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Effect of Dietary Substitution of Dried *Moringa oleifera* Lam. Leaves on Biochemical Parameters of Urine of Badri Cattle

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ABSTRACT: Animal husbandry is an integral part of the Indian economy. Badri cattle is reared by the people of hilly regions of Uttarakhand state. *Moringa oleifera* Lam. is a plant rich in vitamins, minerals and antioxidants which has been consumed as food by both animals and humans since a long time. The present study was carried out on 45 Badri cattle of the age groups 6-12 months, >12-18 months and lactating animals. All the animals of different age-groups were further divided into control (T_0), treatment 1 (T_1) and treatment 2 (T_2) groups where the treatment groups 1 and 2 were fed with concentrate feed substituted with dried Moringa leaves @10 % and 20% substitution, respectively, for a period of 12 months. The challenge in this study was the reception of the experimental dried Moringa leaves'-mixed concentrate feed by the experimental Badri cattle as they reject the feed, if it smells different than usual, before ingesting it. This was managed by keeping an acclimatization period of 10 days for adaptation to this feed by the experimental animals. The results showed a non-significant change in pH, specific gravity and creatinine of experimental animals while overall urea concentration in urine increased significantly in T_1 groups in younger (258.27±.04 mg/ dL) as well as lactating (258.23±.20 mg/ dL) age-groups. The study revealed that substitution of dried Moringa leaves in concentrate feed of Badri cattle had almost no fatal effect on biochemical quality of urine of the experimental animals, and hence, can be substituted by the farmers in field conditions.

Keywords: Badri, Moringa leaves, Concentrate feed, Urine biochemistry.

INTRODUCTION

Livestock play an important role in the Indian agricultural economy by providing a source of livelihood and providing economic independence to a large number of countrymen. Rearing of cattle and buffaloes is quite common among the majority of people in the villages of India for their milk and draft purposes. Livestock of different regions of India have different breed characters and show diverse performances based on the ambient climate and available nutrition. The Indian state of Uttarakhand houses immense biodiversity and has a rich livestock population. Badri cattle is a cattle breed native to the state which is short-heighted with an average body weight of 200-250 kg (NBAGR, 2023). The calves are very active and vigorous. Badri cattle are found in three major coat colors i.e., grey, red and black. The breed has a small udder depicting that the milk yield per day is very low i.e., about 1-1.5 kg/ day (Kumar and Gaur, 2016). Hilly terrain is traversed with ease by cattle of this breed due to small straight legs and the foot-pad which is very hard. The hooves are pointed which help to dig the mountainous soil to climb steep slopes. *Moringa oleifera* Lam. tree, also called as Miracle tree, Drumstick tree and Horseradish tree, has many nutritive values (Table 1). It is a plant native to the countries of India, Pakistan, Bangladesh and Afghanistan. Almost all parts of the Moringa tree namely leaves, bark, flowers, fruit, seeds and root are used to make medicines or are used directly for human consumption for their medicinal values. Their consumption helps in reducing blood sugar levels, lowers blood cholesterol and is an impressive antioxidant for both humans and large ruminants (Ali, 2017). Cow is known to be an

animal whose secretions and waste materials have unique properties. In Hinduism, cow urine has a special significance as a medicinal drink and as a fluid to be used in various ceremonies. The cow urine is sprinkled over a dead body as it is believed that it has spiritual cleansing effects. The same is done to a person coming from cremation ghats before he enters his house. Since cattle had a major place in ancient India, hence the use of cow urine in various ceremonies was emphasized (Wikipedia.org, 2023). Cow urine constitutes 95% water, 2.5% urea, minerals, 2.5% enzymes, many types of salts and hormones along with iron, calcium, phosphorous and potassium. The following study was conducted to observe and interpret the effects of feeding dried *M. oleifera* leaves on the important biochemical parameters of urine of Badri cattle of different age-groups and to know any negative effects caused in their physiological health.

Table 1: Nutrient constitution per 100 gm of dried *M. oleifera* leaves.

Nutrient component	Value
Carbohydrate (gm)	38.0 - 41.2
Fat (gm)	5.2 - 6.5
Protein (gm)	29.2 - 40.0
Fibre (gm)	12.5 - 21.09
Calories (cal)	329

MATERIAL AND METHODS

Present study was conducted at Badri cattle unit of Instructional Dairy Farm, Nagla, College of Veterinary and Animal Sciences, G.B. Pant University of Agriculture and Technology, Pantnagar, Uttarakhand. The Badri cattle unit of dairy farm exclusively houses indigenous Badri breed of cattle of various age groups.

