Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

Journal of Entomology and Zoology Studies

E-ISSN: 2320-7078
P-ISSN: 2349-6800
JEZS 2020; 8(1): 333-337

Received: 19-11-2019
Accepted: 23-12-2019

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Effect of feeding dried *Moringa oleifera* leaves on different haematological parameters and economics in lactating sahiwal cows

Neetu Sonkar, Nishma Singh, AK Santra, Sharad Mishra, Manju Roy, VN Khune and Rupal Pathak

Abstract
The present trial was conducted for 35 days on Sahiwal cows of Bull Mother Experimental Farm, College of Veterinary Science & A.H., Anjora, Durg (C.G). A total of 18 Sahiwal cows of 1st to 5th parity were selected and were randomly and equally divided into 3 groups i.e. T_0 (control), T_1 and T_2 groups. The animals in control group (T_0) were fed with concentrate, green fodder and paddy straw (*ad lib*), whereas in treatment groups T_1 and T_2, 10% and 20% dry matter of concentrate respectively was replaced with dried *Moringa oleifera* leaves. Mean haematological parameters (Total erythrocyte count, Haemoglobin, Packed cell volume etc.) were not affected by replacement of 10% to 20 % dry matter of concentrate by *Moringa oleifera* leaves. The cost of feeding per kg milk production was lower in T_1 and T_2 groups than T_0 group. Thus feeding moringa leaves may be economical for dairy farmers and it can replace upto 20% level of commercial concentrate mixture in milch cows ration without any harmful effect on haematological parameters.

Keywords: *Moringa oleifera*, dried leaves**,** haematological parameters, economics, sahiwal cows

Introduction
The livestock sector plays an important role in the national economy and household food security in developing countries. Livestock population of Indian subcontinent is the highest in the world. As per 20th livestock census, India's livestock population is estimated to be 535.78 million of which, there are 192.49 million cattle, 109.85 million buffaloes, 148.88 million goats, 74.26 million sheep and 851.81 million poultry. The total livestock population shows increasing trend of about 4.6% from the previous census and the number of milch cows and buffaloes has 125.34 million indicating a growth of 6% over previous census [1].

The availability of feed and fodder in present condition is gradually decreasing because of marked reduction in cultivable land under production whereas, the human and animal population is increasing leading to competition especially for protein rich feedstuff in livestock ration. There is a huge difference in the demand and supply of feeds and fodders in India. The poor quality of feed and fodder is the main constraint factor that limits the productivity of farm animals. Generally, farmers feed their animals with various crop residues and low-quality hay that are low in nitrogen, deficient in vitamins and minerals and high in lignocelluloses, which lead to low digestibility and reduced voluntary intake, decrease growth rate, delayed sexual maturity, poor reproductive performance, poor meat quality and low milk yield [2]. Over the last few years, plant scientists and nutritionists have started focusing more on under-utilized crops and trees. Studies on some multi-purpose trees have shown them to be cheaper nutrient source with improved digestibility, voluntary intake and general performance of animals fed low-quality feeds [3].

Moringa oleifera is the most widely cultivated tree species in the family Moringaceae [4] and is gaining popularity as non-conventional fodder owing to its high nutrient content and low antinutritional factor. It can be grown well in the humid tropics or hot dry lands without expensive irrigation techniques and can survive in less fertile soil with little affect of drought condition [5].

The average chemical composition of *Moringa oleifera* leaves were recorded as 95.57% Dry Matter, 26.74% Crude Protein, 8.06% Ether Extract, 11.03% Crude Fibre, 26.35% Neutral Detergent Fiber, 40.40% Acid Detergent Fiber, 89.83% Organic Matter, 39.53% Nitrogen Free

