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Effects of Dietary Turmeric Powder Supplementation on Nutrient Digestibility and Haemato-biochemical Parameters in Konkan Kanyal Goats

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

A 90-day feeding trial was conducted to evaluate the effect of turmeric (*Curcuma longa* L.) powder supplementation on nutrient digestibility, feed utilization and haemato-biochemical parameters in Konkan Kanyal kids. Twenty weaned kids were randomly divided into five treatment groups: T_1 (control, no turmeric), T_2 (3 g/day), T_3 (6 g/day), T_4 (9 g/day) and T_5 (12 g/day). Nutrient digestibility improved progressively with increasing turmeric levels, with dry matter, crude protein, ether extract, crude fiber, nitrogen-free extract and ash digestibility rising from 81.37%, 74.17%, 77.51%, 77.58%,

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61.02% and 71.22% in T_1 to 84.96%, 78.74%, 80.67%, 81.85%, 64.13% and 77.23% in T_5, respectively. Feed conversion efficiency was highest in T_4 (FCR: 9.68), indicating efficient nutrient utilization. Haemato-biochemical observations revealed improved haemoglobin concentration and red blood cell counts, along with a dose-dependent reduction in serum cholesterol, with the most pronounced effects observed in T_5 (12 g turmeric powder supplementation), without any adverse impact on immune status. Overall, turmeric supplementation enhanced digestibility, feed efficiency and metabolic health, confirming its potential as a safe phytogenic feed additive in goats.

Keywords: Phytogenic feed additive; digestibility; serum biochemistry; curcumin; metabolic profile; goat nutrition; indigenous.

1. INTRODUCTION

The effect of dietary turmeric powder supplementation on nutrient digestibility and haematological-biochemical parameters in goats has gained increasing attention as part of the global search for sustainable feeding strategies in livestock production. Phytogenic feed additives, particularly turmeric (*Curcuma longa* L.), have emerged as promising natural alternatives to synthetic growth promoters due to their bioactive compounds, mainly curcuminoids, which are renowned for their antioxidant, anti-inflammatory, antimicrobial, anticoccidial and immunomodulatory effects (Adebisi et al., 2022; Ashraf et al., 2020). These properties can improve gastrointestinal health, stimulate digestive enzyme activity and enhance microbial fermentation in the rumen, resulting in better nutrient digestibility. At the same time, curcumin helps regulate immune function and metabolic pathways, which is reflected in improved haematological and biochemical profiles of supplemented animals.

Konkan Kanyal goats, an indigenous dual-purpose breed of the Konkan region of Maharashtra, India, play a vital role in the livelihood of smallholder farmers due to their adaptability to local conditions and contribution to meat production. However, their productivity is often constrained by nutritional limitations, disease challenges and heat stress (Narute et al., 2012). Among these, heat stress is a major concern, particularly in tropical climates, as it alters metabolic and endocrine functions. Animals under heat stress experience oxidative stress, leading to DNA damage, apoptosis and inflammation, along with suppression of immune function (Nisar, 2019; Aderinboye et al., 2021). Prolonged thermal stress further disrupts metabolic, immune and reproductive functions by activating the sympathetic-adrenal medullary system and the hypothalamic-pituitary-adrenal (HPA) axis (Oderinwale et al., 2019). These disturbances not only compromise animal health but also reduce feed efficiency and productivity.

Monitoring nutrient digestibility and haemato-biochemical parameters provides reliable indicators of metabolic efficiency and systemic health in goats. Nutritional interventions that can positively influence these parameters are therefore crucial in designing feeding strategies for indigenous breeds. Several studies have shown that turmeric supplementation improves dry matter, crude protein, ether extract and fiber digestibility, while also exerting positive effects on blood indices such as haemoglobin concentration, red blood cell count and lipid profile, without negatively affecting immune function (Aderinboye et al., 2021; Oderinwale et al., 2019; Adebisi et al., 2022). Such evidence highlights the dual benefits of turmeric in enhancing both nutrient utilization efficiency and metabolic stability in goats.

In this context, the present study was undertaken to evaluate the effect of dietary turmeric powder supplementation at graded levels (3, 6, 9 and 12 g/day) on nutrient digestibility and haemato-biochemical profiles of Konkan Kanyal goats under a 90-day feeding trial. The aim was to determine the efficacy of turmeric as a natural phytogenic feed additive that could improve digestive efficiency, metabolic health and overall productivity in goats, thereby offering a sustainable strategy for smallholder goat production systems (Caroprese et al. 2014).