A. Selection of animals

The experimental trial was conducted on 45 animals already present at Badri cattle unit of Instructional Dairy Farm, Nagla, GBPUAT, Pantnagar. The animals selected were of 6-12 months, >12-18 months and lactation age-groups. The animals of the required age-groups were selected from the available Badri cattle herd and maintained in separate sheds to conduct the study.

B. Grouping of experimental animals

45 animals were selected from the animals available at the Badri cattle unit of the dairy farm and then they were divided into the 3 broad groups of Control, Treatment 1 and Treatment 2 and the sub-groups of different ages keeping in mind the uniformity of average body weights of experimental animals in each group in the following manner (Table 2).

The selected experimental animals were dewormed as per the standard schedule at least 10 days before the beginning of the experimental feeding trial. The trial was conducted for a period of 1 year (from 2 April, 2021 to 1 April, 2022) where the animals were fed on green fodder, dry fodder and concentrate feed (both sole and mixed with dried *M. oleifera* leaves at two levels).

The feeding of experimental animals during the feeding trial was conducted as per Table 3.

Table 2: Grouping of experimental animals.

Age-groups	Control (T_0)	Treatment 1 (T_1)	Treatment 2 (T_2)
6-12 months	5	5	5
>12-18 months	5	5	5
Lactation	5	5	5
Total	**15**	**15**	**15**

Table 3: Experimental design showing the protocol of treatment on experimental animals.

Age-groups		**Control** (N=15)	**Treatment 1** (N=15)	**Treatment 2** (N=15)
I	**6-12 months** (n=5)	Fed with sole concentrate feed as per the schedule of the dairy farm	Fed with concentrate feed substituted with 10% of dried *M. oleifera* leaves	Fed with concentrate feed substituted with 20% of dried *M. oleifera* leaves
II	**>12-18 months** (n=5)	Fed with sole concentrate feed as per the schedule of the dairy farm	Fed with concentrate feed substituted with 10% of dried *M. oleifera* leaves	Fed with concentrate feed substituted with 20% of dried *M. oleifera* leaves
III	**In lactation** (n=5)	Fed with sole concentrate feed as per the schedule of the dairy farm	Fed with concentrate feed substituted with 10% of dried *M. oleifera* leaves	Fed with concentrate feed substituted with 20% of dried *M. oleifera* leaves

C. Procurement of Moringa leaves and concentrate feed

M. oleifera leaves were collected from in and around of the campus of G.B. Pant University of Agriculture and Technology, Pantnagar as Pantnagar and its nearby areas are blessed with an ample number of Moringa trees. These leaves were then spread on the floor and sun-dried. Concentrate feed required for preparing experimental *M. oleifera* substituted feed were procured from the feed unit of the Instructional Dairy Farm (IDF), GBPUAT, Pantnagar. Green and dry fodder was made available to all the experimental animals from the fodder unit of Instructional Dairy Farm, GBPUAT, Pantnagar in *ad libitum* amount as per the daily schedule of the farm.

D. Feed schedule

The sole concentrate feed and *M. oleifera* leaves' substituted concentrate feed was fed twice a day (after milking time i.e., at 4 am and 4 pm) to control and treatment animals, respectively, keeping in mind the body weight of all the animals. Green and dry fodder was provided *ad-libitum* to all the experimental animals. Plastic tubs and buckets were used for individual feeding of all the experimental animals.

E. Collection of urine and storage

Urine samples were collected from all 45 experimental Badri cattle of different age groups in the beginning, 3rd month, 6th month, 9th month and 12th month of experimental trial. Urine samples were collected at 3:00 pm on the scheduled days of collection in previously marked sterile bottles (200 ml capacity). For the purpose of study, mid-stream urine was collected from all animals as a sample by allowing initial stream of urine to pass out. Collected samples were filtered using muslin cloth to remove the physical dirt, if any. pH and specific gravity of the urine samples were determined immediately after collection. For determining other parameters, the urine samples were stored at -20°C. These urine samples were then used for analysis using standard methods.

