Effect of urea treated paddy straw supplementation on the performance of crossbred cows

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Journal of Livestock Science (ISSN online 2277-6214) 7: 288-292
Received on 4/09/2016; Accepted on 26/10/2016

Abstract

An experiment was conducted on eight crossbred cows of similar age (4-5 yr) and body weight (306.96 ± 12.57 kg) to elucidate the effect of urea treated paddy straw supplementation on their feed intake, milk production and blood biochemical profiles. Crossbred cows were randomly divided into two equal groups and fed a concentrate mixture and paddy straw to meet their nutrient requirement. Group I served as control (without any supplementation), whereas animals in groups II supplemented with *ad libitum* urea treated paddy straw. This experimental feeding lasted for 60 days, during which daily dry matter intake and milk production was recorded. Milk samples were collected daily to estimate the protein, fat and solid not fat. Blood samples were collected at 30 days of the experimental feeding to study blood biochemical parameters. Results revealed significant ($P<0.05$) increase in dry matter intake from 5.72 kg to 7.80 kg and milk yield from 3.15 kg to 4.08 kg without affecting the composition of milk in cows. The serum urea did differ significantly ($P>0.05$) among two treatment groups.

Key words: Cow; Performance; Straw; Urea

Introduction

Paddy straw is the main crop residue used by farmers for ruminant feeding in Odisha. Relatively high fiber and lignin contents reduce the digestibility of paddy straw (Wanapat *et al*., 1985). Feeding paddy straw alone does not provide enough nutrients for optimum production in crossbred cows. Hence, various physical, chemical and biological methods have been used to improve the nutritive value of paddy straw (Wanapat *et al*., 2013). Urea is most extensively used for treatment of paddy straw. Urea treatment of crop residues increases the nitrogen content as well as intake (Tuen *et al*., 1991) and rate of digestion (Ibrahim *et al*., 1989). Supplementation of poor quality feeds with nitrogen sources increases the rate and extent of digestion resulting in improved dry matter intake (Preston and Leng, 1987). In India and Sri Lanka, using urea treated rice straw (4%) supplemented with 1-1.5 kg/day of concentrate resulted in an extra milk yield of 1-1.7 kg/d (Perdock *et al*., 1982). In Odisha, scarcity of fodder and no report of urea treated straw supplementation in cows were recorded. Therefore, the objectives of this experiment were to compare untreated and urea treated paddy straw supplementation on feed intake, milk production and blood haematological and biochemical parameters in lactating crossbred dairy cows.

Materials and methods

An experiment was conducted on eight crossbred (50% Jersey × 50% Red Sindhi) dairy cows (2-4 lactations) at Instructional Livestock Farm, Orissa University of Agriculture and Technology, Bhubaneswar, Odisha. These cows were divided into two different groups of four animals each following complete randomized design. These animals were identified by numbered tags, tethered with cotton rope individually in a well-ventilated shed provided with uniform management practices and having facilities for individual feeding. Animals were dewormed using Fenbendazole (Panacur®) at 10 mg/kg BW and treated against ectoparasites using Deltamethrin (Butox®) spray 10 days before the commencement of experimental feeding. The urea treatment of paddy straw involved adding 4 kg of urea in 50 L water to 100 kg air dry paddy straw. The relevant volume of urea solution was then sprayed onto the chaffed straw and then covered with a plastic sheet for a minimum of 14 days before feeding directly to animals (Prasad *et al.*, 1998). Urea treated paddy straw were given to the animal gradually before commencement of the experiment. The experiment was run for 60 days during which daily dry matter intake were determined. Clean freshwater was available at all times. All cows were fed with concentrate diets at a ratio of concentrate to milk yield of 1: 2 twice daily at 06.00 a.m. and 16.00 p.m. during milking time. The concentrate mixture consisted of (%) crushed maize 45, groundnut oilcake 15, wheat bran 25, deoiled rice bran 12, mineral mixture 2.0 and common salt 1.0. Group I served as control (*ad libitum* paddy straw), whereas animals in groups II supplemented with (*ad libitum* urea treated straw). The proximate and fiber fractions were estimated by methods of AOAC (2005) and Van Soest *et al*. (1991), respectively. Blood samples were collected at 30 days of the experimental feeding to study blood haematological and biochemical parameters.

About 10 ml blood was collected from each cow through jugular venipuncture in the morning (before watering and feeding) at 60 day for analysis of blood biochemical's and hematological parameters. Hemoglobin estimation was done by treating with Drabkin's solution and further change in colour was measured by spectrophotometer. Packed cell volume (PCV) was estimated by Wintrobe method and all blood biochemical parameters (serum glucose, total protein, albumin, globulin, A: G ratio, total cholesterol and urea) were estimated as per the standard protocol provided by Crest Biosystems® (Goa, India) kit. Milk yield was recorded daily during the entire experimental period. Milk samples were composited daily according to the yield for both morning and afternoon milking, preserved with 2-bromo-2 nitropropane-1, 3 dial and stored at 4 °C until analysis for protein, fat and solids-not-fat content by infrared methods using Milko-Scan™ 33 (Foss Electric, Hillerod and Demark). Data generated was analyzed using standard Student's paired't' test.

Results

The chemical composition of the basal diet offered to the animals in different groups has been given in Table 1. The CP content of concentrate mixture was 18.40%.The nutritive values of the rice straw were improved by urea treatment. The CP (%) increased from 2.80 to 6.65. The data obtained during experimental period on daily intake of DM through concentrate and paddy straw have been presented in Table 2 and were found to be significantly ($P<0.05$) different among the two groups.

