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Ramesh Kumar Mishra
Scientist, J.N.K.V.V., K.V.K., Katni, Madhya Pradesh, India

RPS Baghel
Dean, College of Vety. Sc. & A. H. NDVSU, Jabalpur, Madhya Pradesh, India

Rahul Sharma
V.E.O., D.A.H, Rithi, Katni, Madhya Pradesh, India

Shivangi Sharma
Teaching Associate, Dept. of Vety. Medicine, College of Vety. Sc. & A. H. NDVSU, Jabalpur, Madhya Pradesh, India

Pawan Sirothiya
Associate Prof and H.O.D., N.R.M., M.G.C.G.V., Satna, Madhya Pradesh, India

S Nayak
Prof. & Head, Animal Nutrition, College of Vety. Sc. & A. H. NDVSU, Jabalpur, Madhya Pradesh, India

Correspondence
Shivangi Sharma
Teaching Associate, Dept. of Vety. Medicine, College of Vety. Sc. & A. H. NDVSU, Jabalpur, Madhya Pradesh, India

Effect of strategic nutrient supplementation on performance of lactating buffaloes in Katni district of Madhya Pradesh

Ramesh Kumar Mishra, RPS Baghel, Rahul Sharma, Shivangi Sharma, Pawan Sirothiya and S Nayak

Abstract
The study was planned to see the effect of strategic nutrient supplementation on performance of lactating buffaloes in Katni district of Madhya Pradesh. The 12 healthy early lactating Murrha buffalos of 3rd lactation were selected on the basis of body weight, milk yield and milk fat from the dairies of nearby area of Krishi Vigyan Kendra Katni and they were randomly divided into 2 groups of 6 buffaloes in each group. Haemato-biochemical parameters were analysed. Nutrient intake of the animals was compared with the nutrient requirements given in feeding standards. The diet were strategically balanced by supplementing deficient nutrients in the diet. The results revealed that maximum weight loss occurred in buffaloes of T1 (control) group while, it was minimum in those maintained in treatment (T2) group. The milk yield and milk composition like fat, solid not fat, protein, lactose and TS were improved in the treatment groups. The hemato-biochemical and serum mineral concentration data clearly indicated positive effect of dietary treatments on buffaloes.

Keywords: Buffalo, performance, Heamato-biochemical, nutrient supplentation

1. Introduction
India's livestock sector is one of the largest in the world. In spite of highest milk producers in the world, the productivity of our milch animals is very low because of large number of low producing nondescript animals, long calving intervals, poor feeding and lack of improved management practices. The main constraint to livestock development in developing countries is the scarcity and fluctuation in the quality and quantity of animal feed [12]. Only 27-75% of the dairy animal potential yield is realized in different regions of the country [3] because of constraints related to feeding, breeding, health and management.

The crop residues and agro-industrial by products forms the bulk of the ration supply to the animals. The crop residues and local grasses are deficient in protein and certain minerals. It is necessary to strategically supplement these deficient nutrients in the animal ration for optimum reproduction and production.

The inadequate supply of quality feed and improper feeding management limits the availability of important nutrients to the animal during critical period of their production cycle. The strategic nutrient supplementation not only improved the reproductive performance of the anestrous and lactating buffaloes, but it also improved the growth performance of the heifers [13]. The supplementation of mineral mixture in the diet of lactating buffaloes, have significant increase in milk production and onset of oestrous [14]. Among many factors governing the livestock productivity, feeding accounts for more than 60-70% of the total recurring cost. Therefore, qualitative and quantitative improvement in this aspect will improve animal productivity.

2. Materials and Methods
Katni is situated at 23.83^0 latitude and 80.40^0 longitudes at 392 MSL in the southern part of second agro-climate zone, including Kymore plateau and Satpura hills of Madhya Pradesh.

The 12 healthy Murrah buffaloes of 3rd lactation were selected on the basis of body weight, milk yield and milk fat from the dairies nearby to the Krishi vigyan Kendra Katni and they were randomly divided into 2 groups of 6 buffaloes in each group. They were assigned two dietary treatments for the period of four months, considering their body weight and milk yield.

2.1 Group: I (Control/FP)
The routine farmer's practiced was considered as control. The diet of this group consisted of wheat straw 6.5 Kg + 12 Kg green berseem +1.5 Kg concentrate+ concentrate approximately half of the milk yield. They were not providing mineral mixture to the animals and common salt approximately @ 40 g / animal / day was given through drinking water.