Extract [6]. With regards to its nutritional composition, *M. oleifera* leaves have been reported to contain higher amount of vitamins C than orange, higher vitamin A than carrots, more amount of calcium than milk, higher potassium than banana and higher iron than spinach [7]. Apart from its nutritional value, *Moringa oleifera* tree is well known for its medicinal properties such as anticancer, anti-inflammatory, anti-diabetic, anti-microbial and antioxidant as reported by the same author. In addition, *M. oleifera* leaf has been reported to contain all essential amino acids viz. threonine, tyrosine, methionine, valine, phenylalanine, isoleucine, leucine, histidine, lysine and tryptophan. Moringa, as a supplemental feedstuff possesses numerous advantages. It is a perennial plant that can be harvested several times in a single growing season and can also potentially reduce feed cost of livestock ration. Moringa can easily be grown in the field, copes up well, and has a good potential for forage production. Due to all these advantages, it is popularly known as "Miracle Tree". Many researchers investigated the effect of *Moringa oleifera* leaves on haematological parameters of sheep and goats [8, 9]. However, the reports on the effect of supplementation of *Moringa oleifera* leaf in large ruminants are scanty, therefore, the present investigation was planned with the objective to evaluate the effect of feeding dried *M. oleifera* leaves on haematological parameters and economics of feeding in Sahiwal cows.

Materials and Methods

A total of 18 Sahiwal cows of 1st to 5th parity were selected from Bull Mother Experimental Farm of the College of Veterinary Science and Animal Husbandry Anjora, Durg (C.G.) and were randomly and equally divided into 3 groups i.e. T_0, T_1 and T_2 groups with 6 animals in each group. All the animals of T_0 group fed green fodder and commercial concentrate as per requirement along with *ad libitum* paddy straw. In T_1 groups animal were fed with commercial concentrate in which 10% DM of concentrate was replaced by dried *Moringa oleifera* leaves. Likewise, in T_2 group 20 % DM of concentrate was replaced by dried *Moringa oleifera* leaves. The ratio of different feed stuffs in the daily ration was worked out to meet the nutrient requirement of the milch cows [10]. The ratio of roughage to concentrate was around 60:40. Standard management practices were adopted during the research work**.** All the animals selected were dewormed with Albendazole @ 7.5 % of the body weight before starting the experiment. The animals were kept in well ventilated, concrete floored house and fed individually in mangers. They were provided with fresh, clean water *ad libitum* thrice a day. Sheds were kept clean and in hygienic condition. The leaves were harvested from *Moringa oleifera* trees from the adjoining areas and were dried under shed for 4-5 days and stored. The dried leaves were packed and stored for incorporation in the concentrate mixture. The total duration of experimental work was 35 days.

The feed and fodder offered were analysed for various proximate principles according to methods of Association of Official Analytical Chemists [11]. Blood samples were collected through jugular vein from each individual animal at 0 and 35 days of experiment. For haematological parameters blood samples were collected in EDTA tube and by using haematology analyser (Mindray) following parameters were studied- Haemoglobin (Hb), Total erythrocyte count (TEC), Packed cell volume (PCV) and Total leucocyte count (TLC). Economics of feeding was calculated for each group.

Statistical analysis

For interpretation of the result the data were presented as mean and standard error of mean. Data were analysed using one way analysis of variance with general linear model. The post hoc test was done by utilizing Duncan's multiple range test (DMRT) as per method given by Steel and Torrie (1980) [12]. To analyze the difference in treatment interval paired "t" test was applied as per the method suggested by Snedecor and Cochran (1994) [13].

Results and Discussion

Proximate composition of *Moringa oleifera* leaves and other feed stuffs

The comparison of proximate composition between *M. oleifera* leaves and concentrate revealed that the Crude Protein (CP), Ether Extract (EE) and Nitrogen Free Extract (NFE) of dried *Moringa oleifera* leaves was higher than that of the concentrate mixture (Table 1). However, crude fibre and total ash of dried *M. oleifera* leaves was lower than concentrate. The CP content of *M. oleifera* leaves reported in present study was in favour of other researchers [14, 15]. The differences in proximate analysis in *M. oleifera* leaves of different areas might be due to the difference in stage of harvest, soil type, season of harvesting, post harvesting treatment and agroclimatic condition.

