Int. J. Agriworld, Vol. 3 [1] January- 2022

Online ISSN: 2582-7537
Journal's URL:http://www.svpss.in /ijaw/

Received 18.01.2021 Revised 22.01.2022 Accepted 30.01.2022
ORIGINAL ARTICLE **OPEN ACCESS**

Biochemical Indices and Heamtological Parameters of Barbari Goat Fed Moringa *(Moringa oleifera)* Leaves

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ABSTRACT

The changing climatic conditions in the past years have resulted in persistent droughts, heat waves and shortages in animal feed. This has severely affected ruminant animal production leading to a dire need to address feed shortages particularly in small scale farming systems. To address such challenges this experiment was conducted at KVK Jhabua goat unit. Twenty four Barbari goat kids were randomly divided into three groups of eight kids in each group to evaluate the effect of replacing concentrate mixture with Moringa oleifera leaves on Biochemical indices and heamtological parameters in diet of growing Barbari goat kids. The three experimental treatments were T1: 100% concentrate mixture; T2: 50% concentrate mixture + 50 % Moringa leaves and T3: 100 % Moringa leaves. At the end of experimental feeding (90 day), blood samples were collected from each kid to analyze concentrations of aspartate aminotransferase (SGOT), alanine transaminase (SGPT), glucose, total protein, albumin, cholesterol, calcium and phosphorus. The blood micro-minerals viz. copper, zinc, iron, and manganese were analysed by using atomic absorption spectrophotometer. The serum total protein, albumin, SGOT and calcium levels were found to be significantly ($P<0.05$) higher in moringa fed groups as compared to control group. There was no significant difference among different treatment groups for blood concentrations of copper, zinc, iron and manganese content. Based on the results, it was concluded that moringa (Moringa oleifera) leaves are rich in protein and minerals. Replacing the concentrate mixture with moringa leaves in diet of growing Barbari goat kids increased concentrations of blood total protein, albumin, SGOT and calcium while decreased level of blood cholesterol. Feeding of moringa leaves did not affect blood micro-mineral profile in Barbari goat kids.

Keywords: Moringa leaves, Blood metabolites, Blood mineral profile, Barbari goats *etc*.

Introduction

Goat in considered as poor man's cow in Indian condition which is the main occupation for rural people in village condition (Devendra, 2013). Goat meat is consumed by people to fulfill their protein demand and their milk is full of nutrition and easily digestible proteins. But the condition of goat is not good in India due to low productivity which is due to poor quality and inadequacy of available feeds (Qwele *et al*., 2013). The changing climatic conditions in the past years have resulted in persistent droughts, heat waves and shortages in animal feed. This has severely affected ruminant animal production leading to a dire need to address feed shortages particularly in small scale farming systems. Usually, farmers tried to feed their animals through crop residues and poor quality hay that are little in nitrogen, high in lingo-cellulose (Sultana *et al*., 2014) and poor in vitamin and mineral contents, which leads to low digestibility and reduced voluntary intake (Gerbregiorgis *et al*., 2012). *Moringa oleifera* is a rich source for crude protein (Crude protein varies

between 25 and 30% in the leaves) and vitamins (Ferreira *et al*., 2008; Foidl *et al*., 2001), and possesses significant anti-oxidative potential (Verma *et al.,* 2009), attributed to poly-phenols, tocopherols and carotenoids in the foliage. These nutritional traits along with high production of leaf mass, adaptability to grow in all types of soils and tolerance of extreme temperatures, have turned Moringa a potential high quality feed source for livestock (Foidl *et al*., 2001; Sanchez and Ledin, 2006). Recently, focus has been given to the use of moringa leaf meal as a protein source and feed components in animal production especially in goats (Sarwatt *et al*., 2002; Asaolu *et al*., 2012; Moyo *et al*., 2012; Sultana *et al*., 2015). Various studies conducted shown that feeding of moringa leaves in diet of goats, sheep and cattle influenced blood metabolites (Khalel *et al.,* 2014; Kholif *et al*., 2015; 2016; Azzaz *et al.,* 2016). Moreover, effect of moringa leaves feeding on blood mineral profile in livestock has not been investigated yet. Keeping in view of the above mentioned facts, the present study therefore was carried out to determine the effect of replacing concentrate mixture with *Moringa oleifera* leaves on biochemical indices and haematological parameters in diet of growing barbari goat kids.

