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Study on Effect of Supplementation of Moringa Oleifera Leaf Meal (MOLM) on Plasma Glucose, Blood Urea Nitrogen and Cholesterol Parameters of Murrah Buffaloes

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Abstract

The present investigation was undertaken to study the effect of Moringa oleifera leaf meal (MOLM) supplementation on plasma glucose, blood urea nitrogen (BUN), and cholesterol parameters of Murrah buffaloes reared under a loose housing system. In this experiment, 18 Murrah buffaloes were assigned to three treatment groups (T1, T2, and T3) resulting in six buffaloes per treatment based on parity. T1 (control) - Feeding as per ICAR standards (2013), T2 - 75 g MOLM/animal/day, and T3 - 150 g MOLM/animal/day, the experiment was carried out for a period of 21 days before calving (pre-partum) to 5 months of lactation (postpartum). The findings of the study revealed that that there was no increase in plasma glucose concentration, cholesterol level, and BUN by increasing Moringa oleifera leaf meal in the ration of lactating Murrah buffaloes.

Keywords: Cholesterol, Glucose, Lactation, *Moringa oleifera*, Supplementation.

Introduction

The significance of buffalo's contribution to the national economy, farmer's subsistence, and sustainable dairy production cannot be neglected. Buffaloes have a vital role in providing food and livelihood income to farmers. Buffaloes provide more than one-third of Asia's total milk and are the world's second-largest milk producer. Buffaloes are well known for their meat and draught power (Bandyopadhyay *et al.*, 2003). The Livestock Sector has continuously been growing at a Compound Annual Growth Rate (CAGR) of 7.67% (at constant price) from 2014-15 to 2021-22. Milk production during 2022-23 was 230.58 million tonnes showing an annual growth of 3.83 %. The per capita availability of milk in India is around 459 grams/day in 2023 (DAHD, Annual report, 2022-23). Murrah, Nili-Ravi, Surti, and Jaffarabadi, which originated in India's north-western states and have a great potential for milk and fat production in addition to their usage as a work animal and supplementary stock for meat production, are among the best River milk breeds in Asia (Sethi, 2003). India has the privilege of having the World's best breeds of buffaloes; out of which Murrah is the most popular because of its superiority in milking potential and commercial ground. The pride of Haryana, the Murrah breed of buffalo, is a milk-type animal (Dhillod *et al.* 2017). Murrah buffaloes are also given synonyms such as "black gold" or "Holstein-Friesian" of the buffalo world (Dahiya *et al.* 2022).

The evergreen tree fodder *Moringa oleifera* (MO) (family Moringaceae) is a viable alternative nutrient source in ruminant diets (Kholif *et al.,* 2016). Humans throughout the century have consumed the Moringa plant in diverse culinary ways (Iqbal and Bhanger, 2006). *Moringa oleifera* leaves have been shown in epidemiological studies to be an excellent source of nutrition and to have anti-tumor, anti-inflammatory, anti-ulcer, anti-atherosclerotic, and anti-convulsant properties (Dan Malam *et al.*, 2001; Dahiru *et al.,* 2006 and Chumark *et al.*, 2008,). Zeng *et al.* (2018) revealed that MO silage showed non-significant effects on the serum concentrations of glucose ($P > 0.05$). Kholif *et al.* (2018) found that supplementation with *M. oleifera* leaf to replace 75% dry matter of berseem clover can improve feed utilization in Nubian goats. They also observed that Moringa diets increased serum glucose levels but decreased cholesterol and triglyceride levels. Shankhpal *et al.,* (2019) studied that the cholesterol in cows was lowered to 17.60% when the animals were fed with moringa as green fodder. Bashar *et al.* (2020) revealed that levels of blood urea nitrogen did not show any adverse effect on animal health ($P > 0.05$) by feeding Moringa feed.

Various studies were conducted in different species to observe the effect of inclusion of only *Moringa oleifera* leaves on different biochemical parameters but the effect of supplementation of *Moringa oleifera* leaf meal in Murrah buffaloes is scanty. Keeping in view the above facts, the present investigation has been undertaken to study the effect of *Moringa oleifera* supplementation on the performance of lactating Murrah buffalo under a loose housing system to examine the effect of Moringa on the biochemical parameters *viz.* plasma glucose, blood urea nitrogen and cholesterol levels in Murrah buffaloes.