Table 1: Proximate composition of different feeds and fodder (% Dry matter basis)

S No.	Proximate Composition	Different feed and fodder			
		Concentrate	Dried *Moringa oleifera* leaves	Berseem	Paddy straw
1	DM	90	90	15	90.5
2	CP	16	22.07	14	2
3	CF	13.61	9.52	22.75	33.03
4	EE	3.48	4.52	1.93	0.88
5	TA	15.03	10.3	12.99	16.14
6	NFE	51.88	53.59	48.33	47.95

DM –Dry Matter, CP-Crude Protein CF-Crude Fiber, EE-Ether Extract, TA-Total Ash, NFE-Nitrogen Free Extract

Haematological parameters

Results showed that at the end of experiment (35th day) mean total erythrocyte count (TEC) of T_1 group and T_2 group was observed to be higher than the T_0 group but showed non significant differences (Table 2). All the groups were found normal TEC values as cited by Smith (2002) [16]. The results are in accordance with previous authors, Ali (2017) [17] and Yusuf *et al.* (2018) [18]. They found non significantly higher TEC value in moringa supplemented goat as compared to non supplemented goats. The mean haemoglobin (Hb) values of T_0, T_1 and T_2 group was showed non significant difference at the end of experiment (Table 2). The mean haemoglobin concentration of all the three groups was within the normal range as given by Smith 2002 [16]. Results finding of mean Hb

concentration are in accordance with Ali (2017) [17] and Haridas (2018) [19] who reported non significantly higher Hb concentration in moringa supplemented goat and sheep respectively as compared to non supplemented ones. At the end of experiment, mean PCV value of T_1 and T_2 group was higher than T_0 group but exhibited non significant differences (Table 2). PCV value recorded in normal range suggested that all diets sustaining good health and non toxic. Slight elevation in TEC and haemoglobin and PCV concentration in T_1 and T_2 group may be due to *M. oleifera* leaves being rich in all essential amino acids, vitamins (A, B and C) and minerals particularly iron. Iron is necessary for many functions in the body including the formation of haemoglobin and myoglobin [20]. The content of protein (amino acids) also contribute to the activity of erythropoesis by providing amino acids for porphyrin, globin and transferrin synthesis [21]. Beside, *Moringa oleifera* has been reported to contain bioactive compounds viz. alkaloids, flavonoids, phytosterols and saponin. Which are known to possess hematopoietic property that have direct influence on the production of blood in the bone marrow [22]. All these factors contribute to its beneficial effects on red blood cells hence higher values indicates a better health status in moringa supplemented cows.

Results showed that at 35th day the mean TLC of T_0, T_1 and T_2 group showed non significance difference (Table 2). Mean TLC of control and treatment groups was found normal range as cited by Reece *et al.* (2015) [23]. Results of the present investigation are in accordance with Yusuf *et al.* (2018) [18] who found non significant difference in TLC among moringa supplemented and non supplemented goats. Leucocytes are involved in protecting the body from infections and are usually raised in acute infection. Normal mean TLC obtained in all the three groups was suggested that Sahiwal cows have well developed immune system and supplementation of Moringa may have preventive effect from any infection and may boost the immune system of Sahiwal cows.

The mean TEC, Hb and PCV values were non significantly increased in T_1 and T_2 groups whereas in T_0 group it was non significantly decreased at the end of experiment (35th day) than that of beginning (0 day) within group. However, mean TLC of all the three groups observed to be non significantly decreased at the end of experiment than that of the beginning (Table 3).

Economics of feeding

The cost of *Moringa oleifera* dried leaves was calculated on the basis of labour charge for collection of *Moringa oleifera* leaves, transportation cost, cost of gunny bags for storage of dried *Moringa oleifera* leaves etc. By considering these inputs the cost of *Moringa oleifera* dried leaves was considered Rs. 5/kg in the present study. The cost of feeding per cow per day was lower in moringa supplemented groups than control group (Table 4). The cost of feeding/kg milk production in moringa supplemented groups was less than the control group as well as profit from selling of milk was higher in moringa supplemented groups than that of the control group. Economic efficiency of groups T_1 and T_2 was increased by 8 % and 19% respectively. Results of the present investigation are in agreement with Khalel *et al.* [24] as they reported that the cost of feeding in dairy cows was reduced and profit increased by increasing the level of inclusion of *Moringa oleifera* in the rations.