F. pH

pH of urine samples was measured in a fresh sample within one hour after collection by using a pH meter. The pH meter was switched on and the probe was calibrated using standard buffer solution (pH 4, 7 and 10). Probe was rinsed thoroughly with deionized water between buffers and probe was dried using a wipe. The urine sample to be tested was taken in a clean beaker and the electrodes were cleaned with distilled water, wiped and immersed into the beaker then pH was noted down. pH meters have automatic temperature correction, which calculates the pH taking temperature into account.

G. Specific Gravity

The weight of a given volume of material was divided by the weight of the same volume of water to determine its specific gravity. A modified hydrometer called a 'urinometer' was used to estimate the specific gravity of the urine samples (Gurtu and Kapoor 1992). The urinometer's reading in distilled water was recorded as 1.000. After washing and rinsing with urine samples, various lactating Badri cows' pee samples were filled one by one in the urinometer cylinder. Without touching the cylinder's sidewalls, the urine meters were suspended in the urine samples. Specific gravity was measured at the liquid's surface.

H. Urea

Urea estimation in urine samples was done by diacetyl monoxime (DAM) method as per Lakhchaura *et al.* (2001). Protein-free filtrate (PFF) was made for each urine sample after it had been diluted ten times. To make PFF, combine 0.4 ml of urine with 2.6 ml of distilled water, 0.5 ml of 10% sodium tungstate, and 0.5 ml of 2/3 N H_2SO_4; filter the mixture after 10 minutes had passed. Each urine sample was placed in three test tubes with the designations test (T), standard (S), and blank (B). 0.2 ml of PFF, 0.2 ml of urea standard, and 0.2 ml of DAM reagent were added to tubes T, S, and B. Tubular contents were thoroughly combined before being heated in a boiling water bath for 10 minutes and then cooled in running water for 5 minutes. Finally, O.D. of test and standard was read against blank at 520 nm.

I. Creatinine

Estimation of creatinine is based on Jaff's reaction as per Lakhchaura *et al.* (2001) method. For estimation of creatinine in urine samples, PFF was prepared by mixing 4.0 ml of each urine sample with 4.0 ml of distilled water and 4.0 ml tungstate, followed by slow addition of 4.0 ml of 2/3 N H_2SO_4 while mixing. After being maintained for 10 minutes, the solution was filtered to remove PFF. The test (T), standard (S), and blank (B) test tubes were removed (B). 0.4 ml of PFF, 1.0 ml of the creatinine working standard, and 3.0 ml of distilled water were introduced to tubes T, S, and B, respectively. To each tube, 1 cc of picric acid was added. Three tubes received 1.0 ml of 0.75 N NaOH after being thoroughly mixed, and the tubes were left at room temperature for 10 minutes. At 520 nm, developed color was read against nothing.

J. Statistical analysis

The experimental data obtained in the present study was analyzed statistically applying one-way ANOVA by using SPSS software version 21 (Snedecor and Cochran 1994). The significant mean difference was separated by Tukey post hoc analysis with significance level defined at $p< 0.05$.

RESULTS AND DISCUSSION

A. pH

The average values of urine pH of each group of Badri cattle measured at every 3 months from the beginning till the end of experimental period have been presented in Table 4.

The average values of urine pH of T_1sub-group in 6-12 months age group were non-significant ($p>0.05$) than $T_0$from the beginning till the end of the trial. The average values of urine pH of T_2 sub-group of 6-12 months group were non-significant ($p>0.05$) than both T_0 and T_1 groups from the beginning till the end of the trial. Overall observations for all the sub-groups were non-significant ($p>0.05$) to each other.

The average values of urine pH of T_1 sub-group in >12-18 months age group were non-significant ($p>0.05$) than $T_0$from the beginning till the end of trial. The average values of urine pH of T_2 sub-group (7.79±.00) were higher and significant ($p<0.05$) than T_0 (7.76±.00) and lower and significant ($p<0.05$) than T_1 group (7.80±.01) only after the 6th month of the trial. Overall observations for all the sub-groups were non-significant ($p>0.05$) to each other.

The average values of urine pH of lactating animals were non-significant ($p>0.05$) than T_0 from the beginning till the end of the trial. The average values of urine pH of T_2 sub-group of lactating animals were non-significant ($p>0.05$) than both T_0 and T_1 sub-

groups from the beginning till the end of the trial. Overall observations for all the sub-groups were non-significant (p>0.05) to each other.

