EFFECT OF UREA FEEDING ON FEED INTAKE AND PERFORMANCE OF MALE BUFFALO CALVES

A. R. Burque, M. Abdullah*, M.E. Babar*, K. Javed*, and H. Nawaz

Institute of Animal Nutrition and Feed Technology, University of Agriculture, Faisalabad
*Deptt. of Livestock Production, University of Veterinary and Animal Sciences, Lahore.

ABSTRACT

Feed intake, growth rate, feed efficiency and carcass characteristics of male buffalo calves, fed different levels of urea, were investigated. Feeding trials were conducted using 54 male buffalo calves of the Nili-Ravi breed in three experiments. Seven experimental rations were prepared by adding fertilizer grade urea at the levels of 0, 0.5, 1.0, 1.5, 2.0, 2.5 and 3.0 percent, replacing undecorticated cottonseed cake and wheat bran on nitrogen equivalent basis. A ration without urea served as control. At the termination of the feeding trials, 3 calves from each group were slaughtered and carcass data were obtained. It was found that intake of dry matter decreased as the level of urea increased in the ration. The depression in dry matter intake was significant when the urea level exceeded 2.0 percent. Weight gains of calves were significantly higher on urea ration up to 1.0% as compared to control. Almost similar weight gains were observed up to 2.0 percent levels of urea. However beyond this level, i.e. at 2.5 and 3.0 percent, a significant decline in weight gain was observed. The effect of urea feeding with respect to feed efficiency was nearly of the same magnitude as on weight gain. The slaughter data revealed a non-significant difference in the dressing percentage of the carcasses of calves fed 0, 0.5, 1.0, I 5 and 2.0 percent urea in their rations. However, the carcass quality was adversely affected when urea was used beyond 2.0 percent level. Gristles were significantly increased (by about 40%) in the carcasses of calves fed 3.0 percent urea compared to the control animals. Acceptability score through organoleptic tests of cooked meat showed no significant difference between control and 2.0 percent urea fed animals.

Keyword: Urea feeding, Feed intake, Performance, Buffalo calves

INTRODUCTION

The crop residues traditionally constitute the major component of buffalo rations. The productivity of the animals, however, declines when straws are the major source of roughage because of poor digestibility and low voluntary intake.

In rumen, many fiber-digesting bacteria require ammonia for protein synthesis (NRC, 2001). Protein requirements are provided by microbial protein and rumen escape dietary protein (Can *et al*.., 2005). Urea is commonly added to ruminant diet as a source of nonprotein nitrogen that is rapidly hydrolyzed to ammonia in the rumen. Ruminants are known to utilize urea through rumen microbial activity by using crude fiber of the straws as an energy source. The advantages of such practices in terms of economical livestock production are immense. The improvement in the methods of urea feeding has increased its utility in practical rations of livestock. Hence in view of the serious shortage of natural proteins in the country it appears feasible to use urea in livestock feeding on a large scale.

A study was thus conducted to determine the dry matter intake, feed efficiency and carcass and meat characteristics of male buffalo calves fed rations containing different levels of urea.

MATERIALS AND METHODS

An investigation was made to study the effect of urea feeding on feed intake and performance of male buffalo calves. Fifty-four young male buffalo calves of the Nili-Ravi breed were put on feeding trials in three sets each involving 18 animals. The calves used in each set were of almost the same weight and their age ranged between 6 and 8 months. They were dewormed before the start of the experiment and were housed individually in separate pens. They were also allowed an adjustment period of two weeks before the start of the experiment.

