

Effect of Feeding *Moringa oleifera* Meal on Physiological and Haemato-Biochemical Profile of Surti Kids

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ABSTRACT

The present experiment was conducted to study the effect of feeding *Moringa oleifera* meal by replacing compound concentrate mixture in Total Mixed Ration (TMR), on the physiological and haemato-biochemical profile of Surti kids. Twenty-four kids were divided into four treatment groups, viz., 0% (T₁), 25% (T₂), 50% (T₃), and 100% (T₄) replacement of compound concentrate mixture with *Moringa oleifera* meal. Amongst haemato-biochemical parameters, haemoglobin, serum total protein, glucose, cholesterol, SGPT, SGOT, calcium, and phosphorus showed non-significant differences, while serum urea and creatinine differed significantly ($p < 0.05$) between different groups. Physiological parameters though did not differ between groups, the respiration rate and heart rate particularly increased gradually and significantly ($p < 0.01$) with advancing the feeding trial. However, values of all the haemato-biochemical parameters were within the normal physiological range in all the treatment groups.

Key words: Feeding, Haematological parameters, *Moringa oleifera*, Physiological parameters, Surti kids.

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INTRODUCTION

The use of moringa leaves has gained popularity in animal ration as it is a perennial plant and several harvests can be obtained in one growing season. Around 54.17% of goat keepers feed locally available tree leaves in the middle Gujarat region (Jegoda and Modi, 2022). Various experimental studies have concluded that the use of moringa leaves in animal ration improves feed intake, growth, performance, and health of livestock. It can be used in the form of roughage or concentrate (Jiwuba *et al.*, 2016; Kholif *et al.*, 2018; Pandey *et al.*, 2022). Among all trees in the world, it is one of the fastest growing trees with high biomass yield, a small difference in the intake of both fresh or dried moringa leaves, and the ability to store its dried leaves for longer periods without deterioration in nutritive value (Mendieta-Araica *et al.*, 2011). This study was therefore carried out to observe the effect of feeding *Moringa oleifera* meal on physiological, haematological, and biochemical parameters in weaned Surti kids.

MATERIALS AND METHODS

The present experiment was conducted from 9th December 2021 to 12th May 2022 for 154 days at Livestock Farm Complex, College of Veterinary Science & Animal Husbandry, Kamdhenu University, Anand (India) on Surti kids. Twenty-four farm-born Surti kids were grouped into four treatments (T₁ to T₄) based on body weight (av. 12.14±0.33 kg) having 3 males and 3 females in each. The animals were offered *ad-libitum* Total Mixed Ration (TMR) with different replacement rates of compound concentrate mixture (CCM) with *Moringa oleifera*, for 154 days following 30 days adaptation period. All the observations of the actual experiment were taken

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thrice *i.e.*, initially on day 0 (P₁), mid of study day 76 (P₂), and the last day of feeding (day 154, P₃) including jugular blood sampling for assessment of physiological and blood biochemical parameters.

Feeding Management: The experimental TMR included 70% Jowar Hay and 30% Compound Concentrate Mixture (CCM) as control ration (T₁). In treatment T₂, T₃ and T₄ the CCM was replaced with *Moringa oleifera* meal @ 25%, 50% and 100%, *i.e.*, it contained 22.5% CCM + 7.5% *Moringa oleifera* meal (25% replacement), 15% CCM + 15% *Moringa oleifera* meal (50% replacement) and 0% CCM + 30% *Moringa oleifera* meal (100% replacement) respectively. Moreover, 200 g succulent Hybrid Napier + 2 % Mineral mixture of offered feed was common in all the groups.

TMR was offered to the kids individually, *i.e.*, 300 g in the morning (10:30 am) and 200 g in the afternoon (2:00 pm).

The extra allowance (100 g) of TMR was offered individually in the evening (6.00 pm) if there was no leftover. The offered quantity of TMR was increased gradually with the advancement in the age of the kids and daily observation of leftover feed. During morning release in the experimental shed, the kids were able to drink *ad libitum* water from a water trough, and later on, *ad libitum* wholesome water was offered to the kids in a plastic tub, *i.e.*, at 2:00 pm and 5:00 pm.

