EFFECT OF DIETARY LEVELS OF CONCENTRATE SUPPLEMENTION ON FEED INTAKE AND NUTRIENT DIGESTIBILITY OF CROSSBRED CATTLE (BRAHMAN × ZEBU) FROM 13-15 MONTHS OF AGE IN AN GIANG PROVINCE

Nguyen Binh Truong[1,2]

[1]Department of Animal husbandry and Veterinary Sciences, Faculty of Agriculture and Natural Resources, An Giang University, An Giang, Vietnam;
[2]Vietnam National University Ho Chi Minh City, Vietnam

Corresponding author: Nguyen Binh Truong; Tel: 0983377424; Email: nbtruong@agu.edu.vn

ABSTRACT

Five cattle crossbred (Brahman × Zebu) at 13 months of age were in a Latin square design with 5 treatments and 5 periods to evaluate the effect of dietary levels of concentrate supplementation on feed intake and nutrient digestibility. Five treatments were 5 supplement levels of concentrate in the cattle diets at 0, 0.5, 1.0, 1.5 and 2.0 kg/head/day corresponding to C0, C0.5, C1.0, C1.5 and C2.0 treatments. Fresh elephant grass was fed at 5 kg/head/day, while rice straw was fed *ad libitum* for all treatments. One experimental period lasted 14 days with 7 days for adaptation and 7 days for sampling. The results showed that the dry matter (DM), organic matter (OM, crude protein (CP), neutral detergent fiber (NDF) and metabolic energy (ME) intakes were significant among diets. The DM intake was significantly different (P<0.05) among the treatments with the highest value for the C2.0 treatment (4.36 kg/head/day) and the lowest for the C0 treatment (2.98 kg/head/day). The crude protein intake was significantly different (P<0.05), the highest value was for C2.0 treatment (444g) following by C1.5 (379g), CP1.0 (326g), CP0.5 (252g) and C0 (188g) treatments. The ME intake was significantly improved (P<0.05) by increasing concentrate supplementation levels from C0 (24.3 MJ/head/day) to C2.0 (41.2 MJ/head/day). The DM digestibility of C1.0 treatment was not significantly different with C0 and C0.5 treatments but it was significantly lower (P>0.05) comparing to C1.5 and C2.0 diets (61.6% vs 58.1, 58.7, 64.5 and 66.6%, respectively). The CP digestibility of C2.0 treatment (76.9%) was slightly higher (P>0.05) than that of C1.5 and C1.0 diets (73.0 and 67.6%, respectively) but it was significantly higher (P<0.05) compared to C0 and C0.5 diets (54.1 and 64.8%, respectively). The conclusion was that growing Brahman crossbred fed dietary concentrate level at 1.0-1.5 kg/head/day tented to improve total DM intake and crude protein digestibility.

Keywords: *Ruminants, nutrient utilization, digestion, growth.*

INTRODUCTION

The name of local cattle was Bay Nui cattle and Chau Doc cattle that were famous in An Giang province. Nowadays, the Zebu cattle which mainly comes from Cambodia are selling on Ta Ngao market in Tinh Bien district in An Giang. The beef cattle population in An Giang province in 2017 was 85,540 heads (An Giang Sub-Department of Anim. Husbandry and Vet. Med, 2017). They are mainly raised in Tinh Bien, Tri Ton and Cho Moi districts by traditional feedings of grazing or confined systems by natural grasses and crop residues without any supplementations. Consequently, their performance is usually low. While fattening beef cattle was developed in 3 other districts of Cho Moi, Chau Thanh and Chau Phu. The Zebu crossbred cattle from Brahman, Ongole, Sindhi breeds ... was 98.5% of the total herd with the highest ratio for the Brahman crossbred (69.5%) and lowest percentage for local cattle (0.31%). At the same time, the long fattening cattle started from 13 months of age. (Nguyen Binh Truong and Nguyen Van Thu, 2017). Feed supplement was 15.6-27.8% while concentrate feed was 6.2-1.3% in cattle diets. The proportion of crude protein on the diets was lower than in other provinces (Nguyen Binh Truong and Nguyen Van Thu, 2019). Concentrate feeds play a very important role for improving beef production by providing energy, protein, minerals and other micro-nutrients. However, studies on concentrate supplementation to improve nutrition and growth performance in An Giang province have been still limited. Therefore, the objective of this study was to evaluate the feed and nutrient intakes and digestibility of growing crossbred cattle (Brahman × Zebu cattle) affected by dietary concentrate levels for further studies and applications.