Seven experimental rations (A, B, C, D, E, F and G) containing 0, 0.5, 1.0, 1.5, 2.0, 2.5 and 3.0 percent of urea, respectively, were formulated. Rations A, without urea, served as control. In rations B, C, D, E, F and G, cottonseed cake (undecorticated) and wheat bran were replaced by urea on nitrogen equivalent basis. Since feed grade urea was not available in the country, fertilizer grade urea (46 % N) was used. Maize grain and cottonseed cake were coarsely ground and wheat straw was chaffed to permit thorough mixing of the rations. Urea was dissolved in hot water and the solution of urea was then mixed with molasses and the whole mass was homogenized. Urea-molasses mix was sprinkled over the chaffed wheat straw and thoroughly mixed manually. Coarsely ground cottonseed cake, ground maize grains

and wheat bran were then mixed with wheat straw previously treated with urea-molasses mix (Table I).

Three feeding trials were conducted. Each trial was planned according to completely randomized design involving two levels of urea along with the control. The rations used in each trial were randomly assigned to 18 buffalo calves in such a way that six calves were randomly put on each ration. The animals were weighed at the start of the experiment before morning feeding and watering thereafter; weighing was done every week on the same day and time.

Each feeding trial lasted for 91 days. The experimental rations were fed ad libitum to the individual animals. The animals were offered the weighed quantities of the respective rations in two equal portions in the morning and in the afternoon. The feed refused was weighed the next morning to record the amount of feed consumed by each animal daily. The animals were given half a kilogram of fresh berseem per head daily to meet their carotene requirements (NRC, 2001). The animals were offered fresh and clean water thrice a day.

On the termination of each trial, nine calves, three from each ration group were picked up at random to record the carcass data: dressing percentage, gristles percentage and acceptability of meat

Dressing Percentage: The animals were slaughtered and dressed. The dressed carcasses were cut longitudinally into equal halves. Each half of the carcass was weighed separately and the dressing percentage was calculated excluding the visceral organs such as stomach. intestines, liver, spleen, heart and lungs.

Gristles Percentage: During final dressing of the meat for the purpose of cooking, the fascia, tendons nerves and large blood vessels were removed which constituted the gristles. The total weight of gristles was recorded to work out the percentage on the basis of dressed carcass weight.

Acceptability of Cooked Meat: The general appearance of the dressed meat was recorded. The meat was cooked using conventional methods and its acceptability was evaluated through organoleptic tests. The following criteria were used for the evaluation of the quality of meat:

(a) General Appearance
- i) Colour
- ii) Marbling
- iii) Leanness

(b) Organoleptic Evaluation
- i) Flavour
- ii) Palatability
- iii) Juiciness
- iv) Tenderness

The meat was evaluated by a panel of judges using a scoring system of up to 20 (Padda *et al*., 1986). The score cards used by the judges contained coded numbers in respect of meat of different carcasses. The data thus collected were tabulated and analyzed statistically by using the analysis of variance technique and the differences of means were tested by Duncan's Multiple Range Test (Steel *et al*., 1997).

RESULTS AND DISCUSSION

The average values for the feed intake, feed efficiency, weight gain and carcass percentage as obtained from the three experiments are presented in Table 2.

Dry matter intake: In experiment I, the average daily dry matter intake was slightly lower in calves fed ration containing 0.5 percent urea as compared to that of the control. The dry matter (DM) intake further declined ($P<0.05$) when the level of urea content in the ration was increased to 1.0 percent. The decrease in the intake of (DM) was of the order of 9.7 percent as compared to that of calves fed control ration. At 1.5 percent level of urea, a non-significant decrease in the DM intake occurred but with 2.0 percent level of dietary urea a further decrease in feed intake was observed, leading to a significant (15.7 percent) depression in feed intake as compared to the control (Experiment II). With further increases in the levels of dietary urea (2.5 and 3.0 %), the DM intake exhibited further downward trend. The dry matter intake in buffalo calves remained nearly constant up to 1.5 percent dietary urea level. However, beyond this level, the dry matter intake was adversely affected. At 2.5 and 3.0 percent dietary urea levels, the dry matter intake was depressed by 37.0 and 56.7 percent, respectively, as compared to the control.