The physiological parameters, *viz.*, rectal temperature (°F), heart rates (beats/min), and respiration rates (breaths/min) of all experimental kids were recorded under relatively calm and quiet conditions across the experimental period. Haemoglobin (g/dL) was measured from blood samples using a blood auto-analyzer (Mindray BC-2800 Vet). Serum biochemical parameters, *viz.*, total protein (g/dL), glucose (mg/dL), cholesterol (mg/dL), blood urea nitrogen (mg/dL), creatinine (mg/dL), SGOT (serum glutamic-oxaloacetic transaminase) (U/L), SGPT (serum glutamic pyruvic transaminase) (U/L), calcium (mg/dL), and phosphorus (mg/dL) were measured using available kits in Merilyzer Autoquant 200 Excelus™ Machine. The experimental data were analyzed using a factorial completely randomized design (Snedecor and Cochran, 1994).

RESULTS AND DISCUSSION

Physiological Parameters

The treatment effect was found non-significant for all three physiological parameters (Table 1). However, the period effect was observed to be significant ($p < 0.05$) for all three physiological parameters with a rising trend with progress in

the experimental period. This might be due to age or seasonal variation as the experiment was started during winter and ended in summer. Significantly higher respiration rate has also been reported during the summer season as compared to winter by Thiruvankadan *et al.* (2009) and Modi (2019). The non-significant effect of treatment groups on physiological parameters indicated that replacing compound concentrate mixture with *Moringa oleifera* up to 100% did not affect the normal physiological functions of Surti kids.

Haemoglobin

Both the treatment and period effects were found statistically non-significant (Table 2). These results are within the normal range, proving that feeding *Moringa oleifera* meal did not have any adverse effect on the animal health. Comparable results have been reported for average haemoglobin by Manat *et al.* (2016) in Surti goats. However, Gamit *et al.* (2019) in Surti goats and Wankhede *et al.* (2022) in non-descript male kids reported numerically lower values than the present one, but all were within normal physiological range in Indian conditions with local feeds and fodders.

Serum Total Protein, Urea, and Creatinine

The values of serum total protein levels in all the experimental groups were statistically at par, while serum urea and creatinine were significantly higher in T₁ and T₄ as compared to T₂ and T₃ treatments (Table 2). The period effect was observed significant ($p < 0.05$) only for total protein, and the values of all three parameters were within the normal range. The present findings on serum total protein are in agreement with the results of Damor *et al.* (2017) and Pandey (2021),

Table 1: Effect of feeding *Moringa oleifera* meal on physiological parameters of Surti kids (Mean ± SE)

Period	Treatment				Overall Mean (P)
	T ₁	T ₂	T ₃	T ₄	
Respiratory rates (breaths/min)					
P ₁	22.67±1.45	21.33±1.45	24.00±3.56	25.33±1.84	23.33a±1.01
P ₂	25.33±1.84	26.00±1.49	26.67±2.16	27.33±3.07	26.33a±0.96
P ₃	67.33±3.07	67.33±2.08	62.00±2.39	68.67±4.97	66.33b±1.56
Overall	38.44±2.65	38.22±2.66	37.56±2.32	40.44±2.69	38.67±1.27
Heart rates (beats/min)					
P ₁	79.33±3.81	95.33±6.61	80.67±5.45	89.33±5.82	86.17a±2.72
P ₂	123.33±4.97	104.00±7.87	113.33±4.60	125.33±4.32	116.50^b±2.98
P ₃	130.67±4.87	138.00±3.37	140.00±6.17	144.67±2.62	138.33^c±2.59
Overall	111.11±3.11	112.44±3.00	111.33±3.38	119.78±3.13	113.67±1.56
Rectal temperature (°F)					
P ₁	101.00±0.39	101.63±0.37	101.28±0.54	100.93±0.47	101.21^a±0.20
P ₂	101.73±0.17	101.63±0.16	101.70±0.41	101.27±0.20	101.58^a±0.12
P ₃	102.23±0.37	102.03±0.30	102.47±0.17	102.15±0.26	102.22^b±0.13
Overall	101.66±0.11	101.77±0.08	101.82±0.12	101.45±0.11	101.67±0.05

Means with different superscripts within the column (a, b, c) differ significantly ($P < 0.05$) for a parameter.