MATERIALS AND METHODS

Location and time

The experiment was carried out at Sau Duc cattle farm, which was located at Vinh Gia commune, Tri Ton district of An Giang province and the laboratory E205 of Department of Animal Science, College of Agriculture of Can Tho University from December 2018 to April 2019.

Experimental design, feeds and feeding

Five (Brahman × Zebu crossbred) female cattle at 13 months of age with the bodyweight of approximately 163±29.7 kg were used in Latin square design. Five treatments had different levels of concentrate (C) supplementation in the diets including 0, 0.5, 1.0, 1.5 and 2.0 kg/head/day corresponding to C0, C0.5, C1.0, C1.5 and C2.0 treatments.

Table 1. Feed ingredients of the experiment diets

Feeds, kg	**Treatments**				
	C0	***C0.5***	***C1.0***	***C1.5***	***C2.0***
Concentrate	0.0	0.5	1.0	1.5	2.0
Elephant grass	5.0	5.0	5.0	5.0	5.0
Rice straw	*ad libitum*	*ad libitum*	*ad libitum*	*ad libitum*	*ad libitum*

One experimental period lasted 14 days including 7 days for adaptation and 7 days for sample collection. The cattles were kept indoors in individual on cement (1.2x4 m) and protected against mosquitoes by net covering the barn. The elephant grass was planted in the cattle farm; rice straw was bought surrounding the farm. While concentrate feed was occasionally bought from the feed company. The fixed quantities of concentrate were daily offered to the animals 2 times at 7:00 am and 1:00 pm. Elephant grass (EG) was supplied at a level of 5 kg/head/day (in fresh matter) at 10:00 am followed by the rice straw offered *ad libitum* at 8:00 am, 3:00 pm, 5:00 pm and the remainder given at 9:00 pm. Clean and fresh water were offered ad libitum during the whole experiment.

Chemical compositions of feed

The chemical of concentrate, elephant grass and rice straw used in the experiment were shown in Table 2.

Table 2. Chemical composition (%) of feeds using in the experiment

Feeds	**DM %**	**DM %**			
		OM	***CP***	***NDF***	***Ash***
Concentrate	88.9	91.4	15.5	35.5	8.65
Elephant grass	14.3	90.2	8.13	68.6	9.84
Dry rice straw	88.2	89.7	5.43	71.2	10.3

The DM of rice straw was similar with concentrate (88.2% and 88.9%, respectively), while the elephant grass DM content was 14.3%. The DM content of rice straw was lower than the result in the study of N T Ngu et al. (2019) conducted in Can Tho province (91.8%) but higher than those reported by Nguyen Van Thu and Nguyen Thi Kim Dong (2015) (82.0%). The CP content of concentrate was 15.5% highest than of both elephant grass and rice straw (8.13% and 5.43%). It was consistent with the finding reported by Le Thi Thanh Huyen et al. (2017) in Son La province and Nguyen Huu Van et al. (2012) in Quang Ngai province (15.4% and

15.5%, respectively). The NDF content of elephant grass was 68.6% higher than concentrate (35.5%), but it was lower than rice straw (71.2%). It was similar to by Danh Mo (2018) 70.6% in Kien Giang province but it was lower than (76.4%) by Nguyen Huu Van et al. (2012). In the current study, both elephant grass and rice straw mainly supplied with fiber sources, while crude protein was supplied by concentrate in the experimental diets.

Measurements taken

Feeds, nutrient and energy intakes

Feeds and refusals were daily measured for analyses of dry matter (DM), organic matter (OM), crude protein (CP) and neutral detergent fiber (NDF) following the procedure of AOAC (1990) and Van Soest et al. (1991). The metabolic energy (ME) was determined according to Bruinenberg et al. (2002). ME (MJ/kg) = 14.2*DOM + 5.90*DCP (DMO/DCP < 7) , or ME (MJ/kg) = 15.1*DOM (DMO/DCP > 7).

Apparent nutrient digestibility

Apparent DM, OM, CP and NDF digestibility were employed with the animal faces were daily collected and weighed according to McDonald et al. (2010).

