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Effect of balance diet containing formaldehyde treated mustard oilseed cake on performance of lactating buffaloes

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Abstract
The study was planned to see the effect of balance diet containing formaldehyde treated mustard oilseed cake (FT-MOC) on performance of lactating buffaloes. The 12 healthy early lactating Murrha buffalos of 3rd lactation were selected and they were randomly divided into 2 groups of 6 buffaloes each. The routine farmer's practiced was considered as control (T1). In Treatment (T2) group feeding of roughage were similar as T1 and balanced concentrate mixture containing FT-MOC were fed as per nutrient requirement. Significant (P<0.05) difference in milk yield was observed. The fat, protein, lactose and total solid percentage of milk were recorded. The percent change in solid not fat (SNF) during experiment was noticed 0.32% in T1 and 0.96% in T2 groups of buffaloes. The experiment data indicated significantly higher values for haemato-biochemical parameters under study in buffaloes of treatment group than the control group. Balance diet containing formaldehyde treated (@ 1.2% of CP) mustard oilseed cake had significantly improved performance of the buffaloes.

Keywords: Buffalo, formaldehyde, mustard oilseed cake, milk, Heamatobichemical

1. Introduction

Livestock play an important role in strengthening the Indian economy. They provide food, fuel, drought power and manure for agriculture household by utilizing crop residues and by-products. The crop residues and agro-industrial by products forms the bulk of the ration supply to the animals resulting in less availability of nutrients to the lactating animals.

Protein is one of the most important and costliest parts of animal ration. The better utilization of available protein resources is very useful means of economizing the cost of feeding and increasing the feed conversion efficiency. Bypass protein technology is a method of increasing the availability of rumen undegradable protein to the ruminants. The oilcakes like mustard cake, Groundnut cake etc. is highly degradable at rumen. So, protection of these oilcakes by formaldehyde treatment improves the feed value of these protein sources. Feeding of protected nutrients is particularly important during early lactation to help achieve higher peak milk yield hance total lactation production.

Nutritional manipulations of dairy animals enabled in enhancing milk production and alterations in milk constituents. Milk production can be improved upto 50% levels by altering the feed composition with addition of rumen protected supplements [1]. It has been reported by some previous workers that improvement in milk yield and milk qualiy were significantly higher [2-5] when bypass nutrient incorporated in the diet of lactating cow and buffaloes. While, non-significant effect was observed on milk components (fat, solid not fat, protein, lactose, and total solids) due to incorporation of formaldehyde treated protein meals in feed [2, 6]. Hence the study was plan to see the effect of feeding balance diet containing formaldehyde treated (@ 1.2% of CP) mustard oilseed cake vs feeding practices adopted by farmers for lactating buffaloes in the district.

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 climate of the district resembles to that of tropical regions with hot summer and cold winters.

The 12 healthy Murrha buffalos of 3rd lactation were selected on the basis of body weight, milk yield and milk fat from the dairies around 6 km radius of 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/Farmer Practice/T1)

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 but farmers were neither fallowing feeding standard nor balancing diet of animal as per feeding standard. They were not providing mineral mixture to the animals in this group and common salt approximately @ 40 g / animal / day was given through drinking water.

2.2 Group: II (Treatment/ Formaldehyde teared mustered oil cake (FT- MOC)/ T2)

The feeding of roughage to the buffalos in this group was similar as control and balanced concentrate mixture containinhg Formaldehyde treated (@1.2% of crude prtein) mustard oilseed cake were fed as per nutrient requirement for buffaloes as given in Kearls [7] feeding standard (Table 1a, 1b and 2).

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

Ingredients	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 oilseed 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 oilseed 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 (T1)	FT-MOC (T2)
Maize	25.0	41.0
MOC/ FT-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

2.3 Collection of samples

Survey was conducted on existing feeding practices of buffalo in villages of Katni district through common questionnaire. Data were collected regarding animal status, feeding practices adopted by farmers and productive status of animals. The representative samples of straws, fodders, concentrate ingredients and concentrate mixtures offered to the animals were collected and pooled for the analysis. The dried samples were ground to pass through 1 mm sieve and samples were analyzed for proximate principles [8] and minerals by atomic absorption spectrophotometer (AAS).

Before start and at the end of experiment blood samples were collected aseptically from jugular vein of each buffaloes in the morning before feeding and watering. The 5 ml blood was collected in the heparinized vaccutainer for haemoglobin (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) and trace minerals.