2.2 Group: II (Treatment/SNS)
The feeding of roughages to the animals in this group was similar as control and balanced concentrate mixture were fed as per nutrient requirement [6].

2.3 Experimental designs
A survey was conducted on existing feeding practices of buffaloes through common questionnaire. Data were collected regarding animal status and feeding practices adopted by farmers. The representative samples of straws, fodders, concentrate ingredients and concentrate mixtures offered to the animals were also collected for analysis of proximate principles and mineral analysis. The dried samples of concentrate mixture, wheat straw and green forage were ground to pass through 1 mm sieve, pooled, and samples were analyzed for proximate principles as per A.O.A.C. [1] and minerals by atomic absorption spectrophotometer (AAS) Table- 1(a), 1(b) and 2.

Table 1(a): Proximate composition of feed ingredients of Katni district.

	DM	CP	EE	CF	NFE	Ash
Berseem	17.30 ±0.12	15.60 ±0.10	2.12 ±0.22	26.30 ±0.12	45.90 ±0.32	10.10 ±0.21
Sorghum Chari	25.60 ±0.06	07.91 ±0.06	3.31 ±0.10	26.21 ±0.06	54.16 ±0.25	08.42 ±0.33
Pasture grass	20.13 ±0.14	05.40 ±0.10	5.21 ±0.17	28.56 ±0.16	48.28 ±0.31	12.55 ±0.20
Wheat straw	90.80 ±0.10	03.12 ±0.04	1.14 ±0.07	38.55 ±0.11	45.68 ±0.22	11.57 ±0.25
Paddy straw	90.20 ±0.06	03.14 ±0.02	1.34 ±0.09	36.31 ±0.06	48.21 ±0.27	12.55 ±0.36
Maize	89.40 ±0.11	09.10 ±0.10	4.12 ±0.11	02.52 ±0.04	82.45 ±0.15	01.81 ±0.15
Mustard cake	91.50 ±0.07	34.78 ±0.06	9.86 ±0.06	10.16 ±0.06	36.10 ±0.21	09.10 ±0.22
Wheat bran	90.81 ±0.06	13.82 ±0.20	4.22 ±0.13	10.18 ±0.20	63.92 ±0.30	07.92 ±0.30
Rice bran	91.10 ±0.15	11.31 ±0.07	8.30 ±0.09	19.21 ±0,12	49.10 ±0.23	12.10 ±0.24
Rahar Chuni	91.31 ±0.11	14.35 ±0.15	2.34 ±0.10	22.14 ±0,07	54.03 ±0.19	07.19 ±0.19

Table 1 (b): Mineral content of feed ingredients used in Katni district.

Ingredients	Ca (%)	P (%)	Fe (ppm)	Cu (ppm)	Mn (ppm)	Zn (ppm)	Co (ppm
Berseem	1.80±0.06	0.19±0.07	494.71±0.31	03.54±0.06	84.29±0.15	12.38±0.03	0.06±0.01
Sorghum Chari	0.30±0.09	0.11±0.06	385.68±0.45	05.73±0.16	72.31±0.35	15.54±0.06	0.02±0.01
Pasture grass	0.44±0.15	0.09±0.07	225.01±0.51	06.12±0.11	46.81±0.27	24.14±0.08	0.15±0.02
Wheat straw	0.21±0.09	0.06±0.02	269.41±0.67	04.19±0.16	62.88±0.20	23.47±0.04	0.02±0.01
Paddy straw	0.40±0.11	0.09±0.03	478.52±0.33	01.44±0.10	126.06±0.76	17.84±0.02	0.01±0.02
Maize	0.02±0.01	0.40±0.01	010.20±0.56	03.10±0.05	08.16±0.88	27.90±0.09	0.02±0.01
Mustard cake	0.81±0.21	1.05±0.21	527.17±0.78	28.79±0.21	58.20±0.56	76.64±0.07	0.55±0.03
Wheat bran	0.17±0.07	1.26±0.15	139.38±0.33	11.44±0.22	89.53±0.37	56.76±0.04	0.10±0.01
Rice bran	0.12±0.04	1.36±0.25	648.37±0.86	17.81±0.15	104.26±0.39	61.08±0.02	0.07±0.03
Rahar Chuni	0.47±0.15	0.56±0.06	334.52±0.61	14.63±0.07	46.77±0.41	21.32±0.06	0.04±0.02