2. MATERIALS AND METHODS

- **Experimental Animals and Design**

Treatment details:-

Number of treatments: 5
No. of replications: 4
Total no. of animals: 20

- **Experimental layout:-**

Basal diet (Green Sampoorna grass + Jowar kadabi + goat pellets)

T_1: Control (No Turmeric powder) Basal diet
T_2: Basal diet + 3 gm Turmeric powder
T_3: Basal diet + 6 gm Turmeric powder
T_4: Basal diet + 9 gm Turmeric powder
T_5: Basal diet + 12 gm Turmeric powder

Turmeric powder was given as a feed supplement along with concentrate i.e. goat pellets.

- **Chemical Composition of Experimental feed:**

Table 1. Chemical composition of experimental feed

Sr. No	Attributes (%)	Feed ingredients			
		Turmeric Powder	Jowar kadabi	Sampoorna grass	Goat pellet
1	DM	91.15	89.10	23.50	86.65
2	CP	9.95	3.25	9.90	19.40
3	CF	12.11	35.80	23.70	10.90
4	EE	2.46	1.62	5.80	3.80
5	Ash	6.82	6.80	8.90	10.50
6	NFE	68.66	52.53	52.00	55.40

The feed composition shows that turmeric powder is rich in energy (high NFE, 68.66%) with moderate protein, while jowar kadabi is very fibrous (35.80% CF) and low in protein, serving mainly as roughage. Sampoorna grass provides bulk with moderate protein and higher fat, though it has high moisture. Goat pellet is the most balanced feed, with high protein (19.40%), minerals and good energy, making it the best concentrate supplement for growth and productivity.

- **Blood Collection and Haemato-biochemical Analysis**

Blood samples (approximately 10 ml) were collected from each goat via jugular vein using hypodermic syringes before feeding. Blood collection was done at the end of the experiment. Blood (5 ml) was drawn into a heparinized tube to prevent coagulation while the remaining 5 ml was left in the syringe to coagulate. Various haemato-biochemical parameters viz., WBC count, RBC count, Haemoglobin, Total protein, Serum albumin and Serum globulin were determined from local pathological lab as per standard methods with Instrument named BC-5000. (AOAC, 1995).

- **Statistical analysis**

The statistical method known as "Analysis of variance" (ANOVA), which is suitable for the Randomized Block Design, was used to examine the gathered data. For treatment comparison, the standard errors (SE) and critical differences (CD) at the 5% level of significance were calculated and displayed in the corresponding tables. (Snedecor and Cochran, 1994, Ferreira and Palermo-Neto 2012).

3. RESULTS AND DISCUSSION

3.1 Feed Intake

The average feed intake of kids across the treatment groups was as follows: T_1 – 1179.25, T_2 – 1205.50, T_3 – 1185.75, T_4 - 1167.75 and T_5 – 1161.50 g/day. The highest feed intake was recorded in treatment group T_2 (1205.50 g/day), while the lowest was observed in T_5 (1161.50 g/day). The total feed intake over the 90-day trial period ranged from 104.54 kg in T_5 to 108.50 kg in T_2.

Statistical analysis revealed a significant difference in daily feed intake among the five treatment groups. T_2 showed the highest intake, indicating improved palatability, while T_4 and T_5 recorded comparatively lower values than T_1, T_2 and T_3. In comparison, Jansuk et al. (2022) reported higher feed intake, with the control group (T_1) recording 1709.43 g/day, while kids supplemented with 2% and 4% turmeric powder showed slightly lower values of 1661.96 g/day and 1651.28 g/day, respectively. Although intake decreased slightly with increasing turmeric levels, the overall values were higher than those in the present study, suggesting turmeric supplementation supports favorable feed acceptance.

3.2 Dry Matter Intake

The dry matter intake (g/day), DMI per 100 kg body weight (kg) and intake per kg metabolic body weight for various treatment groups, viz. T_1, T_2, T_3, T_4 and T_5 are calculated and presented in Table 3.