Nutrient requirement of the animals under experiment was calculated based on their body weight and production performance. Availability of nutrients for each animal was calculated on the basis of chemical composition of feeds and fodders and their feed intake. Finally, the nutrients intake of the animals was compared with the nutrient requirements as given in feeding standards [7] to work out their nutrient deficiencies/ excess/ imbalance.

Formaldehyde treatment of mustard oilseed cake was done by ground it to pass 1.0 mm sieve. The Formaldehyde @ 1.2 g per 100 g of CP sprayed over ground mustard oilseed cake fallowed by through mixing and finely storing it in to tightly sealed plastic bags for seven days as per procedure standerised [9]

On the basis of results obtained diet was strategically balanced by supplementing deficient nutrients in the diet. The observations were recorded regarding the effect of strategically balanced diet containing formaldehyde treated mustard oilseed cake and farmers practice. All animals were

dewormed before start of experiment. Feeding was made in the morning and evening before milking.

2.4 Observation Recorded

Before start and during the experiment data were recorded regarding feed intake, milk yield and milk costituents. Milk yield was recorded daily in the morning and evening. Milk samples were collected on fortnightly basis from each buffalo on different treatments and analyzed for fat, milk protein, lactose, total solids and solids-not-fat percentage in Milkoscan.

Body weight of each animal was recorded in the morning by the Mullick's formula for buffalo [10]. The heart girth was measured in inches and weight of buffaloes was calculated by using Mullick's formula.

2.5 Analysis of Sampels

Chemical analysis of feeds and fodders for proximate principles [8] and minerals ie. Calcium (Ca), Phosphorus (P), Iron (Fe), Copper (Cu), Manganese (Mn) and Zinc (Zn) with the help of atomic absorption spectrometer. Blood haemoglobin (Hb) was analysed by using Shali's method and blood glucose by heamoglocunometer. The serum analysis for total protein (TP), Ca and P was done by using Semiautomatic hematobichemical analyzer. Milk samples were analyzed for fat, milk protein, lactose, total solids (TP) and solids-not-fat (SNF) percentage in Milkoscan. The experiment data were statisticaly analyzed by using t- test.

3. Results and Discussion

The effect of formaldehyde treated mustard oilseed cake (FT-MOC) containing strategically balanced diet was studied in lactating buffaloes. The experiment data in Table 3 and 4 revealed that body weight loss during the experimental period was higher (7.91kg) in buffaloes of control group (T1) than FT-MOC (T2) group (1.24Kg), where buffaloes were fed FT-MOC diet containing formaldehyde treated mustard oilseed cake as a source of bypass protein. Non significant (P>0.05) change in dry matter intake was noticed during the experiment in both groups, which was 2.88% and 2.87% of the body weight of buffaloes in FT-MOC and control groups, respectively.

Table 3: Effect of formaldehyde treated mustered oil cake (FT-MOC) on performance of lactating buffaloes

Parameters	Control (T1)		FT-MOC (T2)		t- value
	During experiment	Change (%)	During experiment	Change (%)	
Body weight (Kg)	451.14 ±4.84	-7.91 kg (-1.72)	455.90 ±5.14	-1.24 kg (-0.27)	0.93 NS
DMI (% B. W.)	02.87±0.01	4.36	02.88 ±0.03	02.86	0.22 NS
Milk yield (L/day)	08.21 ±0.09	3.92	08.77 ±0.07	12.44	5.21**
Fat	06.78 ±0.05	1.19	06.89 ±0.05	02.84	1.54NS
SNF	09.47 ±0.04	0.32	09.45 ±0.05	00.96	0.39NS
Protein	03.71 ±0.04	2.49	03.75 ±0.02	05.34	1.11NS
Lactose	04.94 ±0.03	-3.52	04.96 ±0.03	-02.36	0.24NS
Total solid	16.26 ±0.02	0.62	16.36 ±0.01	01.61	0.24NS

Note: NS = Non Significant (P<0.05), ** = Highly Significant (P<0.01)

The milk yield in buffaloes of FT-MOC group was 8.77 liter per day which was significantly higher (P<0.01) than control group in which it was only 8.21 liter per day. The change in the production during experiment was 12.44% and 3.92% in FT-MOC and control buffaloes, respectively. The results regarding chemical composition of milk during experiment period showed nonsignificant (P>0.05) increase in most of the milk constituents in buffaloes of FT-MOC group when compared with those of control group. The fat, protein, lactose and total solid percentage of milk were recorded as 6.89, 3.75, 4.96 and 16.36% in buffaloes of FT-MOC group whereas, it was 6.78, 3.71, 4.94 and16.26% in buffaloes of control group respectively. The per cent change in SNF during experiment was noticed 0.32% and 0.96% in control and FT-MOC groups of buffaloes respectively.

