Indian Journal of Animal Sciences **85** (12): 1393–1395, December 2015/Short Communication

Effect of feeding formaldehyde treated protein on nutrient utilization and economics in Surti buffalo heifers

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Received: 13 April 2015; Accepted: 30 June 2015

Key words: Buffalo heifer, Digestibility, Economics, Formaldehyde treated protein, Growth

Protein rich feed ingredients are expensive and valuable component of animal's diet (Walli 2005). Hence, improving the utilization efficiency of protein supplements in ruminant diet is of special concern. Formaldehyde treatment of dietary protein is one of the most common and exploited technique to protect it from ruminal degradation (Kumar *et al*. 2015). Thus, present study was conducted to assess the effect of feeding concentrate mixture containing different proportion of formaldehyde treated protein on nutrient utilization and growth performance in Surti buffalo heifers.

Surti buffalo heifers (20; 16–18 month; 164.68±5.43 kg) were divided into 4 homogenous groups of 5 each using CRD. Compound concentrate mixture (CCM) of four types were formulated by replacing untreated protein ingredient i.e. rapeseed meal with formaldehyde treated (@ 1.0 % of crude protein) one @ 0, 25, 50 and 100% and designated as CON, FTP–25, FTP-50 and FTP–100, respectively (Table 1). All the animals were fed with basal diet containing green (5 kg) and dry fodders (*ad lib.*) along with required quantity of respective CCM. Feeding was carried out for six months.

Table 1. Feed ingredient (%) and chemical composition (% on DM basis) of feed

Particulars	Compounded concentrate mixture				Fodder	
	CON	FTP-25	FTP-50	FTP-100	Green	Dry
Ingredients						
Damaged wheat	4	4	4	4	-	-
Maize grit	4	4	4	4	-	-
Cotton seed ext.	3.5	3.5	3.5	3.5	-	-
Rice polish (fine)	9.9	9.9	9.9	9.9	-	-
Deoiled rice bran	47.1	47.1	47.1	47.1	-	-
Rapeseed meal	10	7.5	5	—	-	-
Rapeseed meal (formaldehyde treated)	—	2.5	5	10	-	-
Rice flake bran	5	5	5	5	-	-
Molasses	11	11	11	11	-	-
Sugar booster	0.5	0.5	0.5	0.5	-	-
Urea	1	1	1	1	-	-
Minerals	2	2	2	2	-	-
Common salt	2	2	2	2	-	-
Chemical composition (dry matter basis)						
Organic matter	88.08	87.62	87.95	87.85	91.04	89.49
Crude protein	18.72	18.71	18.84	18.85	8.08	4.04
Ether extract	2.24	2.25	2.23	2.2	2.93	1.60
Total carbohydrate	67.12	66.66	66.89	66.8	80.04	79.85
Neutral detergent fibre	30.25	29.55	28.76	29.05	65.81	75.07
Acid detergent fibre	16.46	17.54	15.75	16.45	36.63	46.68
Hemi cellulose	13.79	12.00	13.01	12.59	29.18	28.39

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At the 4th month, a 6-day digestion trial was conducted to assess the intake of nutrients and digestibility. The quantity of feed offered, ort and faeces voided was recorded for each animal. Representative samples of feed, ort and faecal samples were collected and analyzed for their proximate (AOAC 2000) and fibre fractions (Van Soest *et al*. 1991).

During experimental period, daily feed offered and ort was recorded to work out voluntary feed intake. All the animals were weighed in the early morning at fortnightly interval to determine their average growth rate. Ratio of voluntary feed intake and growth rate were employed to arrive at feed conversion ratio. Existing cost of different dietary ingredients along with feed consumed by individual animals were utilized to estimate the cost of feeding. Economics of feeding was worked out and expressed as expenditure to gain unit body weight by animals. The data generated were analyzed statistically using SPSS software (version 20.0) by applying one-way ANOVA (Snedecor and Cochran 1994).

