40±0,48	11,60±0,38
PDW (%)	15,01±0,42	15,58±0,65	15,50±0,85
PCT (%)	0,58±0,16	0,70±0,41	0,66±0,27
P-LCR (%)	68,38±5,29	67,70±5,44	67,68±5,83

C. Hematological Parameters at Day 90

At the end of the 90-day period, hematological indices remained within normal physiological ranges (Table 3). WBC values were stable (16.73–17.48 ×10^9/L). RBC ranged from 2.13 to 2.50 ×10^{12}/L, with slightly higher values in T2. Hemoglobin and

hematocrit showed no significant treatment effects. Minor variations in erythrocyte indices (MCV, MCH, MCHC) were observed but without pathological implications. Platelet indices also remained stable, suggesting normal hemostatic function.

Table 3. Blood Physiological Parameters of Saanen x Bach Thao Crossbred Goats on day 90 of the Experiment

Parameter	CON	T1	T2
WBC (10^9/L)	17,23±0,31	16,73±0,26	17,48±0,43
LYM (10^9/L)	11,02±0,42	10,63±0,46	10,80±0,36
MONO (10^9/L)	2,93±0,46	2,73±1,18	2,98±0,56
NEUT (10^9/L)	3,93±0,74	3,73±0,68	3,32±0,48
RBC (10^{12}/L)	2,13±2,30	2,28±2,03	2,50±2,17
HGB (g/dL)	7,61±1,05	7,43±0,93	7,35±0,04
HCT (%)	1,18±0,66	1,71±0,68	1,80±0,72
MCV (fL)	32,45±1,77	31,47±2,18	30,46±1,82
MCH (pg)	28,08±4,12	29,25±4,63	29,38±4,10
MCHC (g/dL)	50,93±5,50	50,74±5,39	52,03±5,89
RDW-SD (fL)	50,08±5,40	49,57±5,83	49,95±4,94
RDW-CV (%)	22,68±5,40	22,48±5,31	22,15±5,60
PLT (10^9/L)	712,38±0,11	12,23±0,10	12,25±0,17
MPV (fL)	11,75±34,22	12,50±40,96	11,75±33,56
PDW (%)	16,39±1,04	17,90±0,95	17,88±0,90
PCT (%)	0,61±0,22	0,91±0,36	0,83±0,23
P-LCR (%)	67,19±6,03	68,22±7,92	66,81±9,12

D. Post-Trial Evaluation

One week after trial completion, hematological parameters showed no residual adverse effects. RBC values slightly increased across treatments (2.69–3.08 ×10^{12}/L), and HGB ranged from 7.21 to 8.37 g/dL. All immune cell counts remained stable. The results of monitoring the physiological indicators of goats after the experiment one week were presented in Table 4.

Table 4. Blood Physiological Parameters of Saanen x Bach Thao Crossbred Goats after the 1-Week Experiment

Parameter	CON	T1	T2
WBC (10^9/L)	17,71±2,79	17,43±3,57	16,78±3,39
LYM (10^9/L)	12,13±1,70	12,22±1,82	11,45±1,5
MONO (10^9/L)	2,71±0,63	3,23±0,91	2,96±1,04
NEUT (10^9/L)	2,88±1,56	2,98±1,35	2,37±1,11
RBC (10^{12}/L)	2,69±7,18	3,06±6,37	3,08±5,29
HGB (g/dL)	7,99±1,96	8,37±2,71	7,21±2,37
HCT (%)	1,92±0,87	1,58±0,53	1,71±0,41
MCV (fL)	31,16±0,24	32,13±0,63	31,99±0,41
MCH (pg)	30,68±1,07	31,03±1,52	32,06±0,76
MCHC (g/dL)	7,02±0,82	7,94±2,22	6,42±1,45
RDW-SD (fL)	32,68±0,24	32,7±0,74	32,35±0,71
RDW-CV (%)	35,65±3,22	34,32±5,99	36,59±6,67
PLT (10^9/L)	719,96±10,42	706,57±21,83	714,87±24,46
MPV (fL)	25,07±1,92	25,39±2,89	24,79±2,64
PDW (%)	18,44±1,49	18,83±1,98	18,68±1,91
PCT (%)	0,81±0,46	0,93±0,61	0,88±0,57
P-LCR (%)	68,93±10,31	67,13±10,45	68,43±9,16