Daily weight gains and feed conversion ratio (FCR)

Cattle were weighed for 2 consecutive days in the early morning before feedings at the beginning and the end of each of each experimental period and the feed conversion ratio was calculated.

Statistical analysis

The data were analyzed by analysis of variance using the ANOVA of General Linear Model (GLM) of Minitab Reference Manual Release 16.1 (Minitab, 2010). Then for the paired comparison of two treatments, the Tukey test of the Minitab was used.

RESULTS AND DISCUSSION

Feed and nutrient intakes

The feeds and nutrients intake of the experiment were determined in Table 3.

Table 3. Total nutrients intake of the experimental cattle

Items	Treatments					P	SE
	C0	*C0.5*	*C1.0*	*C1.5*	*C2.0*		
Feed intake, kgDM/head/day							
Concentrate	0.00	0.44	0.89	1.33	1.78	-	-
Elephant grass	0.71	0.71	0.71	0.71	0.71	-	-
Rice straw	2.27^{a}	2.17^{ab}	2.25^{a}	1.94^{bc}	1.87^{c}	0.001	0.056
Total nutrient intake, kgDM/head/day							
DM	2.98^{d}	3.32^{c}	3.85^{b}	3.99^{b}	4.36^{a}	0.000	0.056
OM	2.69^{d}	3.00^{c}	3.49^{b}	3.62^{b}	3.96^{a}	0.000	0.050
NDF	2.06^{c}	2.15^{bc}	2.37^{ab}	2.30^{a}	2.40^{a}	0.000	0.041
CP, g	188^{e}	252^{d}	326^{c}	379^{b}	444^{a}	0.000	2.864
ME, MJ	24.3^{c}	27.8^{c}	33.8^{b}	36.4^{ab}	41.2^{a}	0.000	1.195

C0, C0.5, C1.0, C1.5 and C2.0 were 0, 0.5, 1.0, 1.5 and 2.0 kg concentrate supplementation (head/day), respectively. The numbers with different superscript letters in the same row were significantly different (P<0.05).

Table 3 shows that elephant grass intake was similar among treatments, while the concentrate intake was slightly different from C0 to C2.0. The rice straw intake of C0 was significantly higher than other treatments because of the level of concentrate supplements in the diets. The DM intake of C1.5 was not significantly different with C1.0 and higher than C0 and C0.5 (3.99 vs 3.85, 2.98 and 3.32 kgDM/head/day, respectively), but it was significantly lower than C2.0 treatments (4.36 kg/head/day). It was lower than the value was reported by N T Ngu et al. (2019) with Brahman crossbred (5.32 kgDM/head/day), but it was similar to findings of Antari et al. (2016) with Brahman crossbred being 3.56 kgDM/head/day. The CP intake of experimental cattle was significantly different among treatments. It was 188, 252, 326, 379 and 444 g/head/day for the C0, C0.5, C1.0, C1.5 and C2.0 diets. The CP value of C1.5 was similar to the reported by Danh Mo (2018) for the Sind crossbred being 380-417 g/head/day. The ME intake of C1.5 was not significantly various with C1.0 and C2.0 (36.4 vs 33.8 and 41.2 MJ/head/day, respectively) but was slightly significant compare to C0 and C0.5 (24.3 and 27.8 MJ/head/day, respectively). These findings were consistent with the results of Dau Van Hai and Nguyen Thanh Van (2016) with ME intake were from 26.6 to 40.4 MJ/head/day by increasing dietary concentrate from 0 to 1.52 kg/head/day. Danh Mo (2018) reported that CP and ME intake were improved by increasing concentrate supplementation. Similarly in this experiment, the ME intake in Table 3 was gradually enhanced by increasing concentrate supplementation from 0 to 2 kg in the diets.