In the present study, the average daily dry matter intake was 697.79, 713.32, 704.23, 696.09 and 694.91 g/day for T_1, T_2, T_3, T_4 and T_5, respectively, with T_2 showing the highest intake and T_5 the lowest. Intake per 100 kg body weight was comparable across treatments (4.25–4.61 kg), while intake per kg metabolic body weight ($W^{0.75}$) ranged from 66.25 g (T_1) to 79.72 g (T_4), showing significant differences. These findings suggest that turmeric supplementation influenced intake when adjusted for metabolic body weight. Comparatively, Kore (2023) reported lower intakes with spirulina (419.16–464.48 g/day), Sawant (2024) observed higher values with ginger powder (731.23–763.95 g/day) and Adebisi (2022) reported lower intake (543.66–547.94 g/day). Oderinwale et al. (2020) found even higher intakes in KalaWAD and WAD does (917.38–1072.30 g/day), with metabolic intakes of 166.69–187.39 g/kg $W^{0.75}$.

3.3 Nutrient Intake

The average daily nutrient intake per animal on a dry matter basis for treatments T_1, T_2, T_3, T_4 and T_5 is presented in Table 4.

In the present study, the average daily dry matter intake was 697.79, 713.32, 704.23, 696.09 and 694.91 g/day for T_1–T_5, respectively. Corresponding intakes of crude protein, ether extract, crude fiber, nitrogen-free extract and ash were 126.31–129.12 g, 47.47–49.59 g, 274.01–284.56 g, 622.50–636.68 g and 102.32–105.55 g, with T_2 consistently showing the highest values and T_5 the lowest, indicating better palatability in T_2.

Comparative studies revealed variable results. Kore (2023) reported lower nutrient intakes in Konkan Kanyal kids fed Spirulina (419.16–464.48 g DM), while Adebisi et al. (2022) also observed lower values in West African Dwarf goats (543.66–547.94 g DM) with turmeric supplementation. Conversely, Sawant (2024) recorded higher or comparable intakes with ginger powder supplementation (731.23–763.95 g DM). Overall, the present findings suggest that turmeric inclusion influenced nutrient intake, with T_2 supporting improved feed acceptance.

3.4 Nutrient Outgo

The average daily outgo of various nutrients in treatment T_1, T_2, T_3, T_4 and T_5 on per cent dry matter basis is presented in Table 5.

In the present study, nutrient outgo showed a gradual decline across treatments. Dry matter outgo decreased from 130.00 g in T_1 to 104.50 g in T_5, crude protein from 32.63 g to 26.58 g, ether extract from 10.46 g to 8.95 g, crude fiber from 62.40 g to 49.73 g, nitrogen-free extract from 242.75 g to 223.25 g and ash from 29.71 g to 23.30 g. This indicates reduced nutrient losses with higher turmeric supplementation.

Comparable findings were reported by Sawant (2024), where nutrient outgo decreased from 139.25 g DM in T_1 to 116.25 g DM in T_5 with ginger supplementation. Similarly, Kore (2023) reported lower overall nutrient outgo values in Konkan Kanyal kids under Spirulina supplementation, ranging from 72.42–69.25 g DM and 57.92–53.86 g CP across treatments.

These comparisons suggest that phytogenic feed additives, including turmeric, may improve nutrient utilization by reducing excretory losses.

3.5 Nutrient Digested

The average daily nutrients digested per animal in treatment T_1, T_2, T_3, T_4 and T_5 on per cent dry matter basis is presented in Table 6.

In the present study, nutrient digestion (g/day) improved progressively from T_1 to T_5. Dry matter digestion increased from 567.79 g in T_1 to 590.41 g in T_5, crude protein from 93.69 g to 98.51 g, ether extract from 37.60 g to 39.33 g, crude fiber from 215.96 g to 224.29 g, nitrogen-free extract from 380.06 g to 399.25 g and ash from 73.54 g to 85.89 g. These results indicate enhanced nutrient utilization at higher supplementation levels.

Comparable findings were reported by Sawant (2024), with digested DM ranging from 607.33–629.95 g/day and CP from 108.65–113.98 g/day, while Kore (2023) observed much lower values in Konkan Kanyal goats under Spirulina supplementation (DM 346.74–395.23 g/day; CP 54.16–69.54 g/day). The present results thus suggest that turmeric inclusion supported improved digestibility of major nutrients compared to basal or alternative supplement diets (Radostits et al. 2006).