Materials and Methods

The study was carried out at the Barbari Goat Unit, KVK Jhabua. Total 24 barbari goat kids (average age 3-4 months) were randomly divided into three treatment groups using completely randomized design, so that each group had eight animals per treatment. The three experimental treatments were T_1 = 100% concentrate mixture; T_2 = 50% concentrate mixture + 50 % Moringa leaves and T_3 = 100 % Moringa leaves. All the kids were treated with albendazole deworming medicine before the commencement of the experiment to ensure the kids were free of intestinal worm. The kids were kept in individual pens and provided individual feeders and water buckets. The kids were allowed 15 days of adjustment period during which they were gradually introduced to the experimental diets. Conventional concentrate mixture was gradually replaced at 0, 50 and 100% with dried moringa leaves and mixed thoroughly and supplied to animals. *Moringa oleifera* leaves were collected from the locally available moringa plots of the KVK Farm. The collected moringa leaves were dried in shed on thick plastic sheets. Kids were allowed 6 hours daily grazing. In addition to grazing, kids were supplemented with above mentioned diet at the 1% of live body weight. The duration of the feeding trial was of 90 days. The chemical composition of concentrate mixture and moringa leaves was analyzed according to standard procedures of the AOAC (2000). On day 90^{th}, blood samples were collected from each kid in the morning (before feeding and watering) under aseptic conditions through jugular vein puncture. Immediately after blood collection the vials were kept in slant position without disturbing. After 1 hr. and centrifuged at 700xg for 15 min to separate the serum, which was analyzed for serum biochemical constituents. The concentrations of aspartate aminotransferase (SGOT), alanine transaminase (SGPT), glucose, total protein, albumin, cholesterol, calcium and phosphorus were determined by using respective ready to use kits (procured from Agappe Diagnostics Ltd., Kerala, India) by employing Clinical Analyzer-635 (Systronics India Ltd., India). The micro-minerals were analyzed by digestion of 0.2 ml blood serum sample with 1.8 ml of triple acid mixture (Nitric acid: Sulphuric acid: Perchloric acid @ 4 : 2 : 1) till it becomes colorless. After digestion the final volume was made up to 10 ml with triple glass distilled water. Copper, zinc, iron, and manganese concentration from digested samples were estimated by atomic absorption spectrophotometer (Model AAS 4141, Electronic Corporation of India Ltd.).

Statistical Analysis:

One way ANOVA procedures by using SPSS (Version 11.0, SPSS Inc, Chicago, USA) were adopted to analyses the data of blood biochemical and minerals. The difference between treatments were analyzed by using students'' test and analysis of variance and the significance was declared at $P<0.05$.

Results and Discussion

Chemical and mineral composition of feeds

The chemical and mineral composition of the *Moringa oleifera* leaves and concentrate mixture used in this study are presented in Table 1.

The analyses revealed that the content of crude protein (23.12 vs. 16.45 %), crude fibre (8.05 vs. 5.42 %), ether extract (5.46 vs. 2.41%), total ash (14.12 vs. 8.98 %) and calcium (1.15 vs. 0.94 %) were higher in Moringa leaves as compared to the

concentrate mixture. But, the levels of dry matter (74.41 vs. 94.00 %) and phosphorus (0.12 vs. 0.65 %) were lower in Moringa leaves than concentrate mixture.

The crude protein content of moringa foliage used in the study was comparable with the values (29.7, 25.95 and 22.6%) obtained by (Fadiyimu *et al.*, 2010; Manh *et al.*, 2005 and Sánchez *et al.*, 2006), respectively, but higher than the values (19.5 and 19.3% in DM) reported by (Kakengi *et al.*, 2005; Aregheore2002), respectively. The variations in nutritive value of moringa foliage could be due to the age of harvest, soil type and fertility, proportion of leaf and stem and agro-ecological zone where trees are growing.