Table 2: Ingredient composition of concentrate mixture used in experiment (%)

Ingredient	Control	Treatment (SNS)
Maize	25.0	41.0
MOC	30.0	25.0
Wheat bran	10.0	16.0
Rice bran	05.0	-
Rahar chuni	30.0	17.0
Urea	-	01.0
Min. Mix. (g/day)	-	90.0
Salt in water (g/day)	40.0	40.0

Nutrient requirement of the animals under experiment was calculated based on their body weight and production performance. The availability of dry matter (DM), crude protein (CP), total digestible nutrient (TDN), major elements (Ca, P) and trace elements (Fe, Cu, Mn and Zn) for each animal was calculated on the basis of chemical composition of feeds and fodders and their feed intake. Finally, the nutrient intake of the animals was compared with the nutrient requirements given in feeding standards [6] to work out their nutrient deficiencies/ excess/ imbalance. The diet was strategically balanced by supplementing deficient nutrients in the diet and effect of nutrient supplementation on production performances of the animals was observed. Ration was prepared considering the availability of feed ingredients and feeding practices adopted by dairy farmers.

2.4 Collection of sample
Aseptically blood samples were collected from jugular vein of each buffaloes in the morning before feeding and watering at start and end of the strategic nutrient supplementation. The 5 ml blood was collected in the heparinized vaccutainer for hemoglobin (Hb) and blood glucose estimation. Whereas, 10 ml blood was collected in clean glass test tube without anticoagulant for analysis of serum total protein (TP), calcium (Ca) phosphorus (P), iron (Fe), copper (Cu), manganese (Mn) and Zinc (Zn).

2.5 Observations recorded
After adaptation period of 21 days observations were recorded regarding feed intake, milk production and milk constituents. For all the animals similar feeding conditions were maintained except the amount of strategic supplements. Milk yield was recorded daily in the morning and evening. Body weight of buffaloes was taken at the start and end of experiment by the Mullick's formula for buffalo [18]. The economics of milk production were calculated on the basis of milk production and cost of feeding during experiment.

2.6 Analysis of samples
Chemical analysis of feeds and fodders for Proximate

principles [1] and minerals with the help of atomic absorption spectrometer (AAS). The blood haemoglobin was analysed by using Shali's method and blood glucose by heamoglocunometer. The serum analysis for total protein, Ca and P was done by using Semi-automatic hemato-biochemical analyzer and trace elements (Fe, Cu, Mn and Zn) by AAS. Milk samples were analyzed for fat, milk protein, lactose, total solids and solids-not-fat percentage by Milkoscan. The data were statistically analysed by using t-test.

3. Results and discussion

The data on the effect of strategically balanced diet on performance of lactating buffaloes has been presented in Table 3. The data revealed that higher loss in body weight was 7.91 Kg in buffaloes reared on farmers practice (control). Whereas, strategically nutrient supplemented (Treatment) group of buffaloes reduced only 2.91 Kg body weight during experiment period. Regarding dry matter intake (DMI) among two group did not differ significantly (P>0.05) which was 2.86% and 2.87% of body weight of buffaloes in treatment and control groups, respectively. The percent change in DMI was higher in control groups (4.36%) of buffaloes during experiment period.

Table 3: Effect of strategic nutrient supplementation (SNS) on performance of lactating buffaloes

Parameters	Control		Treatment		t- value
	During experiment	Change (%)	During experiment	Change (%)	
Body weight (Kg)	451.14±4.84	-7.91 kg(-1.72)	454.43 ±4.70	-2.90 kg(-0.63)	0.77
DMI (Kg)	12.96 ±0.12	2.69	13.0 ±0.16	1.33	1.14
DMI (% B. W.)	02.87±0.01	4.36	02.86±0.02	1.42	0.24
Milk yield (L/day)	08.21 ±0.09	3.92	08.62* ±0.08	9.53	3.46**
Fat	06.78 ±0.05	1.19	06.91 ±0.06	2.37	1.64
SNF	09.47 ±0.04	0.32	09.39 ±0.06	0.54	1.21
Protein	03.71 ±0.04	2.49	03.70 ±0.03	4.52	0.24
Lactose	04.94 ±0.03	-3.52	04.98 ±0.03	-2.54	0.20
Total solid	16.26 ±0.02	0.62	16.30 ±0.01	1.24	1.21

*Means bearing different superscript differ significantly (p<0.05)
** Means bearing different superscript differ highly significant (P>0.01)