Materials and Method

Based on the same parity, 18 lactating Murrah buffaloes of varying lactation stages were chosen from the herd of buffalo farm of the Department of Livestock Production Management, College of Veterinary Sciences, Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar (1^{st} to 5^{th} parity). These buffaloes were divided into three treatment groups (T1, T2, and T3), with six lactating buffaloes per treatment based on parity and a factorial fully randomized design (FCRD). The study was carried out over a period of 21 days pre-partum to 5 months of lactation (171 days) to determine the impact of adding MOLM to the treatments listed in Table 1. These treatments include T1 (control), which feeds lactating buffaloes wheat straw, green fodder, and concentrate mixture (on a DM basis) to meet the animal's nutritional needs by ICAR guidelines (2013), T2- which feeds according to ICAR guidelines (2013) plus 75 g of MOLM/day, and T3which feeds according to ICAR guidelines (2013) plus 150 g of MOLM/day. The MOLM was purchased from the nearby market. Buffaloes were given MOLM in a concentrated mixture from day 21 prepartum to day 150 days in milk (DIM) postpartum. Table 2 lists the cost and chemical composition (% DM base) of the various feed items supplied to the buffaloes in the experiment. Blood samples were collected at the beginning of the experiments i.e. 21 days before calving, at the day of calving, and thereafter at the end of the experiment. i.e. 150 days after calving. Biochemical parameters in the plasma and serum samples were determined using an Automated Random Access Clinical Chemistry Analyzer (EM Destiny 200TM, Erba Diagnostics Mannheim GmbH). The experiment was started with prior approval taken to conduct the present investigation in the 21^{st} meetingof the Institutional Animal Ethics Committee, LUVAS held on February 12^{th}, 2021 (1669/GO/ReBiBt-S/Re-L/12/CPCSEA 06/12/2012).

Table 1: Chemical composition (% DM basis) and cost of different feed ingredients fed to the experimental buffaloes

Ingredients	DM	CP	CF	EE	Ash	OM	NFE	Rs./kg
Fodder								
Wheat straw	94.68	2.87	35.20	1.20	9.3	85.74	46.47	3.69
Green Berseem	22.31	15.2	25.70	1.80	11.08	94.84	52.14	1.50
Green Maize	24.93	9.1	24.70	3.41	8.31	84.03	46.82	1.50
Concentrate								
Maize	88.92	9.10	2.40	3.40	2.25	91.04	76.14	20.25
Barley	92.91	11.9	5.20	2.32	5.21	93.26	73.84	16.50
Groundnut cake	95.12	41.5	7.4	9.53	7.30	96.38	37.95	32.13
Soyabean meal	88.95	46.80	4.80	1.51	7.31	97.25	44.14	46.44
Mustard cake	93.77	31.71	7.56	6.19	7.27	91.51	46.05	27.88
Moringa oleifera leaf meal(MOLM)	90.12	23.12	8.95	4.67	10.13	83.21	46.47	160.00
Mineral mixture	96.45	-	-	-	-	-	-	68.00
Common salt	98.46	-	-	-	-	-	-	2.91

**Recorded from Feed and Fodder store, LUVAS, Hisar. *DM- dry matter, CP- crude protein, CF- crude fibre, EE- ether extract, OM- organic matter, and NFE- nitrogen free extract*

Statistical Analysis

The collected data were statistically analyzed using a completely randomized design (CRD) by Snedecor and Cochran (1994). Using the General Linear Models process in the SPSS-23 program, all the data were put through an ANOVA (SPSS, 2019). Duncan's multiple range tests were utilized to determine the mean differences between the various treatments. Consequently, a level of ($P<0.05$) was used as the criterion for statistical significance (Duncan, 1955)

Results and Discussion

The overall mean plasma glucose concentration was 58.06, 66.02, and 71.08 mg/dl in treatment groups T_1, T_2, and T_3, respectively. The statistical analysis of the data revealed that plasma glucose concentration did not differ significantly among treatments. Analogous to the findings of the present study, Zeng *et al.* (2018) revealed that MO silage had no significant effects on the serum concentrations of glucose in cows ($P > 0.05$). Similarly, Kekana *et al.* (2020) found that blood glucose levels increased significantly ($P<0.05$) with increasing levels of Moringa in the diet of lactating cows. Kholif *et al.* (2018) revealed that supplementation of ration with *M. oleifera* leaf to replace 75% dry matter of berseem clover can improve feed utilization in Nubian goats. They also observed that Moringa diets increased serum glucose levels.