IV. DISCUSSION

The present study evaluated the effects of corn stover silage inclusion at different concentrate replacement levels on hematological parameters of Saanen × Bach Thao crossbred goats over a 90-day feeding period. Overall, the hematological profiles remained stable across treatments and sampling times, indicating that partial substitution of concentrate with corn stover silage did not adversely affect physiological homeostasis, immune status, or erythropoietic function.

White blood cell (WBC) counts are widely recognized as primary indicators of immune competence and inflammatory responses in ruminants. In the current study, WBC values ranged approximately from 15.3 to 17.7 $\times 10^9$/L throughout the experimental period. Although minor fluctuations were observed among treatments and sampling times, no consistent increasing or decreasing trend was associated with corn stover silage inclusion. Importantly, values remained within established physiological reference ranges for growing goats. At day 45 and day 90, WBC counts in silage-fed groups (T1 and T2) were comparable to the control group, suggesting that dietary inclusion of corn stover silage did not induce systemic inflammatory responses. Elevated WBC counts in ruminants are typically associated with infection, stress, or inflammatory challenges. The absence of such elevation supports the hygienic quality of the silage and the adequacy of management conditions.

Differential leukocyte counts (lymphocytes, monocytes, and neutrophils) also showed no biologically meaningful differences among treatments. Lymphocytes constituted the predominant leukocyte population, consistent with normal immunological patterns in goats. The stability of lymphocyte counts indicates maintained adaptive immune function, while neutrophil values suggest absence of acute stress or bacterial infection. Monocyte counts exhibited moderate variation over time but without treatment-specific trends, implying normal mononuclear phagocyte system activity. Collectively, the leukocyte data confirm that replacing part of the concentrate with corn stover silage did not compromise immune stability in Saanen × Bach Thao crossbred goats.

Red blood cell (RBC) count, hemoglobin concentration (HGB), and hematocrit (HCT) are critical indicators of erythropoietic activity and oxygen transport capacity. Across all sampling periods, RBC values ranged approximately from 2.0 to 3.1 $\times 10^{12}$/L, while HGB values were generally between 7.1 and 8.4 g/dL. These ranges are consistent with reported physiological norms for growing goats under tropical and subtropical conditions. No significant reduction in RBC, HGB, or HCT was observed in T1 or T2 despite the reduced concentrate inclusion levels. This finding is particularly important because concentrate feeds are typically major sources of dietary protein and energy, both essential for erythropoiesis. The absence of anemia or reductions in hemoglobin concentration suggests that corn stover silage, when combined with elephant grass and appropriate concentrate supplementation, provided adequate nutrients to sustain red blood cell synthesis.

At day 90, RBC values in T2 were numerically higher than in the control group, although differences were not statistically significant. This may reflect compensatory physiological adaptation or improved ruminal fermentation efficiency associated with fiber-rich silage diets. High-fiber diets can stimulate rumination and saliva production, enhancing rumen buffering capacity and microbial protein synthesis, which indirectly supports hematopoiesis.

Mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), and mean corpuscular hemoglobin concentration (MCHC) provide insight into red blood cell morphology and hemoglobinization status. In the present study, these indices fluctuated moderately during the experimental period but did not exhibit consistent treatment-related deviations. At mid-trial (day 45), MCV values slightly increased compared to baseline across all groups. Such changes may reflect age-related physiological development rather than dietary effects, as the animals were still growing. By day 90, MCV values decreased slightly but remained within physiological limits, suggesting normal erythrocyte maturation.

MCH and MCHC values remained relatively stable across treatments. The absence of hypochromic or macrocytic patterns indicates that micronutrient supply—particularly iron, copper, and B-vitamins—was sufficient to maintain normal hemoglobin synthesis. This is noteworthy because agricultural by-products such as corn stover are sometimes considered nutritionally inferior. The ensiling process likely improved digestibility and nutrient availability, mitigating potential deficiencies.