The heamato-biochemical parameters have been presented in Table 4. The data indicated significant (P>0.05) difference in the haemoglobin (Hb) and glucose content of blood between two groups of buffaloes. The haemoglobin content of buffaloes of FT-MOC group during treatment is 13.06 g/dl due to intervention of dietary treatment.Whereas, in control group Hb content was 11.86 g/dl. The blood glucose level at the end of experiment was recorded as 53.41 mg/dl and 59.80 mg/dl in the buffaloes of controle and FT-MOC group respectively. The change in glucose concentration due to dietary treatment was significantly (P<0.05) higher in FT-MOC group of buffaloes than that of control group but the increase was within the physiological range. The highelysignificant (P>0.01) difference in the concentration of serum TP, Ca and P was recorded in buffaloes of FT-MOC groups then the farmer practice of feeding control group. At the end of experiment total protein concentration were recorded as 6.27 mg/dl and 7.26 mg/dl for buffaloes of control and treatment group respectively but the values were within the normal range. The concentration of serum Ca and P were 10.83 mg/dl and 5.17 mg/dl respectively in buffaloes of FT-MOC group. However, it remained only 8.96 mg/dl and 4.38 mg/dl respectively in control group. The highlysignificant improvement in serum Ca and P was found because of nutrients supplementation.

Table 4: Effect of formaldehyde treated mustered oil cake on hematobiochemical parameters of lactating buffaloes

Parameters	Control (FP)		FT-MOC (T2)		t- value
	At end	Change (%)	At end	Change (%)	
Hemoglobin (gm/dl)	11.86 ±0.23	1.37	13.06 ±0.44	12.01	2.43*
Glucose (mg/dl)	53.41 ±1.16	4.09	59.80 ±2.13	15.20	2.63*
Total protein (mg/dl)	06.27 ±0.13	-0.63	07.26 ±0.09	13.62	6.32**
Ca (mg/dl)	08.96 ±0.28	1.36	10.83 ±0.12	19.27	6.06**
P (mg/dl)	04.38 ±0.16	3.06	05.17 ±0.16	20.79	3.48**

Note: * = Significant (P<0.05), ** = Highly Significant (P<0.01)

The shortest postpartum heat was noticed in buffaloes of FT-MOC (76.50). The postpartum heat in control groups of buffaloes was 102.80 days. The total cost on daily feeding of each buffalo was highest in those belonged to FT-MOC (Rs.116.51) and less in control (Rs.113.27) groups. However, total income from daily sale of milk per animal was highest in buffaloes of FT-MOC (Rs.394.65) then control (Rs.369.45) groups. The return over feed cost per day per buffalo was recorded higher in buffaloes of FT-MOC (Rs.278.14) then control (Rs.256.18) groups.

The data revealed that there was negligible loss in body weight in buffaloes of FT-MOC group. However, it was much more in those of control group. The higher reduction in weight of control buffaloes was probably because of utilization of body reserves due to shortage of nutrients in their diet during early and mid lactation. Ballnce diet containing bypass protein prevented loss of weight in buffaloes of FT-MOC group probably because of better utilization of protein and more availability of amino acids directoly to the animals. Feeding of bypass protein reduces fermentation of protein in the rumen and consequently less nitrogen loss from the rumen resulting into availability of maximum quantity for production. Whereas, control diet was deficient for certain nutrient which led to utilization of body stores as a result there was reduction in body weight. The previous researchers [11] also reported positive effect of bypass protein on weight gain in sheep. Correlation between dietary protein and body weight in sheep was observed [12].

The non-significant improvement in dry matter intake noticed in buffaloes of FT-MOC group due to supplementation of bypass protein in lactating dairy animals [13]. The greater per cent change in DMI of control group might be associated with less density or deficiency of nutrients. Whereas, buffaloes of FT-MOC group received balance diet as well as bypass protein. The bypass nature of protein prevents the losses of protein due to microbial digestion which could be directly utilized by buffaloes hence increases the efficiency.