Table 2. Average daily feed intake during experimental period

Treatments	Average feed offered (g/day)	Average feed leftover (g/day)	Average feed intake (g/day)	Total feed intake for 90 days (kg)
T_1	1299.50	120.25	1179.25[a]	106.13
T_2	1341.00	135.50	1205.50[b]	108.50
T_3	1340.75	155.00	1185.75[a]	106.72
T_4	1330.50	162.75	1167.75[c]	105.10
T_5	1327.50	166.00	1161.50[c]	104.54
SE ±	-	6.72	0.28	-
CD (5%)	-	20.71	0.88	-

Note: Numbers having different superscripts differed from each other.

Table 3. Average dry matter intake by experimental kids during metabolic period (DM basis)

Treatments	DMI			
	Body weight (kg)	Daily intake (g/day)	Intake per 100 kg BW (kg)	Intake per kg $W^{0.75}$ BW (g)
T^1	15.16	697.79	4.61	66.25[a]
T^2	15.48	713.32	4.61	69.44[a]
T^3	15.58	704.23	4.53	71.39[ab]
T^4	16.40	696.09	4.25	79.72[b]
T^5	15.86	694.91	4.40	75.14[b]
SE ±	0.34	3.61	0.10	1.28
CD (5%)	NS	11.14	NS	3.93

Note: Numbers having different superscripts differed from each other

Table 4. Average intake of nutrients in experimental kids (DM basis)

Treatments	Nutrient intake (g/d)					
	DM	CP	EE	CF	NFE	Ash
T_1	697.79	126.31	48.51	278.36	622.81	103.25
T_2	713.32	129.12	49.59	284.56	636.68	105.55
T_3	704.23	127.13	48.33	279.04	631.59	104.07
T_4	696.09	125.48	47.66	275.15	623.93	102.68
T_5	694.91	125.09	47.47	274.01	622.50	102.32
SE ±	3.61	0.65	0.25	1.43	3.24	0.53
CD (5%)	11.14	2.01	0.77	4.42	9.97	1.65

Table 5. Average outgo of nutrients in experimental kids (DM basis)

Treatments	Nutrients outgo (g/d)					
	DM	CP	EE	CF	NFE	Ash
T_1	130	32.625	10.455	62.4	242.75	29.7125
T_2	126.75	31.825	10.275	60.475	240.5	28.4875
T_3	119.25	29.7	9.725	57.2	235.25	26.675
T_4	112.25	27.9	9.25	53.1	228	24.975
T_5	104.5	26.575	8.95	49.725	223.25	23.3
SE ±	1.83	0.42	0.17	0.50	1.34	0.39
CD (5%)	5.64	1.30	0.51	1.54	4.14	1.19

Table 6. Average digested nutrients in experimental kids (DM basis)

Treatments	Nutrients digested (g/d)					
	DM	CP	EE	CF	NFE	Ash
T_1	567.79	93.69	37.60	215.96	380.06	73.54
T_2	586.57	97.30	39.33	224.09	396.18	76.60
T_3	584.98	97.43	38.60	221.84	396.34	79.89
T_4	583.84	97.58	38.01	222.05	395.93	82.11
T_5	590.41	98.51	38.30	224.29	399.25	85.89
SE ±	3.83	0.94	0.22	1.50	4.01	0.66
CD (5%)	11.80	2.89	0.68	4.62	12.34	2.04

3.6 Average Nutrient Digestibility (%) in Kids (DM basis)

The average nutrient digestibility coefficients of different proximate nutrients in the experimental diets fed to goats were evaluated, presented in Table 7.

The nutrient digestibility coefficients of different treatments (T_1–T_5) are presented in Table 7. A progressive improvement was observed in dry matter (DM), crude protein (CP), ether extract (EE), crude fiber (CF), nitrogen-free extract (NFE) and ash digestibility with increasing levels of turmeric supplementation. Dry matter digestibility increased from 81.37% in T_1 to 84.96% in T_5, while CP digestibility improved from 74.17% in T_1 to 78.74% in T_5, suggesting better protein utilization in turmeric-supplemented groups.