Table 2: Effect of feeding *Moringa oleifera* meal on haemoglobin level and serum biochemical parameters of experimental Surti kids

Parameter	Period	Treatment				Overall Mean (P)
		T ₁	T ₂	T ₃	T ₄	
Haemoglobin (g/dL)	P ₁	10.08±0.28	10.58±0.62	10.85±0.072	10.25±0.41	10.44^b±0.24
	P ₂	9.88±0.37	10.38±0.59	9.45±9.13	9.55±0.20	9.82^a±0.18
	P ₃	9.78±0.16	9.60±0.28	9.15±0.20	9.02±0.17	9.39^a±0.11
	Overall	9.92±0.08	10.19±0.15	9.82±0.15	9.61±0.10	9.88±0.06
Total protein (g/dL)	P ₁	6.32±0.18	6.46±0.31	6.69±0.25	6.47±0.20	6.49^b±0.11
	P ₂	6.19±0.23	6.32±0.42	5.92±0.08	6.16±0.27	6.15^{ab}±0.12
	P ₃	6.62±0.26	6.01±0.17	5.87±0.11	5.85±0.15	6.09^a±0.10
	Overall	6.37±0.06	6.27±0.09	6.16±0.06	6.16±0.06	6.24±0.03
Serum urea nitrogen (mg/dL)	P ₁	32.65±0.60	30.61±0.45	34.50±0.61	35.46±1.36	33.31±0.53
	P ₂	35.08±0.57	33.51±0.62	31.35±0.69	34.63±1.33	33.64±0.47
	P ₃	33.25±0.90	34.33±0.66	32.55±0.80	35.58±0.55	33.93±0.40
	Overall	33.66^{xy}±0.23	32.82^x±0.25	32.80^x±0.25	35.23^y±0.30	33.63±0.14
Serum creatinine (mg/dL)	P ₁	1.25±0.14	0.94±0.02	0.97±0.06	0.96±0.05	1.03±0.04
	P ₂	0.97±0.02	0.93±0.02	0.90±0.02	0.98±0.08	0.94±0.02
	P ₃	0.99±0.04	0.98±0.02	0.93±0.02	0.99±0.02	0.97±0.01
	Overall	1.07^y±0.03	0.95^x±0.01	0.93^x±0.01	0.98^{xy}±0.01	0.98±0.01
Serum glucose (mg/dL)	P ₁	56.36±2.78	56.69±1.27	58.44±3.88	57.34±2.98	57.21^a±1.24
	P ₂	60.42±0.99	57.71±1.08	55.53±1.22	60.62±5.16	58.57^{ab}±1.25
	P ₃	60.79±1.65	63.76±1.23	58.59±1.45	63.57±1.16	61.68^b±0.74
	Overall	59.19±0.57	59.39±0.50	57.52±0.67	60.51±0.97	59.15±0.35
Serum cholesterol (mg/dL)	P ₁	84.63±1.54	84.64±1.23	90.41±1.59	85.28±3.27	86.24±1.02
	P ₂	85.88±1.40	85.90±1.60	85.32±1.87	88.60±1.65	86.42±0.75
	P ₃	86.17±2.34	84.05±1.63	83.90±2.07	85.57±1.31	84.92±0.83
	Overall	85.56±0.48	84.86±0.40	86.54±0.60	86.48±0.61	85.86±0.26
SGPT (U/L)	P ₁	15.06±0.86	15.82±0.79	14.39±0.30	15.23±0.91	15.13±0.34
	P ₂	15.09±0.96	14.96±1.20	14.99±0.70	14.40±0.97	14.86±0.42
	P ₃	15.44±0.87	13.77±1.05	14.35±0.56	15.79±1.21	14.84±0.44
	Overall	15.20±0.23	14.85±0.29	14.57±0.15	15.14±0.28	14.94±0.12
SGOT (U/L)	P ₁	78.49±1.30	78.31±1.14	80.74±1.26	79.32±2.39	79.22±0.71
	P ₂	78.71±1.21	79.48±1.48	77.96±1.20	81.25±1.16	79.35±0.60
	P ₃	77.44±1.12	77.77±1.51	79.48±1.71	81.68±1.25	79.09±0.70
	Overall	78.21±0.32	78.52±0.37	79.39±0.39	80.75±0.46	79.22±0.20
Serum calcium (mg/dL)	P ₁	9.26±0.34	9.10±0.33	9.16±0.67	8.60±0.45	9.03±0.21
	P ₂	9.06±0.15	8.86±0.18	9.93±0.77	9.09±0.77	9.24±0.25
	P ₃	9.12±0.25	9.56±0.19	9.79±0.56	9.54±0.17	9.50±0.15
	Overall	9.15±0.07	9.18±0.07	9.63±0.18	9.08±0.14	9.26±0.06
Serum phosphorus (mg/dL)	P ₁	5.51±0.41	5.43±0.18	5.44±0.59	5.30±0.48	5.42±0.19
	P ₂	5.38±0.27	5.30±0.27	5.85±0.54	5.54±0.50	5.52±0.18
	P ₃	5.40±0.22	5.73±0.31	5.79±0.55	5.84±0.31	5.69±0.16
	Overall	5.43±0.08	5.49±0.07	5.69±0.15	5.56±0.12	5.54±0.05