Table 2: Mean ± SE of haematological parameters in different groups of Sahiwal cows

Particulars	Groups			Sign.
	T_0	T_1	T_2	
TEC($\times10^6$/mm^3)				
0 day	5.30 ± 0.17	5.42 ± 0.35	5.91 ± 0.13	NS
35 day	5.28 ± 0.23	5.68 ± 0.13	6.16 ± 0.40	NS
Hb (mg/dl)				
0 day	8.88 ± 0.25	8.92 ± 0.46	9.50 ± 0.20	NS
35 day	8.55 ± 0.33	8.98 ± 0.18	9.58 ± 0.45	NS
PCV%				
0 day	26.22 ± 0.49	26.28 ± 1.68	27.67 ± 0.76	NS
35 day	26.13 ± 0.98	27.20 ± 0.66	28.58 ± 1.19	NS
TLC($\times10^3$/mm^3)				
0 day	8.88 ± 0.32	8.73 ± 0.41	8.65 ± 0.40	NS
35 day	8.72 ± 0.37	8.50 ± 0.39	8.47 ± 0.38	NS

Days	DLC (%)	T_0	T_1	T_2	Sign.
Initial (0day)	N	30.16±0.70	29.5±0.50	28.83±1.01	NS
	L	63.67±0.76	63.5±0.76	63.83±0.79	NS
	E	4.33±0.42	4.83±0.31	5.00±0.37	NS
	M	1.83±0.31	2.17±0.40	2.33±0.42	NS
	B	0	0	0	NS
35 day	N	29.67±0.99	29.00±0.68	28.67±0.67	NS
	L	64.17±0.70	64.33±0.61	64.67±0.61	NS
	E	4.50±0.43	4.67±0.33	4.80±0.31	NS
	M	1.67±0.21	2.00±0.26	1.83±0.31	NS
	B	0	0	0	NS

Sig- Significance level, NS: Non Significance

TEC-Total erythrocyte count, Hb- haemoglobin, PCV-Packed cell volume, TLC- Total leucocytes count, 10^6/mm^3-million per cubic millimeter, mg/dl-milligram per deciliter, %- percentage, 10^3/mm^3- thousand per cubic millimeter, N-Neutrophils, L- Lymphocyte, M-Monocytes, E-Eosinophils, B- Basophils.

Table 3: Mean ± SE of initial and final haematological parameters within groups of Sahiwal cows

Particulars	Groups								
	T_0			T_1			T_2		
	0 day	35 day	Sig.	0 day	35 day	Sig.	0 day	35 day	Sig.
TEC ($\times 10^6$/mm^3)	5.30 ± 0.17	5.28 ± 0.23	NS	5.42 ± 0.35	5.68 ± 0.13	NS	5.91 ± 0.13	6.16 ± 0.40	NS
Hb (g/dl)	8.88 ± 0.25	8.55 ± 0.33	NS	8.92 ± 0.46	8.98 ± 0.18	NS	9.50 ± 0.20	9.58 ± 0.45	NS
PCV%	26.22 ± 0.49	26.13 ± 0.98	NS	26.28 ± 1.68	27.20 ± 0.66	NS	27.67 ± 0.76	28.58 ± 1.19	NS
TLC ($\times 10^3$/mm^3)	8.88 ± 0.32	8.72 ± 0.37	NS	8.73 ± 0.41	8.50 ± 0.39	NS	8.65 ± 0.40	8.47 ± 0.38	NS
DLC (%)									
Nutrophils	30.16±0.70	29.67±0.99	NS	29.50±0.50	29.00±0.68	NS	28.83±1.01	28.67±0.67	NS
Lymphocytes	63.67±0.76	64.17±0.70	NS	63.50±0.76	64.33±0.61	NS	63.83±0.79	64.67±0.61	NS
Eosinophils	4.33±0.42	4.50±0.43	NS	4.83±0.31	4.67±0.33	NS	5.00±0.37	4.80±0.31	NS
Monocytes	1.83±0.31	1.67±0.21	NS	2.17±0.40	2.00±0.26	NS	2.33±0.42	1.83±0.31	NS
Basophils	00	00	NS	00	00	NS	00	00	NS