Ether extract digestibility also showed an increasing trend, ranging from 77.51% in T_1 to 80.67% in T_5. Similarly, crude fiber digestibility improved from 77.58% in T_1 to 81.85% in T_5, reflecting better fiber degradation. Nitrogen-free extract digestibility rose steadily from 61.02% in T_1 to 64.13% in T_5, while ash digestibility increased from 71.22% in T_1 to 77.23% in T_5. These results clearly demonstrate that turmeric supplementation consistently enhanced the digestibility of all major nutrients, with maximum values recorded in T_4 and T_5.

The overall improvement in digestibility can be attributed to turmeric's bioactive compounds, particularly curcumin, which enhance gut health, microbial fermentation and nutrient absorption. Similar findings were reported by Khalesizadeh et al. (2011), who observed CP digestibility of 77.02% with turmeric supplementation and Adebisi et al. (2022), who reported EE and CF digestibility values of 74.96% and 81.02% in turmeric-fed goats. Thus, turmeric serves as an effective natural feed additive, improving nutrient utilization, digestibility and overall productivity in Konkan Kanyal kids.

In the present study, the feed conversion efficiency (FCE) was significantly high in T_4 (11.45%), indicating the most efficient feed utilization, followed by T_5 (10.81%), T_3 (10.14%) and T_2 (9.74%). The lowest FCE was recorded in the control group, T_1 (9.50%), suggesting that the treatments improved feed efficiency compared to the untreated group (Tao et al. 2012).

In the present study, total body weight gain ranged from 5.43 kg (T_1) to 6.48 kg (T_4), with T_4 recording the highest gain. Total feed consumption on a dry matter basis varied between 62.54 kg (T_5) and 64.20 kg (T_2). Feed conversion ratio (FCR) values were 11.58 (T_1), 11.36 (T_2), 10.79 (T_3), 9.68 (T_4) and 10.25 (T_5), with T_4 showing the most efficient utilization.

The results indicate that turmeric supplementation improved feed efficiency, with

the lowest FCR (9.68) in T_4 compared to the control (11.58). Similar improvements in FCR with turmeric supplementation were reported by Aderinboye et al. (2021) and Adebisi et al. (2022), supporting the role of turmeric rhizome powder in enhancing growth performance and nutrient utilization in goats.

3.7 Haemato-biochemical Parameters

The effect of turmeric powder supplementation on haematological and biochemical parameters is summarized in the Table 10. Among the haematological parameters, haemoglobin concentration exhibited a significant difference ($P<0.05$) among the treatment groups. The highest haemoglobin value was recorded in T_5 (11.63 g/dL), which was markedly higher than the control group (T_1: 8.98 g/dL). This suggests that increasing levels of turmeric supplementation had a positive influence on haemoglobin synthesis, possibly due to the iron content and antioxidant properties of turmeric that may enhance erythropoiesis. Habeeb and El-Tarabany (2012) reported that haemoglobin (Hb) concentration in Zaraibi goats increased from 11.56 g/dL in the control group to 12.50 g/dL with Curcumin supplementation. This suggests that Curcumin enhanced the oxygen-carrying capacity of blood and supported better physiological function under heat stress conditions (Victoria 2000)s.

The RBC (red blood cell) count ranged from 7.63 to 8.88 $\times 10^6/\mu L$, with the highest value again observed in T_5. However, the variation among treatments was non-significant (NS), indicating that turmeric supplementation did not substantially affect erythrocyte concentration. Despite the lack of statistical significance, the numerical increase in RBC count in the supplemented groups could still imply improved erythropoietic activity. Compared to the present study, Aderinboye et al. (2021) reported higher RBC counts in goats supplemented with turmeric, with values increasing from 11.7 to $12.3 \times 10^6/mm^3$. Similarly, Habeeb and El-Tarabany (2012) observed a significant rise in RBC count from 10.55 to 11.58 million/µL in Curcumin-supplemented Zaraibi goats, supporting the role of turmeric in enhancing erythropoiesis under stress conditions.