The effect of increased urea proportion in dry matter intake has been variable. Some workers observed a depression in intake (Forero *et al*., 1980 and Koster *et al*., 1997), whereas others have reported an increase or no effect (Koster *et al*., 2002). Higher levels of urea tended to affect the palatability of ration as reported by Erfle *et al.* (1978) in lactating cows. Similarly Pond and Yen (1985) observed lowered feed intake in ewes given basal diet having I percent urea than those fed basal diet alone. Casper and Schingoethe (1986) also noted a depression of dry matter intake in cows fed a concentrate mixture containing urea. In lactating cows, decreased intake of silage and total dry matter due to feeding of urea were reported by Huber *et al*. (1980). In contrast, daily feed intake of bulls given wheat straw and a concentrate mixture with urea at 0, 0.75, 1.50 or 2.25 percent levels was not adversely affected (Colpan, 1983). Ho Quang *et al*., (1999) also reported that increasing of urea in the feed decreases the intake.

In the present study the replacement of protein nitrogen was of the magnitude of 63.89 and 73.40 percent, representing 2.5 and 3.0 percent dietary urea, respectively. Milton and Brandt (1994) observed a decrease (3.8%) in feed intake of steers fed diets containing urea as compared to soybean meal diet.

Weight gain: In experiment I, apparently the average daily weight gain increased with the increase in the level of urea up to 1.0 percent as compared to that of the control ration. However, there was no significant difference in weight gain of buffalo calves fed with rations containing 0, 0.5 and 1.0 percent urea. In experiment II, the average daily gain in body weight was 0.91, 0.81 and 0.75 kg in buffalo calves fed rations containing 0, 1.5 and 2.0 percent urea, respectively. At 2.5 and 3.0 percent urea levels, the weight gain of calves was reduced by more than 62 and 88 percent, respectively as compared to that of the control in experiment III (Table 2).

The data in these experiments showed that the weight gains of growing buffalo calves were comparable with those in the control when urea was included in the rations up to 2.0 percent. However when the urea level exceeded this level, a significant ($P< 0.01$) depression in the weight gain of the experimental animals was observed. Moreover, when more than 63 percent of the total nitrogen in the diet was supplied from urea (2.5 percent level), a significant depression was exhibited in the weight gain of calves (Table 2). The addition of urea at 0.5 percent level to a low protein basal diet (14 percent nitrogen equivalent) had not been shown to exert any significant influence on weight gain of bulls (Rakhimov *et al*.., 1984). The use of urea at such a low level as employed in the present study did not indicate any adverse effect on the weight gain of the buffalo calves. This tended to suggest that the type of concentrate, i.e. low or high protein content did not matter much with respect to growth promotion when urea was fed at lower levels. Similar results were obtained by Reddy and Mudgal (1985) by incorporating urea in a concentrate mixture to provide 50 percent digestible crude protein. The present results based on the use of urea below 2 percent level in male buffalo calves are in agreement with their findings on the weight gain of buffalo heifer calves. This presumably indicated that weight gain in male and female buffalo calves was of the same magnitude with urea fed at levels given above.

The present results are also substantiated by those of Sharma *et al*.. (1983) who observed no significant difference in weight gains of calves that were fed urea to contribute 60 percent nitrogen to the rations. Similarly non-significant differences were observed in the weight gain of young male cattle given 2.0 percent urea in the ration (Holub and Marounek, 1985). It may be stated that feeding urea up to 2.0 percent level could be economical in raising buffalo calves under existing farm conditions. On the other hand, Langar *et al*.. (I984) showed that in buffalo heifer calves, an addition of 2.3 percent urea in a concentrate mixture containing maize, groundnut cake and wheat bran did not exert any adverse effect on the weight gains. This probably indicated that the safe limit on the use of urea is between 2.0 and 2.5 percent level of the diet. Significant improvements in weight gain was observed due to feeding of ammoniated wheat straw under stall-fed condition (Misra *et al*., 2006).