The study inferred that there was no increase in plasma glucose concentration, by increasing *Moringa oleifera* leaf meal in the ration of lactating Murrah buffaloes which may be due to increased demand of energy partitioning for production after calving.

The blood urea nitrogen concentration (BUN) of experimental buffaloes showed statistically non-significant differences among various treatments. The overall mean BUN concentration was 35.79, 36.93, and 40.33 mg/dl in treatment groups T_1, T_2, and T_3, respectively. Contrary to the present finding, Zeng *et al.* (2018) MO silage increased serum urea concentrations. This result agrees with the findings of Kholif *et al.* (2016). These results indicated that BUN was not affected by supplementation of *Moringa oleifera* leaf meal in the ration of lactating Murrah buffaloes.

Table 2: Mean glucose (mg/dl), blood urea nitrogen (mg/dl), and cholesterol (mg/dl) level in plasma of experimental buffaloes under different dietary treatments

Parameter	Period	Treatments		
		T_1	T_2	T_3
Mean glucose (mg/dl)	At start of experiment	60.33±3.73	64.17±4.16	66.67±6.17
	At time of calving	45.5±7.5[a]	62.33±4.33[ab]	73.83±7.55[b]
	At end of experiment	68.5±7.59	71.5±2.73	74.33±9.89
	Overall mean	**58.06±4.58**	**66.02±2.7**	**71.68±2.65**
Mean blood urea nitrogen concentration (mg/dl	At start of experiment	39.4±1.81	40.65±2.32	42.5±1.38
	At time of calving	34.85±4.53	36.35±1.77	36.83±4.75
	At end of experiment	33.12±1.91	33.8±3.18	42.1±5.23
	Overall mean	**35.79±1.87**	**36.93±2.00**	**40.33±1.75**
Mean cholesterol (mg/dl)	At start of experiment	71.17±6.18	72.00±5.52	70.17±5.99
	At time of calving	81.5±13.82	69.00±7.87	67.5±3.85
	At end of experiment	71.33±7.60	71.33±7.85	64.67±3.53
	Overall mean	**74.83±3.63**	**70.83±5.02**	**67.50±2.11**

**The mean values with different superscripts in a row differ significantly (P<0.05).*

The overall mean plasma cholesterol concentration (mg/dl) was 74.83, 70.83, and 67.50 in treatment groups T_1, T_2, and T_3, respectively. The average plasma cholesterol concentration of experimental buffaloes showed statistically no significant (P<0.05) differences among various treatments. The present results are in agreement with Bushara *et al.* (2017) who revealed that supplementation of Moringa feed did not affect the range of standard values of cholesterol. Contrarily to the present finding, Damor *et al.* (2017) evaluated the effect of replacing the concentrate mixture with *M. oleifera* leaves on the blood biochemical profile of Mehsana goat kids and concluded that replacing the concentrate mixture with Moringa leaves in the diet of growing Mehsana goat kids decreased level of blood cholesterol. Divya *et al.* (2014) evaluated the effects of *M. oleifera leaves* in broiler chicken, on serum chemistry by feeding 0.5%, 1.0%, 1.5%, and 2.0% MOL diets. The dietary inclusion of MOL powder, in broiler ration significantly (P<0.05) decreased the serum cholesterol. These results indicated that cholesterol level was not affected by supplementation of *Moringa oleifera* leaf meal in the ration of lactating Murrah buffaloes.

Conclusion

These results indicated that most of the biochemical parameters were found in the normal range and had no detrimental effect on the health status of animals. It is inferred from the present study that there was no increase in plasma glucose concentration, cholesterol level, and BUN feeding *Moringa oleifera* leaf meal at two levels in the ration of lactating Murrah buffaloes

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Contribution by Authors

Equal contribution. All authors declared that 'written informed' consent was obtained from the approved parties for the publication of this article and accompanying images.

Conflict of Interests

There is no conflict of interest.

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