Sig- Significance level, NS: Non Significance

TEC-Total erythrocyte count, Hb- haemoglobin, PCV-Packed cell volume, TLC- Total leucocytes count, 10^6/mm^3-million per cubic millimeter, mg/dl-milligram per deciliter, %- percentage, 10^3/mm^3- thousand per cubic millimeter.

Conclusion

The proximate analysis of dried *M. oleifera* leaves exhibited that it contains substantial crude protein and could be used as a protein source in different livestock feeds. The haematological parameters were not affected by the feeding of *M. oleifera* leaves. Feeding of dried *M. oleifera* leaves may be economical to the farmers as it had reduced the feed cost and it can replace upto 20% level of commercial concentrate mixture in milch cows without any harmful effect on haematological parameters.

Table 4: Economic of feeding

S. No.	Particular	T_0		T_1		T_2	
		Quantity (kg)	Cost (Rs)	Quantity (kg)	Cost (Rs)	Quantity (Kg)	Cost (Rs)
1.	Total concentrate consumed/day/animal @ Rs. 21/ kg	4.40	92.4	3.96	83.16	3.52	73.92
2.	Total dried *Moringa oleifera* leaves consumed/day /animal @ Rs. 5/kg	-	-	0.44	2.20	0.88	4.40
3.	Total green Berseem consumed/day/group @ Rs. 3/kg	8.00	24.00	8.00	24.00	8.00	24.00
4.	Total paddy straw consumed/day/ animal @ Rs. 2.69/kg	4.80	12.92	4.84	13.02	4.87	13.10
5.	Total feed consumed / day/animal	17.20	-	17.24	-	17.27	-
7.	Total cost of feeding/day/animal	-	129.32	-	122.38	-	115.42
8.	Avg. milk prod./day/ animal	5.08	-	5.13	-	5.34	-
9.	Cost of feeding /kg milk production /day/animal	-	25.45	-	23.85	-	21.61
10.	Price of milk/kg	-	45	-	45	-	45
11.	Profit/kg milk	-	19.55	-	21.15	-	23.39
12.	Relative economic efficiency	-	100%	-	108%	-	119%

Kg- kilograms, Rs- Rupees

References

1. Department of animal husbandry, dairying and fisheries (DADF). 20th Livestock census. Basic animal husbandry statistics. Ministry of Agriculture, Govt. of India, 2017.
2. Gebregiorgis F, Negesse T, Nurfeta A. Feed intake and utilization in sheep fed graded levels of dried moringa leaf as a supplement to Rhodes grass hay. Tropical Animal Health and Production. 2012; 44(3):511-517.
3. Kakengi AMV, Shem MN, Sarwatt SV, Fujihara T. Can *Moringa oleifera* be used as a protein supplement for ruminants? Asian-Australian Journal of Animal Science. 2005; 18(1):42-47.
4. Bellostas N, Soslash JC, Nikiema A, Soslash H, Pasternak D, Kumar S. Glucosinolates in leaves of Moringa species grown and disseminated in Niger. African Journal of Agricultural Research. 2010; 5(11):1338-1340.
5. Anwar F, Sajid L, Muhammad A, Anwarul HG. *Moringa oleifera*: A Food plantwith Multiple Medicinal Uses. Phytotherapeutic Research. 2007; 21(1):17-25.
6. Asaolu VO, Binumote RT, Akinlade JA, Oyelami OS, Kolapo KO. Utilization of *Moringa oleifera* fodder combination with *Leucaena leucocephala* (LEU) and *Gliricidia sepium* (GLI) fodders by West African dwarf goats (WAD). International Journal of Agricultural Research. 2011; 6(8):607-619.
7. Gopalakrishnan L, Doriya K, Kumar DS. Moringa oleifera: A review on nutritive importance and its medicinal application. Journal of Food Science and Human Wellness. 2016; 5(2):49-56.
8. Akinyemi AF, Alokan JA, Adebowale NF. Effect of inclusion level on nutrient intake, digestibility, nitrogen balance and haematological parameters of West African Dwarf (WAD) sheep fed *Moringa oleifera* as supplements to *Panicum maximum*. Journal of Animal Science. 2010; 6(10):634-643.
9. Meel P, Gurjar ML, Nagda RK, Sharma MC, Gautam L, Manju. Effect of *Moringa oleifera* leaves feeding on hemato - biochemical profile of sirohi goat kids. Journal of Entomology and Zoological Study. 2018; 6(5):41-48.
10. ICAR. Nutrient requirements of cattle and buffalo. Indian Council of Agricultural Research, New Delhi, India, 2013.
11. AOAC. Official Methods of Analysis. 17th edn. Association of Official Analytical Chemists, Virginia, USDA, Washington, DC, 2000.