According to Kaneko *et al.* (1997), cow urine had a pH that ranges from 7.4 to 8.4 and was reported to be 7.86 by Kumar (2002), both of which were similar to the present observations. The findings of the urine analysis of Patoo *et al*. (2016) on Badri cattle were in agreement with the present findings.

The pH of urine had no significant change between control and treatment animals. Hence, the supplementation of Moringa leaves in the diet had no negative effect on urinary physiology of Badri cattle.

Table 4: Average pH of urine of different groups of Badri cattle during the experimental period.

Groups	Beginning	3 months	6 months	9 months	12 months	Overall
6-12 M						
T_0	7.74±.00	7.76±.01	7.76±.01	7.77±.01	7.77±.01	7.76±.01
T_1	7.79±.03	7.81±.03	7.81±.03	7.80±.03	7.81±.03	7.80±.03
T_2	7.71±.02	7.74±.02	7.78±.02	7.79±.02	7.80±.02	7.76±.02
>12-18 M						
T_0	7.77±.00	7.76±.00	7.76±.00^{a}	7.7±.00	7.77±.00	7.75±.00
T_1	7.78±.01	7.79±.01	7.80±.01^{ab}	7.79±.01	7.79±.01	7.79±.01
T_2	7.77±.01	7.78±.00	7.79±.00^{c}	7.78±.00	7.78±.01	7.78±.01
LACTATION						
T_0	7.70±.02	7.71±.02	7.71±.02	7.71±.02	7.72±.02	7.71±.02
T_1	7.72±.04	7.73±.04	7.73±.04	7.74±.04	7.74±.04	7.73±.04
T_2	7.67±.01	7.72±.03	7.72±.03	7.73±.03	7.73±.03	7.71±.03

Values bearing different superscripts in the same column differ significantly (p<0.05).

B. Specific Gravity (SG)

The average values of specific gravity of urine of each group of Badri cattle measured at every 3 months from the beginning till the end of experimental period have been presented in table5.

There was no significance found in the readings of specific gravity of urine in treatment animals (both T_1 and T_2) of any of the age-groups when compared with their respective control groups and among the treatment groups. Overall observations for all the sub-groups were non-significant (p>0.05) to each other.

Kaneko *et al.* (1997) reported that specific gravity of cow urine ranges from 1.025 to 1.045 and Kumar (2002) reported it to be 1.030 ±0.0007, both of which were similar to the present observations. The findings of the urine analysis of Patoo *et al*. (2016) on Badri cattle were in agreement with the present findings.

The specific gravity of urine had no significant change between control and treatment animals. Hence, the supplementation of moringa leaves in the diet had no negative effect on urinary physiology of Badri cattle.

Table 5: Average SG of urine of different groups of Badri cattle during the experimental period.

Groups	Beginning	3 months	6 months	9 months	12 months	Overall
6-12 M						
T_0	1.03±.00	1.03±.00	1.04±.00	1.04±.00	1.04±.00	1.04±.00
T_1	1.03±.00	1.03±.00	1.03±.00	1.03±.00	1.03±.00	1.03±.00
T_2	1.03±.00	1.04±.00	1.04±.00	1.03±.00	1.04±.00	1.04±.00
>12-18 M						
T_0	1.03±.00	1.03±.00	1.04±.00	1.03±.00	1.04±.00	1.03±.00
T_1	1.03±.00	1.03±.00	1.03±.00	1.03±.00	1.04±.00	1.03±.00
T_2	1.03±.00	1.04±.00	1.04±.00	1.04±.00	1.04±.00	1.04±.00
LACTATION						
T_0	1.04±.00	1.04±.00	1.04±.00	1.04±.00	1.04±.00	1.04±.00
T_1	1.04±.00	1.04±.00	1.04±.00	1.04±.00	1.04±.00	1.04±.00
T_2	1.04±.00	1.04±.00	1.04±.00	1.04±.00	1.04±.00	1.04±.00

Values bearing different superscripts in the same column differ significantly (p<0.05).

C. Urea concentration

The average values of urea concentration of urine of each group of Badri cattle measured at every 3 months from the beginning till the end of experimental period have been presented in table 6.