Feed Efficiency: The feed efficiency ratio was calculated on DM basis. The average feed efficiency ratios for rations containing various levels of urea are shown in Table 2. In experiment I, the amount of feed required per kg of weight gain was lower when urea was used at 0.5 and 1.0 percent levels as compared to that of the control. Statistically, the efficiency of feed utilization did not improve significantly with 0.5 and 1.0 percent urea levels.

In experiment II, the difference in the feed efficiency of rations containing 0, 1.5 and 2.0 percent urea was also not significant. The buffalo calves used in experiment III required 2.87, 5.00 and 10.82 kg of dry matter for 1 kg increase in live weight when fed rations containing 0, 2.5 and 3.0 percent levels of urea, respectively. These results indicated that the animals fed ration containing 2.5 percent urea required nearly double the quantity of feed per kg of weight gain as compared to that of the control. Similarly, those animals given 3.0 percent dietary urea required four times more feed per kg of weight gain when compared with those in the control ration. Significant ($P< 0.01$) differences in feed efficiency ratios were observed among the three experimental rations.

It appeared that calf rations containing up to 2.0 percent urea exhibited improved efficiency of feed utilization, whereas at 2.5 and 3.0 percent levels there seemed to be a marked depression on the efficiency of feed utilization.

Improvements in the efficiency of feed utilization in animals were also reported when urea was added as part of concentrate feed at levels less than 2.5 percent, i.e., 2.3 percent in overall diet contributing 60 percent of total dietary nitrogen (Sedykh, 1979; Khattab *et al*. 1981).

Carcass and meat evaluation: The dressing and gristles percentages of buffalo calves and overall acceptability scores of the cooked meat in relation to rations containing varying levels of urea in three experiments are presented in Table 2.

Dressing Percentage: The data on dressing percentage of buffalo calves in experiments I and II showed non-significant differences among various rations containing dietary urea up to 2.0 percent as compared to that of the control. In experiment III, a significant ($P< 0.05$) decrease in dressing percentage of buffalo calves was observed due to the incorporation of urea at 2.5 and 3.0 percent levels. Duncan's Multiple Range Test revealed that buffalo calves on a ration containing 3.0 percent urea had a significantly lower dressing percentage compared to that of the control, but the difference tended to be non-

significant when compared with those on the ration containing 2.5 percent urea.

The results indicated that inclusion of urea up to 2.0 percent level in the ration of growing buffalo calves did not affect the dressing percentage significantly. However, the rations containing higher levels of urea (2.5 and 3.0%) resulted in poor dressing percentage. The dressing percentage of the carcasses of buffalo calves fed urea up to 2.0 percent of the ration did not vary significantly from their respective controls (Table 2).

Cho (1981) reported a mean dressing percentage of 54.8 ± 4.9 which seemed to be comparatively higher than what is obtained in the present study because he included the weight of four feet and tail of the animal in carcass weight. Wanapat (1981) reported that dressing percentage of male buffaloes was 43.6, being significantly lower (P< 0.01) than 52.8 for male cattle. This indicated that the dressing percentage of male buffalo calves used in various studies conducted in different countries was on average 43 to 50 with a high concentrate ration (10.5 percent crude protein) containing 0.9 percent urea. The findings in the present study support the above reported results.

Gristles Percentage: The data on gristles percentage obtained from animals on experiments 1 and II when analyzed statistically showed non-significant differences, while those in experiment III, the percentage of gristles was found to have significant differences due to various rations. Duncan's Multiple Range Test indicated that gristles percentage was significantly (P< 0.01) higher at 3.0 percent level of urea as compared to those upto 2.5 percent and control. However, there was no significant difference between percentage of gristles in case of ration containing 2.5 percent urea and control.

The results indicated that the gristles percentage significantly (P< 0.01) increased when urea was fed at 3.0 percent level, the increase being of the magnitude of 40.0 percent over that of the control.