12. Steel RGD, Torrie JH. Principle and Procedures of Statistics. A biometrical apporoach. 2nd edn. McGraw-Hill, New York, USA, 1980.
13. Snedecor GW, Cochran WG. Statistical Methods. 8th edn. Oxford and IBH. The Iowa State University Press, Ames, Iowa, USA, 1994.
14. Babeker EA, Bdalbagi YMA. Effects of feeding different levels of *Moringa oleifera* leaves on the performance, haematological, biochemical and some physiological parameters of Sudan Nubian goats. Journal of Animal and Feed Research. 2015; 5(2):50-61.
15. Choudhary RK, Roy A, Roy PS, Singh KM, Kumar P. Effect of Replacing Concentrate Mixture with Moringa Leaves (*Moringa oleifera*) on Performance of Lactating Bengal Goats in Kishanganj District of Bihar, India. Internatinal Journal of Current Microbiology and Applied Sciences. 2018; 7:2895-2900.
16. Smith BP. Large animal internal medicine. 3rd edn. Mosby, Harcourt Health science company America, USA, 2002, pp. 393-416.
17. Ali SB. Growth performance of goats fed *Moringa oleifera* leaf meal incorporated in concentrate mixture. MVSc thesis submitted to Maharashtra Animal and Fishery Sciences University, Nagpur, 2017, pp. 38-49.
18. Yusuf AO, Mlambo V, Iposu SO. A nutritional and economic evaluation of *Moringa oleifera* leaf meal as a dietary supplement in West African Dwarf goats. South African Journal of Animal Science. 2018; 48(1):81-87.
19. Haridas RM. Effect of supplementation of *Moringa oleifera* leaf meal on the performance of growing sheep (*ovis aries*). MVSc. thesis submitted to Maharashtra Animal and Fishery Sciences University, Nagpur, 2018, pp. 51-56.
20. Elbashier OM, Ahmed HE. The effect of feeding different levels of *Moringa oleifera* leaf meal on the performance and some blood parameters of broilers. International Journal Science and Research. 2016; 5(3):632-635.
21. Koury MJ, Ponka P. New insights into erythropoiesis: the Roles of folate, vitamin B12, and iron. Annual Review of Nutrition. 2004; 24:105-131.
22. Hewitt CD, Jnness DG, Wills MR. Normal Biochemical and Hematological Values in New Zealand Rabbits. Clinical Chemistry. 1989; 35:1777-1779.
23. Reece WO, Erickson HH, Goff JP, Uemura EE. Duke's physiology of domestic animals. 13th edn. John Wiley and Sons, Inc., 2015, pp. 118.
24. Khalel MS, Shwerab AM, Hassan AA, Yacout MH, El-Badawi AY, Zaki MS. Nutritional evaluation of *Moringa oleifera* fodder in comparison with *Trifolium alexandrine* (berseem) and impact of feeding on lactation performance of cows. Life Science Journal. 2014; 11(10):1040-1054.