Blood biochemical profile

The effect of replacement of conventional concentrate with Moringa leaves on blood biochemical profile in Barbari goat kids is presented in Table 2.

All the measured blood biochemicals were within the reference ranges (Boyd, 2011). The blood glucose level (mg/dl) observed in different treatment groups were 68.33±1.15, 72.50±2.70 and 70.22±5.19 in T_1, T_2 and T_3 groups, respectively. Result showed that there was comparable effect observed on all over the different treatment groups. The concentration of glucose found in the present study was in agreement with the values reported by (Kholif *et al*., 2015). They reported that feeding moringa leaves diets to goats had no significant effects ($P > 0.05$) on glucose concentrations. In contrarily to our findings (Kholif *et al*., 2016), (Khalel *et al.,* 2014) and Azzaz *et al.,* (2016) observed that feeding moringa leaves to goat kids had significant effects ($P<0.05$) on glucose concentrations. The serum total protein level (g/dl) found to be significantly ($P<0.05$) higher T_2 (7.35±0.13) and T_3 (7.58±0.14) groups as compared to T_1 (6.86±0.25) group. Similarly, albumin concentrations were significantly higher group T_2 and T_3 than group T_1. The concentration of total protein and albumin found in the present study were in agreement with the values reported by (Khalel *et al*., 2014) and (Babeker and Abdalbagi 2015). They reported that feeding moringa leaves diets to goats significantly increased total protein and albumin concentrations. However, contrarily to our findings (Kholif *et al*., 2015) reported that feeding moringa leaves did not affected serum protein and albumin levels. The higher serum protein and albumin levels observed in the present study may be due to higher protein content of Moringa leaves than the concentrate mixture.

The cholesterol concentration was significantly lower in T_3 group as compared to T_1 and T_2 groups and respective values for groups T_1, T_2 and T_3 were 124.65±1.59, 124.41±1.68 and 110.60±1.86 (mg/dl). Similar to the present findings, (Kholif *et al*., 2015; 2016) recorded lower serum cholesterol concentrations in goats fed Moringa leaves in their diets. The enzyme SGPT concentrations were found to be 9.60±1.08, 9.02±1.23 and 12.51±1.05 U/L in T_1, T_2 and T_3, respectively, which were similar ($P>0.05$) among the treatment groups. In line with the present findings, (Azzaz *et al.*, 2016) reported that feeding of Moringa dried leaves to diets of Rhamani lactating ewes had no significant effect on serum level of SGPT. Similarly, (Khalel *et al*., 2014) observed no significant difference in SGPT concentrations in lactating cows fed Moringa leaves, respectively. In contrast, (Kholif *et al*. 2015) recorded that feeding of Moringa leaf meal as a protein source min lactating Anglo-Nubian goat's diets significantly increased ($P<0.05$) SGPT concentration. The SGOT concentration was significantly higher in T_3 group than the groups T_1 and T_2. The respective values for groups T_1, T_2 and T_3 were 16.30±1.16, 17.46±1.28and 22.99±2.76 U/L. In agreement with the present results, (Kholif *et al*., 2016) reported that feeding of *Moringa oleifera* leaf meal as a protein source in diets of lactating goats had significantly higher serum SGOT levels. The observed SGOT levels in present study were within normal physiological ranges are important indicators of liver activity and function suggesting there were no pathological lesions in the liver (Pettersson *et al.,* 2008) to feeding of Moringa leaves.

Blood mineral profile:-

The blood mineral profile in Barbari goat kids fed experimental diets is presented in Table 3.