The effect of dietry treatment on milk production revealed highly significant (P>0.01) improvement in treatment group than control. The milk production in treatment group was noticed as 8.62 liter per day which was significantly higher (P<0.01) than the buffaloes of control group having milk production 8.21 liter per day. The change in the production from their initial yield during experiment was 9.53% and 3.92% in treatment and control groups, respectively. The results regarding chemical composition of milk indicated an increase in percentage of fat, lactose, total solid (TS) which was 6.91%, 4.98%, 16.30% respectively in treatment group than 6.78%, 4.94%, 16.26% respectively in control group but values did not differ significantly (P<0.05). The percent change in solid not fat (SNF) and protien were also noticed non significanlty (P>0.05) higher in treatment (0.54% and 4.52%) than control (0.32% and 2.49%) group of buffaloes.

The heamatobiochemical parameters have been presented in Table 4(a). The data revealed significant (P<0.05) improvement in Hb (12.76 g/dl) and glucose (58.56 mg/dl) concentration due to dietry treatment. The improvement in concentration of serum TP (7.18 mg/dl), Ca (10.79 mg/dl) and P (5.21 mg/dl) was highly significant (P>0.01) in buffaloes belongs to treatment group. Whereas, lower concentration of Hb (11.86 g/dl), glucose (53.41 mg/dl), TP (6.27 mg/dl), Ca (8.96 mg/dl) and P (4.38 mg/dl) were recorded in in control group.

Table 4 (a): Effect of strategic nutrient supplementation on hematobiochemical parameters of lactating buffaloes

Parameters	Control		Treatment		t- value
	At end	Change (%)	At end	Change (%)	
Hemoglobin (gm/dl)	11.86 ±0.23	1.37	12.76 ±0.31	08.59	2.32*
Glucose (mg/dl)	53.41 ±1.16	4.09	58.56 ±1.33	12.98	2.92*
Total protein (mg/dl)	06.27 ±0.13	-0.63	07.18* ±0.11	12.89	5.27**
Ca (mg/dl)	08.96 ±0.28	1.36	10.79* ±0.12	21.24	5.92**
P (mg/dl)	04.38 ±0.16	3.06	05.21 ±0.21	20.60	3.12**

*Means bearing different superscript differ significantly (p<0.05)
** Means bearing different superscript differ highly significant (P>0.01)

The trace minerals concentration in serum of buffaloes has been presented in Table 4(b). The data obtained regarding trace minerals concentration in serum of buffaloes during the experiment revealed that serum iron (Fe) concentration in buffaloes of both the groups did not differ significantly (P<0.05). The significant (P<0.05) increase in Cu and highly significant (P>0.01) increase in concentration of Mn and Zn was observed in buffaloes of treatment group over control. The serum Cu, Mn and Zn concentration were 0.58, 0.61 and 0.69 ppm respectively in treatment group of buffaloes. Whereas, the level was only 0.48, 0.51 and 0.50 ppm respectively in control group at the end of experiment. The negative change in the concentration of Zn was noticed in control group, whereas dietary treatment has produced positive effect in the buffaloes of nutrient supplemented group.

Table 4 (b): Effect of strategic nutrient supplementation on serum trace mineral profile of lactating buffaloes

Parameters	Control		Treatmengt		t- value
	At end	Change (%)	At end	Change (%)	
Fe (ppm)	2.10 ±0.05	3.45	2.23 ±0.06	10.95	1.73
Cu (ppm)	0.48 ±0.02	9.09	0.58 ±0.03	38.10	2.81*
Mn(ppm)	0.51 ±0.02	8.51	0.61 ±0.03	27.08	3.16**
Zn (ppm)	0.50 ±0.03	-7.41	0.69 ±0.03	23.21	5.09**

*Means bearing different superscript differ significantly (p<0.05)

** Means bearing different superscript differ highly significant (P>0.01)

The data revealed that during experimental period, maximum reduction in body weight (1.72%) was in buffaloes reared on farmers practice group. While, it was minimum (0.61%) in SNS group. No change in body weight was noticed when buffaloes were fed with balanced diet or diet supplemented for deficient nutrients [11, 15, 16, 20]. While, improvement in the body weight of buffaloes was noticed because of strategic supplementation in their diet [8]. The differences in the body weight reported by different researchers may be associated with stage of lactation and age of experimental buffaloes. The loss of weight in both the group in present study was probably because of limited storage capacity of rumen which restricted the DMI of buffaloes resulting into shortage of nutrient during peak production which became more pronounced when buffaloes were fed on imbalanced diet which had been noticed in the control animals. The dry matter intake during the experiment period did not differ significantly (P>0.05) among buffaloes of treatment and control group. Similar finding was also noticed by previous researchers [2, 8]. The higher DMI in control group was probably because of less density of nutrients in control diet. Whereas, buffaloes of treatment group had received diet in well balanced form hence much change in per cent DMI had not occurred.