The milk production in buffaloes of FT-MOC group was significantly higher ($P<0.01$) than those in control group. The increase in the yield of FT-MOC group was probably associated with the supply of nutrients during peak which led to achieve high peak and sustain production for longer period. Conversely, buffaloes of control group were deficit of nutrients during peak production which adversely affected their performance. Significant effect on milk production was recorded in present study due to feeding of balance diet containing bypass protein. Similar results have been reported by earlier workers [3-5, 14-18] when lactating animals supplemented with bypass protein. Improvement on milk fat was also noticed by researchers [5, 17] as recorded in present study. The other milk constituent like milk protein, lactose, SNF and TS percent were noticed non-significant change and this observation was also supported by finding of researchers [13, 19] who noticed that supplementation of bypass protein and fat had no significant effect on the milk constituents in lactating cows. The significant improvement in milk yield and its constituent might be due to the increase supply of amino acids at tissue level. Several workers reported that formaldehyde treatment leads to increased supply of amino acids at the lower tract [19-21]. The concentration of milk constituents was also associated with the lactation stage and milk yield of animals. Probably that was the reason why lactose revealed towards the negative side in comparison to the values recorded in the beginning of the experiment in the same buffalo. Less reduction of lactose in buffaloes offered FT-MOC diet than control buffaloes due to positive response of dietary treatment.

Perusal of the data revealed that hemoglobin content of blood did not varied much between the buffaloes of two groups before treatment. The improvement in it due to dietary treatment was recorded higher in FT-MOC group than control. The increase in Hb was probably because of efficient utilization of nutrients and their supply in proper ratio in the diet. The blood glucose level of experimental buffaloes was significantly ($P<0.05$) higher in FT-MOC buffaloes due to effect of dietary treatment than the control. It was reported that high intake of energy supply may increase serum glucose [22]. While, it was [11, 23] observed that feeding of protected protein increases plasma glucose in the blood.

The significant positive effect of bypass protein on serum total protein was noticed in the present study. Similar result was reported [11] in lamb. The positive correlation between dietary protein and plasma protein were reported [24, 25]. They found that increase in the digestibility of CP could be attributed to the increase in serum total protein. Moreover formaldehyde treatment of dietary proteins caused lower ruminal digestion as a result higher quantity of dietary protein escaped to abomasum and small intestine for acid digestion, simultaneously, higher absorption of amino acids led to higher level of serum total protein. The results were in agreement with those of researcher [25]. They reported that value of serum total protein increased ($P<0.01$) when goats were fed protected protein in the diet.

The increase in serum Ca and P was probably attributed to their appropriate ratio in the diet which led to better absorption through the digestive tract of buffaloes of FT-MOC group but increase was maintained in normal range because of physiological mechanism of animal body.

The reduction in days of postpartum was also a good parameter to assess the physiological state of buffaloes. In the study, days of postpartum heat have reduced in buffaloes supplemented with bypass nutrient in balance diet than the control groups. This was probably because of good physiological status of buffaloes. Significant improvement in the overall reproductive performance of the crossbred cows when fed with procted protein [26].

Supplementation of bypass protein in buffaloes yielding more than 8.0 liters milk was found economical in the present study. The findings of previous workers [2, 5, 13] also indicated that supplementation of bypass protein and fat was economical in cows yielding more than 8.0 Kg milk per day. The maximum profit from milk was obtained in buffaloes of FT-MOC group which was probably attributed to low feed consumption behind per liter milk.

4. Summary and Conclusion

The results revealed that maximum weight loss occurred in buffaloes of control group while, it was minimum in those maintained in FT-MOC group. The milk yield was maximum in buffaloes of FT-MOC group. The shortest postpartum heat was noticed in buffaloes of FT-MOC group fallowed by the buffaloes of control groups. Total income from daily sale of milk as well as return over feed cost was highest in buffaloes of FT-MOC group.

Overall results clearly indicated that balance diet containing bypass protein was very much helpful in maintaining the good health and production performance of lactating buffaloes. Maximum profit was obtained in buffaloes those fed FT-

MOC group. On the basis of our findings, it can be conclued that balance diet containing formaldehyde treated (@ 1.2% of CP) mustard oilseed cake had significantly improved performance of the buffaloes and profit of the farmers.

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