The level of calcium (mg/dl) was significantly higher in groups T2 (10.51±0.44) and T3 (11.09±0.39) as compared to the group T1 (8.56 ±0.35). As the chemical composition (Table 1) revealed that the content of calcium was higher in Moringa leaves than the concentrate mixture and same is reflected in blood calcium level in the present study. The blood phosphorus level (mg/dl) observed in different treatment groups were

5.07±0.24, 4.87±0.30 and 5.15±0.27 in T1, T2 and T3 groups, respectively. Result showed that the phosphorus levels were statistically similar (P>0.05) among the different treatment groups. There was no significant difference among different treatment groups for blood concentrations of copper, zinc, iron and manganese content. There are no reports of effect of feeding Moringa leaves in diets of goats, sheep and cattle till date. So, this study is first to report the values of blood micro-minerals such as copper, zinc, iron and manganese in goats fed Moringa leaves as replacement of concentrate mixture.

Table 1: Chemical and mineral composition of Moringa leaves and concentrate mixture (on % DM basis) fed to experimental Barbari goat kids

Chemical composition	Moringa leaves	Concentrate mixture
Dry matter (%)	74.41	94.00
Crude protein (%)	23.12	16.45
Crude fibre (%)	8.05	5.42
Ether extract (%)	5.46	2.41
Total ash (%)	14.12	8.98
Calcium (%)	1.15	0.94
Phosphorus (%)	0.12	0.65
Copper (ppm)	9.47	22.56
Manganese (ppm)	88.21	47.53
Zinc (ppm)	26.77	36.51
Iron (ppm)	324.56	201.26

Table 2: Blood biochemical profile in Barbari goat kids fed experimental diets (n = 24)

Parameters	Treatments			Significance
	T_1	T_2	T_3	
Glucose (mg/dl)	68.33±1.15	72.50±2.70	70.22±5.19	NS
Total Protein (g/dl)	6.86^{a}±0.25	7.35^{b}± 0.13	7.58^{b}±0.14	*
Albumin (g/dl)	3.78^{a}±0.17	4.56^{b}±0.29	4.71^{b}±0.28	*
Cholesterol (mg/dl)	124.65^{a}±1.59	124.41^{a}±1.68	110.60^{b}±1.86	***
SGPT (U/L)	9.60±1.08	9.02±1.23	12.51±1.05	NS
SGOT (U/L)	16.30^{a}±1.16	17.46^{a}±1.28	22.99^{b}±2.76	*

*^{ab}Means in a row with different superscripts differ significantly (*P<0.05; ***P<0.001; NS: non-significant).*

Table 3: Blood mineral profile in Barbari goat kids fed experimental diets (n = 18)

Parameters	Treatments			Significance
	T_1	T_2	T_3	
Calcium (mg/dl)	8.56±0.35	10.51^{b}±0.44	11.09^{b}±0.39	*
Phosphorus (mg/dl)	5.07±0.24	4.87±0.30	5.15±0.27	NS
Copper (ppm)	0.46± 0.02	0.48± 0.02	0.47±0.02	NS
Iron (ppm)	1.54± 0.01	1.51± 0.01	1.50± 0.05	NS
Zinc (ppm)	0.79± 0.01	0.79±0.01	0.80±0.02	NS
Manganese (ppm)	1.03± 0.20	1.23± 0.25	1.12± 0.29	NS

*^{ab}Means in a row with different superscripts differ significantly (*P<0.05; NS: non-significant).*

Conclusion

Based on the results, it was concluded that moringa (*Moringa oleifera*) leaves are rich in protein and minerals. Replacing the concentrate mixture with moringa leaves in diet of growing Barbari goat kids increased concentrations of blood total protein, albumin, SGOT and calcium while decreased level of blood cholesterol. Feeding of moringa leaves did not affect blood micro-mineral profile in BARBARI goat kids.

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CITATION OF THIS ARTICLE

Kumar, C., Tomar, I. S., Sharma, A. K and Singh, M. (2022). Biochemical Indices and Heamtological Parameters of Barbari Goat Fed Moringa (*Moringa oleifera*) Leaves, *Int. J. Agriworld*, 3 [1]: 39-32.