Table 2. Mean intake of nutrients and their digestibility

Attributes	CON	FTP-25	FTP-50	FTP-100	s.e.m.†
DMI, kg	6.83	7.00	7.02	6.9	0.030
DMI, % BW	2.85	2.97	2.96	2.87	0.029
Digestible nutrient intake					
Dry matter, kg	3.80	3.90	4.06	3.90	0.046
Organic matter, kg	3.56	3.70	3.80	3.68	0.040
Crude protein, g	439.07	436.89	450.67	464.33	5.529
Digestibility coefficient, %					
Dry matter	55.70	56.56	57.83	57.42	0.642
Organic matter	58.88	59.71	61.01	60.24	0.526
Crude protein*	57.16[a]	57.28[a]	59.56[b]	60.83[b]	0.394
Ether extract	65.55	66.86	68.12	64.48	0.614
Total carbohydrate	57.05	58.18	57.47	58.37	0.316
Neutral detergent fibre	46.47	46.67	46.70	43.63	0.509
Acid detergent fibre	35.48	37.39	38.45	37.08	0.752
Hemi cellulose	59.35	58.16	56.31	56.70	1.261

Values in a row bearing different superscript differ significantly; *(P<0.05); †Standard error of mean.

Comparable intake of DM and digestible nutrients is suggestive of no adverse effect of formaldehyde treatment on palatability (Table 2). Digestibility of crude protein was higher (P<0.05) in FTP-50 and FTP-100, which could be justified on the concept of rumen undegradable protein. Dietary protein in these groups have enjoyed 2 levels of digestion viz. microbial and enzymatic (Walli 2005). Only a limited fraction of dietary protein entering into the rumen gets degraded by ruminal microbes to ammonia, which is being utilized for microbial protein synthesis, while the rest fraction was available for digestion at lower gastrointestinal tract, viz. abomasum and intestine (McDonald *et al*. 2010). Our results are in agreement with those of previous studies for nutrient intake (Arewad *et al*. 2011) and digestibility (Patel *et al*. 2012).

Improved weight gain (P<0.01) in FTP-50 and FTP-100 is an obvious reflection of better utilization of dietary protein in respective groups (Table 3). Higher daily gain (P<0.01) with comparable feed intake resulted into improved (P<0.05) feed efficiency in FTP-100; however, economics of feeding was comparable among dietary treatments (Table 2). Patel *et al*. (2012) have also reported improved feed efficiency in buffalo heifers due to feeding of FTP.

The present finding revealed that feeding of formaldehyde treated protein (FTP) ingredient in concentrate mixture has no adverse impact on feed intake and palatability. Their dietary inclusion at higher rate improves better growth rate and feed utilization in buffaloes. Though, FTP-50 and FTP-100 reduced (P>0.05) the cost of unit weight gain by ₹ 6–7, but the differences were not able to attain level of significance.

SUMMARY

Present study was carried out to assess the effect of feeding concentrate mixture containing different proportion of formaldehyde treated protein (FTP) on nutrient utilization, growth and its economics in buffalo heifers. Four types of compounded concentrate mixture (CCM) were formulated by replacing untreated rapeseed meal with formaldehyde treated @ 0, 25, 50 and 100% and designated as CON, FTP-25, FTP-50 and FTP-100, respectively. Surti

Table 3. Mean growth rate, feed utilization efficiency and economics of feeding

Attributes	CON	FTP-25	FTP-50	FTP-100	s.e.m.†
Initial BW, kg	166.20	163.80	162.6	166.00	5.443
Final BW, kg	250.40	247.40	259.00	267.60	6.275
Net gain, kg**	84.20[a]	83.60[a]	97.20[b]	101[b]	2.525
Average daily gain, g**	467.77[a]	464.44[a]	540.0[b]	564.44[b]	14.033
Mean DMI, kg	6.37	6.39	6.51	6.59	0.106
Feed conversion ratio*	13.75[b]	13.82[b]	12.11[ab]	11.78[a]	0.364
Total feed cost, ₹	7822.85	8083.27	8441.28	8759.08	208.15
Cost/kg BW gain, ₹	93.92	96.97	87.28	86.37	2.573
Gain w.r.t. CON, ₹	0.00	–3.05	6.64	7.55	2.62

Values in a row bearing different superscript differ significantly; (P<0.05); ** (P<0.01); †Standard error of mean.

buffalo heifers (20) divided into 4 homogenous groups were offered with respective CCM along with green (5 kg) and dry fodder (*ad lib*.). Nutrient and feed intake was similar amongst group with higher digestibility of crude protein in FTP-50 and FTP-100. Due to comparable feed intake accompanied by higher growth rate, FTP-100 displayed better feed efficiency without affecting cost of feeding. Thus, this study reveals that dietary inclusion of FTP at higher rate improves utilization of crude protein accompanied by better growth rate and feed utilization efficiency in buffaloes without affecting economics of feeding.

ACKNOWLEDGEMENT

Financial support and facilities provided by Dean, College of Veterinary Science and farm facilities rendered by Research Scientist, Livestock Research Station, NAU are gratefully acknowledged.

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