Means with different superscripts within the row (x, y) and the column (a, b) differ significantly (P<0.05) for a parameter.

where the values were slightly higher in different breeds of Indigenous goats. In agreement with the present findings, the average serum creatinine levels in the range of 0.59 to 1.20 mg/dL were reported by Sorathiya and Fulsoundar (2016) and Pandey (2021) in Surti breed. In the present study, iso-nitrogenous TMR was offered in all four treatment groups during the experiment. The values for serum total protein, urea, and creatinine were within normal range, indicating that even after replacing concentrate with 100% *Moringa oleifera* meal, no adverse effect was observed on the kidney function of the experimental animal. The increase in serum protein level may be due to improved protein utilization from the feed possibly due to increased CP and OM consumption and digestibility (Kholif *et al.*, 2016b).

Serum Glucose and Cholesterol

Among the treatments, periods, and P x T interactions, only the serum glucose level showed significant ($p < 0.05$) variation between periods, being higher at P₁ than P₃ (Table 2). Comparable results on serum glucose have been reported in Surti goats (Modi, 2019) and Surti kids (Pandey, 2021), and in Baladi kids (Sayed-Ahmed and Shaarawy, 2019). *Moringa* fodder may help in bypassing some soluble carbohydrates to be absorbed, such as glucose. *Moringa oleifera* has antidiabetic properties containing flavonoids to inhibit the α -amylase activity and regulate glucose levels in the blood (Meel, 2018). Similar or slightly lower results of cholesterol were reported by Manat *et al.* (2016) and Gamit *et al.* (2019) in Surti goats. However, Sorathiya and Fulsoundar (2016) recorded quite lower serum cholesterol levels in Surti goats. The phytochemical compounds decrease the formation and absorption of cholesterol (Kholif *et al.*, 2016a). This could be the reason for maintaining cholesterol level in the normal range in treatment groups.

Serum Glutamic Pyruvic and Oxaloacetic Transaminases

The non-significant difference was recorded for the period, treatment, and P x T interaction effect for both these enzymes (Table 2). Yusuf *et al.* (2018) in West African Dwarf goats, Zaher *et al.* (2020) in local goats and Pandey (2021) in Surti kids reported equivalent results of SGPT, While El-Sanafawy *et al.* (2017) in Zairaiby goats and Sayed-Ahmed and Shaarawy (2019) in Baladi kids reported higher values as compared to present findings of SGPT indicating that even after replacing concentrate with 100% *Moringa oleifera* meal no adverse effect was observed on the functions and activities of liver.

Serum Calcium and Phosphorus

No significant difference was observed on serum calcium and phosphorus between treatment groups or periods (Table 2). However, the *Moringa oleifera* meal 75% supplemented group had numerically higher values than other groups. Similar results were reported by Sorathiya and Fulsoundar

(2016), Zaher *et al.* (2020), and Pandey (2021) in different breeds of goat.

CONCLUSIONS

The findings of the present study replacing compound concentrate mixture with different levels of *Moringa oleifera* meal (0, 25, 50, 75, 100%) in TMR of Surti kids revealed no significant changes/effects, except serum urea and creatinine, which differed significantly ($P < 0.05$) between different groups. These observations suggested that replacing concentrate with 100% *Moringa oleifera* meal in TMR has no adverse effect on physiological and haemato-biochemical parameters of growing Surti goat kids.

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