Red cell distribution width (RDW-SD and RDW-CV) increased slightly at later sampling points. RDW reflects heterogeneity in erythrocyte size and can increase during regenerative erythropoiesis. However, since RBC and HGB values remained stable, the moderate RDW variation likely represents physiological adaptation rather than pathological change.

Platelet count (PLT) and associated indices (MPV, PDW, PCT, P-LCR) are indicators of thrombopoietic activity and hemostatic balance. Throughout the experiment, platelet counts remained relatively stable, with no significant differences among treatments. At day 45, PLT values in silage-fed groups were slightly higher than in the control group; however, these differences were not statistically significant and remained within normal ranges. Platelet indices such as MPV and PDW showed minor fluctuations but no consistent treatment-related patterns. Stable platelet profiles suggest that corn stover silage inclusion did not affect bone marrow function or induce subclinical inflammatory processes. Since platelet production can be influenced by nutritional stress or systemic inflammation, the observed stability further supports the safety of the dietary treatments.

An important observation of this study is the absence of abrupt hematological disturbances during the transition from adaptation phase to experimental feeding. Blood parameters measured one week after the trial concluded remained comparable to end-of-trial values, indicating no delayed adverse effects. Slight temporal variations observed across sampling points are likely attributable to growth, environmental conditions, and normal physiological maturation rather than dietary factors. Goats at six months of age are still undergoing rapid development, which can influence hematological values independently of diet.

From a production perspective, the ability to replace part of concentrate feed with corn stover silage without negatively affecting hematological health is economically and environmentally significant. Concentrates often represent the most expensive component of goat diets. Utilizing locally available agricultural residues such as corn stover can reduce feed costs and dependence on imported ingredients. Moreover, ensiling enhances feed preservation, reduces seasonal feed shortages, and contributes to more stable year-round feeding strategies. The present findings provide physiological evidence that such substitution does not compromise animal health, thereby supporting wider adoption of silage technology in semi-intensive and smallholder goat production systems.

Subsequent work by Bernes and Stengärde (2012) further confirmed that feeding silage instead of hay did not significantly affect feed intake or live weight gain in sheep, although marginally higher values were sometimes observed in hay-fed groups. Comparable outcomes have been documented in cattle production systems. Studies conducted by Ayaşan et al. (2012) reported no differences in body weight or average daily gain between animals offered high-quality fresh forage and those receiving silage-based diets. Similar conclusions were drawn by Juniper et al. (2005), Kirkland and Patterson (2006), and Browne et al. (2005), who observed comparable growth performance across various combinations of maize silage, grass silage, alfalfa silage, and ensiled root crops. Collectively, these studies suggest that well-prepared silage can maintain productive performance equivalent to conventional forage sources when diets are properly balanced.

The findings of the present study align with earlier research examining the effects of different forage conservation strategies on growth performance and physiological parameters in small ruminants. Previous investigations comparing hay, grass silage, and maize silage as primary forage sources have generally reported minimal impacts on rumen fermentation characteristics and systemic metabolic indicators. For example, studies by Bernes and colleagues (2008) demonstrated that replacing hay with silage did not significantly alter ruminal pH, ammonia (NH_3) concentration, or the major volatile fatty acids (acetate, propionate, and butyrate), which are key end-products of rumen microbial fermentation. Likewise, serum biochemical indices such as glucose, total protein, and albumin were not influenced by forage type, indicating preserved metabolic homeostasis.

Within the Vietnamese context, investigations into ensiled agricultural by-products have yielded consistent results. Research by Nguyen H. Q. and Nguyen X. B. (2008), as well as Nguyen H. V. et al. (2008), demonstrated favorable responses in ruminants fed ensiled cassava pulp, with no detrimental effects on physiological status. More recent work on Phan Rang sheep by Nguyen D. T. et al. (2021) reported normal growth performance when silage was incorporated into the diet; final body weight at day 90 ranged from 19.0 to 19.9 kg without significant differences among treatments ($P > 0.05$). Importantly, subsequent hematological evaluations in the same breed by Nguyen B. P. et al. (2023) confirmed that silage feeding did not adversely affect blood physiological indices. Furthermore, recent studies focusing on dairy-type goats have reached similar conclusions. Investigations conducted by Nguyen T.T.H. (2024) and Hien, N.T.T. (2024) demonstrated that inclusion of silage in diets of Saanen goats did not alter hematological or serum biochemical parameters.