Acceptability Score: In experiments I and II, the acceptability scores for cooked meat revealed non significant differences due to different levels of urea used. In experiment III, however, the acceptability scores of the cooked meat showed significant (P<0.01) differences.

Organoleptic evaluation showed that the use of urea up to 2 percent level in the ration of growing buffalo calves had no adverse effect on the acceptability of the cooked meat. The acceptability was significantly lower at 2.5 and 3.0 percent urea levels. The parameters used for organoleptic test of buffalo calf meat were the same as already employed for studying buffalo meat by Padda el al., (1986). They reported that with regard to tenderness, flavour, juiciness and overall acceptability, the quality of buffalo meat is either superior or at par with top quality beef. This of course, was true of the meat of young buffaloes aged 2 to 3 years that were reared and fed for slaughter.

Table 1. Composition of experimental rations (%)

Ingredients	RATIONS						
	A	B	C	D	E	F	G
Cottonseed Cake (Undec.)	30.00	24.00	18.00	7.50	----	----	-----
Urea	------	0.50	1.00	1.50	2.00	2.50	3.00
Wheat bran	20.00	20.00	20.00	20.00	19.00	6.50	----
Maize grain	------	------	------	6.00	11.00	11.00	4.00
Molasses (cane)	15.00	20.50	26.00	30.00	33.00	45.00	8.00
Wheat straw	35.00	35.00	35.00	35.00	35.00	35.00	35.00
Dry matter	89.54	88.35	85.17	86.14	85.37	82.85	80.24
Crude protein	9.77	9.99	10.21	10.03	10.23	10.27	10.41
Crude fiber	16.48	15.53	14.28	12.25	10.73	10.57	8.77
Nitrogen free extract	61.48	62.69	63.90	66.89	68.79	68.31	69.08

CONCLUSIONS: The dry matter intake, gain in weight and efficiency of feed utilization in buffalo calves fed rations containing urea up to 2.0 percent level were apparently improved, whereas, with 2.5 and 3.0 percent dietary urea, a significant depression in values of all these parameters was observed. Incremental incorporation of urea from 0.5 to 2.0 percent levels did not exert adverse effects on the dressing percentage, gristles percentage and acceptability of meat. However the use of urea at 2.5 and 3.0 percent levels in the rations significantly lowered the dressing percentage, increased gristles percentage and led to lowered acceptability of meat.

Table 2. Average dry matter intake, weight, feed efficiency, dressing percentage and acceptability score of meat from buffalo calves fed different experimental rations

PARAMETER	RATIONS								
	Experiment1			Experiment II			Experiment III		
Urea level	Control	0.5	1.0	Control	1.5	2.0	Control	2.5	2.0
Dry matter intake (kg)	4.52[a]	4.50[a]	4.08[b]	5.02[a]	4.43[ab]	4.23[b]	5.57[a]	3.51[b]	2.41[c]
Daily weight gain (kg)	0.69[a]	0.72[a]	0.71[a]	0.91[a]	0.81[a]	0.75[a]	0.88[a]	0.33[b]	0.10[c]
Feed efficiency	2.97[a]	2.87[a]	2.58[a]	2.52[a]	2.50[a]	2.61[a]	2.87[a]	5.00[b]	10.82[c]
Dressing percentage	48.50[a]	49.87[a]	50.36[a]	49.77[a]	49.51[a]	49.38[a]	48.45[a]	44.33[a]	41.04[b]
Gristles percentage	7.70[a]	7.26[a]	7.91[a]	7.74[a]	8.41[a]	7.74[a]	6.52[a]	7.33[a]	10.52[b]
Acceptability score	13.66[a]	13.33[a]	13.00[a]	16.33[a]	6.33[a]	16.33[a]	15.67[a]	10.67[b]	8.33[c]

Means with the same superscript within each experiment for various parameters (rows) show non-significant differences.

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