The milk production in treatment group of buffaloes was significantly higher (P<0.01) than the buffaloes of control group, The increase in production was also reported [5, 7, 8, 11, 19, 20, 21] when dairy animals were fed balanced diet or diet supplemented for deficient nutrients. The increase in the yield of treatment group was mainly attributed to supply of balanced nutrients during peak production when animals have high demand of nutrients to achieve and maintain long peak milk production. Due to shortage of nutrients in buffaloes ration during high demand for milk production, body reserves alone were not able to fulfill their nutrient requirements, hence adverse affect on production performance of buffaloes of control group was noticed.

The results on chemical composition of milk indicated insignificant positive change in both the groups but improvement was more pronounced in buffaloes of treatment group than control for all the parameters of study except lactose. The differences in milk constituents were statistically non significant (P<0.05) between both the groups. The previous workers [2, 21] had also reported non-significant improvement in milk constituents when diet was supplemented for minerals or animals were fed on balance diet. On the other hand [17] researchers noticed significantly higher milk fat, TS and SNF in the treatment than control group. The reduction in lactose content was noticed in both the groups, although reduction was much in the buffaloes fed on control diet than SNS supplemented group. The positive change in the milk constituents were probably attributed to higher nutritional status of lactating buffaloes led to higher concentration of nutrients in the blood circulation and maximum nutrients reached in the mammary glands for synthesis of milk, hence increased concentration of constituents had occurred in their milk. The concentration of milk constituents was also associated with lactation stage and milk yield of animals. Probably, that was the reason why the lactose revealed towards the negative side from the values obtained before start of experiment.

The data on heamato-biochemical parameters revealed that improvement in Hb content was more pronounced in buffaloes of treatment than control group. The improvement was probably because of dietary supplementation of balanced nutrients in the ration which led to reduction in stress of lactating buffaloes, hence better physiology of buffaloes. The increase in blood glucose concentration due to dietary treatment was significantly (P<0.05) higher in buffaloes of treatment group than. The significantly (P<0.05) higher values of total protein in the buffaloes of treatment group was probably because of appropriate level of protein in their ration. However, less improvement in serum total protein in buffaloes of control group might be associated with low level of protein in their ration.

Significantlhy higher serum Ca and P was noticed in SNS group during treatment than control. The increase in serum Ca and P was probably due to their appropriate ratio in the diet which led to their better absorption in the digestive tract in treatment group but increase was maintained in normal range because of physiological mechanism of animal body. The previous workers [9, 11] also noticed improvement in plasma Ca and P level due to strategic supplementation in buffaloes.

The data revealed that iron (Fe) content in serum of buffaloes of treatment and control group did not differ significantly (P>0.05). Normal range of serum Fe level may be attributed to the abundance of iron in soil as well as in feeds and fodders of the selected area. Similar findings were reported by researchers [4, 10, 22]. Significantly higher serum copper (Cu), manganese (Mn) and zinc (Zn) concentration was recorded in treatment than buffaloes of control group. The increase in serum concentration of minerals during experiment was probably associated with their better absorption and utilization because of their presence in proper ratio in the ration of buffaloes of treatment group. Similar Improvement in plasma minerals concentration in buffaloes was also reported [10].

4. Summary and conclusion

The results revealed that maximum weight loss occurred in buffaloes of T1 (control) group while, it was minimum in those maintained in treatment (T2) group. The milk yield was significantly higher in treatment group than the buffaloes of control group. The milk composition like fat, SNF, protein, lactose and TS were found to improve in the treatment groups due to dietary treatments but differences among them were non-significant (P<0.05). The hemato-biochemical and serum mineral concentration data clearly indicated positive effect of dietary treatments on buffaloes. The shortest postpartum heat was noticed in buffaloes of SNS group.

On the basis of our findings, it can be concluded that use of scientific technologies like strategic nutrient supplementation had significantly improved the productive and reproductive

performance of the buffaloes and profit of the farmers.

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