Table 7. Average nutrient digestibility in experimental kids (%DM basis)

Treatments	Nutrients digestibility					
	DM	CP	EE	CF	NFE	ASH
T_1	81.37	74.17	77.51	77.58	61.02	71.22
T_2	82.23	75.34	79.32	78.75	62.22	73.01
T_3	83.06	76.62	79.88	79.49	62.74	74.35
T_4	83.87	77.76	79.75	80.70	63.45	75.68
T_5	84.96	78.74	80.67	81.85	64.13	77.23
SE ±	0.27	0.41	0.15	0.20	0.34	0.40
CD (5%)	0.82	1.25	0.46	0.62	1.06	1.22

Table 8. Feed conversion efficiency

Treatments	T_1	T_2	T_3	T_4	T_5
Feed conversion efficiency (%)	9.50^d	9.74^c	10.14^b	11.45^a	10.81^{ab}
SE ±	0.16				
CD (5%)	0.50				

Note: Numbers having different superscripts differed from each other

Table 9. Feed Conversion Ratio (FCR)

Treatments	Total body weight gain kg	Total feed consumption DM	FCR
T_1	5.43^c	62.80	11.58^a
T_2	5.65^{bc}	64.20	11.36^a
T_3	5.88^b	63.38	10.79^b
T_4	6.48^a	62.65	9.68^c
T_5	6.10^{ab}	62.54	10.25^{bc}
Mean	5.91	63.11	10.73
SE ±	0.1	-	0.16
CD (5%)	0.3	-	0.49

Note: Numbers having different superscripts differed from each other

Table 10. Effect of feeding turmeric (*Curcuma longa* L.) powder on average haemoglobin (g/dl) of Konkan Kanyal kids

	Treatmentss					Mean	SE (M)	CD (0.05)	Reference value
	T_1 (control)	T_2	T_3	T_4	T_5				
Haemoglobin	8.98	9.50	9.65	9.90	11.63	9.93	0.23	0.69	8.00 – 12.00 (g/dl)
RBC	7.63	8.33	8.13	8.38	8.88	8.27	0.46	NS	8.00 – 18.00 ($\times 10^6$/µl)
WBC	10.13	10.2	10.4	10.1	10.3	10.2	469.3	NS	4.0 – 13.0 ($\times 10^3$/µl)
Total protein	6.75	6.71	6.84	6.75	6.71	6.75	0.14	NS	6.4 – 7.0 (g/dl)
Serum albumin	3.63	3.54	3.75	3.48	3.42	3.56	0.14	NS	2.7 – 3.9 (g/dl)
Serum globulin	3.12	3.17	3.09	3.27	3.29	3.19	0.13	NS	2.7 – 4.1 (g/dl)
Total cholesterol	89.75	90.5	85.8	84.5	83	86.7	1.74	5.36	80-120 (mg/dl)

(Reference source – Veterinary medicine 2006)