The average values of urea concentration of T_1 sub-group in 6-12 months group were non-significant (p>0.05) than T_0 sub-group from the beginning till the end of the trial. The average values of urea concentration of T_2 sub-group (257.73±.28, 257.74±.28, 257.75±.28, 257.75±.29 and 257.75±.29 mg/dl) of 6-12 months group were higher and statistically significant (p<0.05) than T_0 (257.30±.07, 257.32±.06, 257.32±.06, 257.30±.10 and 257.34±.07 mg/dl) from the beginning till the end of the trial, respectively, while against T_1 sub-group, they were non-significant during the complete experimental trial. Overall observation for T_1 sub-group was significant than T_0 and T_2 sub-groups.

Table 6: Average urea concentration (mg/dl) of urine of different groups of Badri cattle during the experimental period.

Groups	Beginning	3 months	6 months	9 months	12 months	Overall
6-12 M						
T_0	257.30±.07^a	257.32±.07^a	257.32±.06^a	257.30±.10^a	257.34±.07^a	257.32±.06^a
T_1	258.22±.05^{ab}	258.23±.05^{ab}	258.27±.04^{ab}	258.29±.04^{ab}	258.30±.04^{ab}	258.27±.04^b
T_2	257.73±.29^b	257.74±.28^b	257.75±.28^b	257.75±.29^b	257.75±.29^b	257.74±.28^a
>12-18 M						
T_0	257.59±.12	257.60±.12	257.59±.12	257.59±.11	257.60±.11	257.59±.11
T_1	257.63±.32	257.65±.33	257.65±.42	257.62±.05	257.66±.32	267.92±.41
T_2	257.61±.12	257.62±.12	257.63±.12	257.62±.12	257.63±.12	257.62±.12
LACTATION						
T_0	257.34±.08^a	257.35±.08^a	257.34±.08^a	257.33±.08^a	257.34±.08^a	257.34±.07^a
T_1	257.22±.20^a	258.18±.20^b	258.24±.20^b	258.24±.20^b	258.25±.21^b	258.23±.20^b
T_2	257.51±.07^b	257.53±.07^a	257.54±.08^a	257.54±.08^a	257.55±.08^a	257.53±.35^a

Values bearing different superscripts in the same column differ significantly (p<0.05).

The average values of urea concentration of T_1 sub-group in >12-18 months age group were non-significant (p>0.05) than T_0 from the beginning till the end of trial. The average values of urine pH of T_2 subgroup were non-significant (p>0.05) than T_0 and T_1 sub-groups from the beginning till the end of trial. Overall observations for all the sub-groups were non-significant (p>0.05) to each other.

The average values of urea concentration of lactating animals of T_1 sub-group were non-significant (p>0.05) than T_0 sub-group from the beginning till the end of the trial. The average values of urea concentration of T_2 sub-group (257.51±.07, 257.53±.07, 257.54±.08, 257.54±.08 and 257.55±.08 mg/dl) of lactating animals were statistically significant (p<0.05) for both T_0 (257.34±.08, 257.35±.08, 257.34±.08, 257.33±.08 and 257.34±.08 mg/dl) and T_1 (257.22±.20, 258.18±.20, 258.24±.21, 258.24±.20 and 258.25±.20 mg/dl) sub-groups from the beginning till the end of the trial, respectively. Overall observation for T_1 sub-group was significant than T_0 and T_2 sub-groups.

Kaneko *et al.* (1997) reported that urea concentration of cow urine ranged from 23 to 28 mg urea N/kg/day (49 to 240 mg/dl urea), which were dissimilar to the present findings. The findings of the urine analysis of Patoo *et al*. (2016) on Badri cattle were in agreement with the present findings.

The urea concentration of urine in T_1 subgroup in >12-18 months age-group and lactating animals age-group increased significantly due to increase in physiological nitrogen metabolism in Badri cattle but did not increase so as to cross the normal range. Hence, Moringa leaves' supplementation didn't show the effects of urea toxicity in Badri cattle.

D. Creatinine concentration

The average values of creatinine concentration of urine of each group of Badri cattle measured at every 3 months from the beginning till the end of experimental period have been presented in Table 7.

The average values of creatinine concentration of T_1 sub-group in 6-12 months age group were non-significant (p>0.05) than T_0 from the beginning till the end of trial. The average values of creatinine concentration of T_2 sub-group were non-significant (p>0.05) than T_0 and T_1 sub-groups from the beginning till the end of trial. Overall observations for all the sub-groups were non-significant (p>0.05) to each other.