Table 3 presents the effect of urea treated paddy straw on milk yield and composition in crossbred dairy cows. Milk yield and production of 4.0% FCM (Fat corrected milk) was significantly higher ($P<0.05$) in supplemented group than un-supplemented control animals, but milk composition did not differ among the treatments.

The data concerning blood haematological and biochemical parameters of crossbred cows were presented in Table 4. Results revealed no significant ($P>0.05$) effect of treatments on blood haemoglobin and PCV value of crossbred cows. The overall mean values for serum glucose, total protein, albumin, globulin,

albumin: globulin ratio and total cholesterol did not differ among the two treatments. However, there was significant ($P<0.05$) difference in serum urea concentration among two groups.

Table 1: Chemical composition (% DM basis) of concentrate mixture, paddy straw and urea treated straw fed to cows

Nutrients	Concentrate mixture	Paddy straw	Urea treated straw
Organic matter	90.90	83.50	83.76
Crude protein	18.40	2.80	6.65
Ether extract	2.30	1.20	1.64
Total ash	9.10	16.50	16.24
NDF	33.10	79.70	72.50
ADF	11.60	51.40	48.70
ADL	2.40	7.90	7.20
Hemicellulose	21.50	28.30	23.80
Cellulose	9.20	43.50	41.50

Table 2: Effect of urea treated Paddy straw on voluntary feed intake of crossbred cows

Attributes	Group		SEM	P value
	I	II		
DM intake through straw (kg)	3.42[a]	4.80[b]	0.11	0.03
DM intake through concentrate (kg)	2.30[b]	3.00[b]	0.15	0.04
Total DM intake (kg)	5.72[a]	7.80[b]	0.30	0.02
DMI/100kg BW	1.88[a]	2.52[b]	0.20	0.04

[ab] Means bearing different superscripts in the same row differ significantly

Table 3: Effect of urea treated paddy straw on yield and composition of milk

Attributes	Group		SEM	P value
	I	II		
Milk production				
Milk yield, kg/d	3.15[a]	4.08[b]	0.12	0.03
4.0% FCM*, kg/d	3.20[a]	4.19[b]	0.24	0.03
Milk composition (%)				
Fat	4.10	4.17	0.20	0.34
SNF	8.20	7.95	0.31	0.48
Protein	4.32	4.24	0.14	0.52

[ab]Means bearing different superscripts in the same row differ significantly

*4.0% FCM (fat collected milk) = 0.40 (kg of milk/d) +15.00 (kg of fat).

Table 4: Effect of urea treated Paddy straw on blood chemistry of crossbred cows

Attributes	Group		SEM	P value
	I	II		
Hb (g/dl)	10.19	10.76	0.28	0.86
PCV (%)	38.40	38.10	1.20	0.77
Glucose (mg/dl)	57.66	55.17	1.92	0.74
Total Protein (g/dl)	5.44	6.22	0.32	0.61
Albumin (g/dl)	2.93	3.14	0.06	0.82
Globulin (g/dl)	2.51	3.08	0.07	0.53
Albumin: Globulin	1.16	1.01	0.08	0.21
Total Cholesterol (mg/dl)	117.62	123.58	3.96	0.15
Urea (mg/dl)	32.12[a]	41.65[b]	0.80	0.01

[ab] Means bearing different superscripts in the same row differ significantly

Discussion

In urea treated straw, crude protein content was increased from 2.8 to 6.5%. This might be due to the binding of ammonia released from the hydrolysis of urea inside the intermolecular spaces of straw (Reddy *et al.,* 1991). The increase in straw intake under the present experiment may be due to the increased degradability in the rumen (Trach *et al*., 2001). In addition, an increase in the outflow of straw cell walls into the abomasum as a result of alkali treatment has also been reported (Males, 1987). Moreover, this was consistent with the findings of Wanapat *et al*. (2009), Djibrillou *et al*. (1998) who reported that urea treated rice straw could improve feed intake, rumen ecology and digestibility of nutrients in cows.

Supplementation of urea treated straw increased the milk yield in crossbred cows. The increased in milk production may be due to increased DM intake and digestibility of nutrients. Similar findings have been reported by Mapato *et al*. (2010) and Talukdar *et al.* (1990) in cows fed with urea treated rice straw. Contrary to this, Prasad *et al.* (1998) did not observe any change in milk yield due to supplementation of urea treated paddy straw. This may be due to higher crude protein concentration in their basal diet.

Supplementation of urea treated straw has no significant effect on blood haematological parameter such as haemoglobin & PCV value of cross bred cows. Similarly, Dutta *et al.* (2004) observed that supplementation of 4% urea treated wheat straw had no effect on haemoglobin and PCV value of lactating buffaloes.

Serum biochemical parameter such as glucose, total protein, albumin, globulin, albumin: globulin ratio and total cholesterol did not vary significantly among two treatment groups. The present result was similar to the finding of Wanapat *et al*. (2009) and Tiwari *et al*. (2001). Contrary to this, Naik *et al*. (2005) observed decreased globulin concentration in blood of male buffaloes fed with urea treated straw which may be due to cytotoxic effect of urea on lymphoid organs. But serum urea was significantly different among two treatment groups. This finding was consistent with the finding of Wanapat *et al*. (2009), and Naik *et al*. (2005) who found that there was an increase in BUN when animals were fed with urea- treated straw. This upswing may presumably be either due to the more amounts of NPN in urea treated straw or the changes in vital organs like liver and kidney.

Conclusion Supplementation of urea treated straw increased the dry matter intake, milk yield and serum urea concentration without affecting the milk composition and blood biochemical parameters in cows.

Acknowledgments The authors are thankful to the Vice-Chancellor, Orissa University of Agriculture and Technology, Bhubaneswar, Odisha, India, for providing the necessary facilities to carry out this work.

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