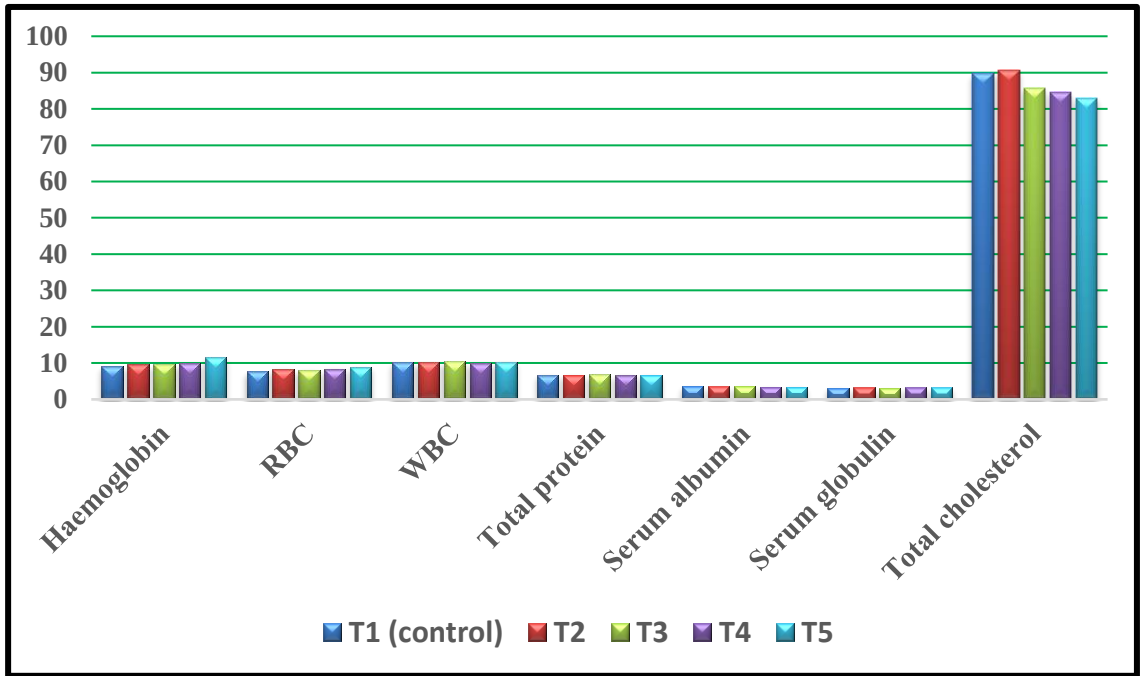

Fig. 1. Haemato-biochemical levels

Similarly, the WBC (white blood cell) count ranged narrowly from 10.1 to 10.4 ×10³/µL, with no significant difference observed across treatments. This suggests that turmeric supplementation did not adversely impact the immune cell profile of the kids, indicating its safety and non-inflammatory nature at the given supplementation levels. Compared with the present investigation, comparable white blood cell (WBC) counts were reported by El-Gohary et al. (2012) ranging from 9.44 ± 0.14 to 10.32 ± 0.50 (×10³/mm³).

Biochemical parameters such as total protein, serum albumin and serum globulin did not differ significantly among treatments. Total protein values remained fairly constant (6.71–6.84 g/dL), with a pooled mean of 6.75 g/dL, indicating stable protein metabolism with turmeric supplementation. Serum albumin was slightly higher in T_3 (3.75 g/dL) compared to other groups, while serum globulin ranged between 3.09 and 3.29 g/dL. Similar trends have been reported by Habeeb and El-Tarabany (2012), who recorded higher total protein in curcumin-treated goats (8.16 g/dL) compared to controls (7.65 g/dL). Aderinboye et al. (2021) also reported comparable total protein (6.40–7.05 g/dL), serum albumin (3.10–3.45 g/dL) and globulin (3.30–3.60 g/dL) values in turmeric-supplemented goats.

Interestingly, total cholesterol levels demonstrated a significant reduction ($P<0.05$) in turmeric-supplemented groups, particularly in T_5 (83 mg/dL), compared to the control (T_1: 89.75 mg/dL). The declining trend in cholesterol levels with increasing turmeric dosage suggests a hypocholesterolemic effect, likely due to the curcumin content of turmeric, known to interfere with hepatic cholesterol synthesis and promote lipid metabolism. Habeeb and El-Tarabany (2012) reported that total cholesterol levels were 126.6 ± 3.63 mg/dL in the control group and 100.6 ± 3.6 mg/dL in the curcumin-treated group. This significant reduction in cholesterol indicates a beneficial hypocholesterolemic effect of curcumin administration.

Haemoglobin concentration increased significantly with turmeric supplementation (8.98–11.63 g/dl), while RBC, WBC, total protein, albumin and globulin remained unaffected. These results are in agreement with reports in Black Bengal goats supplemented with *Curcuma longa*–based phytoadditives, where blood indices, except lipids, showed no significant variation among groups (Singh et al., 2025). A consistent reduction in cholesterol (89.75 to 83.0 mg/dl) was observed, corroborating earlier findings of a hypocholesterolemic effect of phytoadditive supplementation (Singh et al., 2025).

4. CONCLUSION

Turmeric supplementation improved nutrient digestibility in Konkan Kanyal kids, with dry matter, protein, fiber, fat, ash and carbohydrate digestibility increasing from T_1 to T_5. The highest values were recorded in T_5 (12 g), while T_4 (9 g) also showed nearly equal efficiency, as reflected in the best feed conversion ratio (9.68). Haematological and biochemical profiles improved, with T_5 (12 g) showing the highest haemoglobin and RBC counts, along with a marked reduction in serum cholesterol, without adverse effects on immune status. These results confirm turmeric as a safe and effective phytogenic additive to enhance digestion, metabolic health and overall welfare in goats.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declares that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

ETHICAL APPROVAL

All procedures involving animals in this study were carried out following ethical standards and welfare guidelines. Prior approval was obtained from the Institutional Animal Ethics Committee (IAEC), Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli. The animals were handled humanely, with due care taken to minimize discomfort and ensure well-being throughout the research period.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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