The average values of creatinine concentration of T_1 sub-group in >12-18 months age group were non-significant (p>0.05) than T_0 from the beginning till the end of trial. The average values of creatinine concentration of T_2 sub-group were non-significant (p>0.05) than T_0 and T_1 groups from the beginning till the end of trial. Overall observations for all the sub-groups were non-significant to each other.

The average values of creatinine concentration of T_1 sub-group (26.67±.13, 26.79±.03, 26.81±.02, 26.81±.02 and 26.82±.02 mg/dl) of lactating animals were higher and statistically significant (p<0.05) than T_0 group from the beginning till the end of the trial. The average values of creatinine concentration of T_2 sub-group (27.40±.05, 27.42±.04, 27.48±.01, 27.49±.01 and 27.51±.02 mg/dl) of lactating animals were higher and statistically significant (p<0.05) for T_0 (27.09±.05, 27.09±.06, 27.11±.06, 27.11±.07 and 27.12±.07 mg/dl) from the beginning till the end of the trial and T_1 sub-group (26.79±.03, 26.81±.02, 26.81±.02 and 26.82±.02 mg/dl) after the 3rd, 6th, 9th and 12th month of the trial, respectively. Overall observations for all the sub-groups were non-significant (p>0.05) to each other.

Kaneko *et al.* (1997) reported that daily creatinine concentration of cow urine ranged from 15 to 20 mg/kg BW (15 to 53.33 mg/dl), which were dissimilar to the present findings. The findings of the urine analysis of Patoo *et al*. (2016) on growing Badri cattle were in agreement with the present findings.

The creatinine concentration of urine increased significantly in the subsequent observations in lactating animals but did not increase so as to cross the normal range. The overall observations were found to be statistically unchanged in all the age-groups. Hence, Moringa leaves' supplementation didn't show the effects of urea toxicity in Badri cattle.

Table 7: Average creatinine concentration (mg/dl) of urine of different groups of Badri cattle during the experimental period.

Groups	Beginning	3 months	6 months	9 months	12 months	Overall
6-12 M						
T_0	27.06±.35	27.07±.35	27.07±.34	27.08±.35	27.08±.35	27.07±.34
T_1	26.39±.01	26.39±.00	26.39±.01	26.40±.01	26.40±.01	26.39±.01
T_2	26.39±.03	26.40±.03	26.41±.04	26.42±.04	26.42±.04	26.41±.04
>12-18 M						
T_0	26.82±.18	26.83±.17	26.83±.17	26.82±.17	26.82±.17	26.82±.17
T_1	26.96±.19	26.96±.18	26.97±.19	26.97±.19	26.97±.18	26.97±.18
T_2	26.95±.27	26.98±.28	27.00±.30	27.00±.29	27.01±.29	26.99±.27
LACTATION						
T_0	$27.09±.05^a$	$27.09±.06^a$	$27.11±.06^a$	$27.11±.07^a$	$27.12±.07^a$	27.10±.06
T_1	$26.67±.13^b$	$26.79±.03^b$	$26.81±.02^b$	$26.81±.02^b$	$26.82±.02^b$	26.78±.10
T_2	$27.40±.05^b$	$27.42±.04^c$	$27.48±.01^c$	$27.49±.01^c$	$27.51±.02^c$	27.46±.03

Values bearing different superscripts in the same column differ significantly ($p<0.05$).

CONCLUSIONS

It can be concluded that dietary substitution of Moringa leaves increases nitrogen metabolism in younger animals releasing more urea in urine but within the normal range, hence no urea toxicity is observed in the animals. Along with this, all other parameters showing no statistically significant changes depict that dried *M. oleifera* leaves can be substituted at 10% and 20% rates in concentrate feed and fed to Badri cattle in field conditions without any fear of any negative effects or change in their physiological health.

FUTURE SCOPE

M. oleifera is used as feed and food by both animals and humans, respectively. All the parts of moringa plant are highly nutritious and mineral-rich. Green parts of moringa plant have been fed to animals to improve their health and increase milk production since a long time. This was the first ever feeding trial on Badri cattle which generated good results hence, feeding interventions in Badri cattle using other plants like Neem or Eucalyptus can be done in future. Researches including feeding of dried parts of moringa plant to cattle are scarce in nature which can be increased in future to establish the results. Since no urea toxicity was seen in the experiment, increase in the percentage of moringa substituted in the concentrate feed with increase in the experimental period can be tried in future to explore any further effect of feeding moringa in the urine of Badri cattle and other indigenous and exotic cattle breeds too.

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