Taken together, these findings corroborate the results of the present study, reinforcing the view that properly fermented corn stover silage can be incorporated into ruminant diets without compromising growth performance, metabolic stability, or hematological health. The current data therefore contribute additional physiological evidence supporting the safe and sustainable utilization of corn stover silage in goat production systems.

The stability of hematological parameters observed in the present study is further supported by a broad body of literature indicating that blood profiles in goats are influenced more strongly by genetic background, physiological status, and management conditions than by moderate dietary modifications when nutrient requirements are adequately met. For instance, Al-Seaf and Al-Harbi (2012) demonstrated significant breed-related variability in hematological traits and immune responsiveness among goat genotypes and their crosses, emphasizing the genetic component underlying leukocyte counts and lymphocyte proliferation. Similarly, comparative studies across breeds by El Nasri et al. (2016) and Samira A.M. et al. (2016) confirmed that differences in blood biochemical and hematological parameters are frequently attributable to breed and production system rather than feed type alone.

Reference ranges established for Saanen goats by E. B. (2012), as well as standardized biochemical intervals reported in the Merck Veterinary Manual (Meck, 2016), indicate that the values recorded in the current experiment fall within accepted physiological limits. Comparable hematological baselines have been described in various goat breeds, including West African Dwarf goats (Opara et al., 2010), Girgentana goats (Piccione et al., 2010), and Boer × Hair goat crossbreeds (Ozgur et al., 2019).

These studies collectively demonstrate that WBC, RBC, HGB, and platelet indices typically fluctuate within relatively narrow physiological margins in clinically healthy goats.

Management system and environmental adaptation have also been shown to influence hematological profiles. Olayemi et al. (2009) reported that rearing system and sex significantly affected hematological indices in West African Dwarf goats, while Mellado et al. (2006) identified relationships between blood metabolites and grazing-based diets under rangeland conditions. However, when dietary treatments are nutritionally balanced, hematological stability is generally maintained. For example, Washaya et al. (2019) found no detrimental changes in hematological or biochemical parameters when goats were supplemented with legume forages, and Belewu and Ogunsola (2010) observed that alternative protein sources in mixed rations did not adversely affect blood indices when diets were properly formulated.

Within Vietnam, breed-related hematological characteristics of Bach Thao, Boer, and Saanen goats have been documented by Nguyen T. T. H. et al. (2022), who reported values comparable to those observed in the present experiment. Taken together, these findings reinforce the interpretation that the inclusion of corn stover silage in the diets of Saanen × Bach Thao crossbred goats did not induce pathological alterations in blood physiology. Rather, the hematological stability recorded here is consistent with established reference ranges and with previous evidence demonstrating that well-balanced ruminant diets—regardless of forage conservation method—are compatible with normal immune, erythropoietic, and metabolic function.

In summary, the comprehensive evaluation of leukocyte, erythrocyte, and platelet parameters demonstrates that corn stover silage can be safely incorporated into diets of Saanen × Bach Thao crossbred goats for at least 90 days. Hematological stability confirms adequate nutritional supply and absence of systemic stress or inflammatory responses. These results reinforce the feasibility of using corn stover silage as a sustainable alternative feed resource in goat production under conditions of forage scarcity and increasing production intensification.

V. CONCLUSIONS

Inclusion of corn stover silage in diets of Saanen × Bach Thao crossbred goats for 90 days did not adversely affect hematological parameters. Most blood indices remained within physiological ranges, indicating maintained health and normal immune function. Corn stover silage can therefore be considered a safe and viable alternative feed resource for sustainable goat production under semi-intensive systems.

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