Nutrient intake ratio and nutrient per body weight

The proportion of nutrient and nutrient per live weight intake were determined in Table 4

Table 4. Nutrient ratio and nutrient intake per body weight of experiment

Items	Treatments					P	SE
	C0	***C0.5***	***C1.0***	***C1.5***	***C2.0***		
Nutrient ration, %DM							
Concentrate	0.00[e]	13.6[d]	23.3[c]	33.6[b]	40.9[a]	0.000	0.787
NDF	69.2[a]	64.5[b]	61.4[c]	57.6[d]	55.1[e]	0.000	0.276
CP	6.35[e]	7.62[d]	8.48[c]	9.52[b]	10.2[a]	0.000	0.077
Nutrient intake per body weight, kg/100kgBW							
DM	1.71[d]	1.94[c]	2.25[b]	2.32[ab]	2.49[a]	0.000	0.048
OM	1.54[d]	1.76[c]	2.03[b]	2.11[ab]	2.26[a]	0.000	0.043
NDF	1.18[b]	1.26[ab]	1.38[a]	1.34[a]	1.37[a]	0.003	0.032
CP, g	108[e]	148[d]	190[c]	222[b]	254[a]	0.000	4,965
ME, MJ	14.0[c]	16.5[bc]	20.1[ab]	21.3[a]	23.6[a]	0.000	0.855

C0, C0.5, C1.0, C1.5 and C2.0 were 0, 0.5, 1.0, 1.5 and 2.0 kg concentrate supplementation (head/day), respectively. The numbers with different superscript letters in the same row were significantly different (P<0.05).

The concentrate ratio on the diets was significantly different among diets. The C2.0 treatment (40.9%) was higher than for C0, C0.5, C1.0 and C1.5 at 0, 13.6, 23.3 and 33.6%, respectively because of effects of concentrate supplement levels on the diet. The result of the experiment was similar to reported by Danh Mo (2018) being 15-70% and Do van Quang et al. (2015) being 24.6-66.7%. The proportion of NDF on C2.0 treatment was significantly lower than C1.5, C1.0, C0.5 and C0 (55.1% vs 57.6, 61.4, 64.5 and 69.2%, respectively). The concentrate supplement levels led the value of C2.0 treatment had lowed among treatments. It was similar to findings to Dau Van Hai and Nguyen Thanh Van (2016) with concentrate supplement levels on the diets being 27-72%. The CP intake increased on the diets but it was 10.2% for

C2.0 treatment. However, it was concern to the experiment by Yuangklang et al. (2010) being 8.0-14.0%.

The DM intake per 100 kg body weight of C1.5 treatments was not significantly several with C1.0 and C2.0 treatments (2.32 vs 2.25 and 2.49 kgDM/100kgBW, respectively) but it was significantly higher than C0 and C0.5 treatments for 1.71 and 1.94 kgDM/100kgBW. It was similar to the reported by Dau Van Hai and Nguyen Thanh Van (2016) being 1.75-2.56 kgDM. The result of Do Van Quang et al. (2015) showed that DM/100kgBW increasing by the levels of concentrate supplements in the diets. The CP intake of C2.0 treatment was significantly higher than C0, C0.5, C1.0 and C1.5 treatments (254 vs 108, 148, 190 and 222 g/100kgBW, respectively). Because the concentrate intake was increased significantly various on the experiment. The reported by Nguyen Van Thu and Nguyen Thi Kim Dong (2015) being 230 g/100kg BW for Sind crossbred cattle. The ME intake of C2.0 treatment (23.6 MJ/100kgBW) was slightly higher ($P>0.05$) to than that of C1.0 and C1.5 treatments (20.1 and 21.3 MJ/100kgBW) but it was significantly higher ($P<0.05$) compare to C0 and C0.5 treatments (14.0 and 16.5 MJ/100kgBW, respectively). Table 4 was confirming to the effect of concentrate supplements for nutrient ratio and intake among treatments.

Apparent digestibility and daily weight gain

The nutrient digestibility, daily weight gain, feed conversion ratio and feed cost of experimental diets shown on the Table 5.

Table 5. Daily weight gain, feed conversion ratio and feed cost

Items	Treatments					P	SE
	C0	*C0.5*	*C1.0*	*C1.5*	*C2.0*		
Apparent digestibility, %							
DM	58,1^{b}	58,7^{b}	61,6^{ab}	64,5^{ab}	66,6^{a}	0,029	1,917
OM	59,9^{b}	60,9^{b}	64,0^{ab}	66,7^{ab}	69,0^{a}	0,017	1,779
NDF	68,4	64,0	66,0	66,6	67,6	0,362	1,560
CP	54,1^{c}	64,8^{bc}	67,6^{ab}	73,0^{ab}	76,9^{a}	0,003	2,732
Body weight, kg							
Initial	176	174	172	171	174	0,901	13,42
Final	178	177	178	177	181	0,201	13,53
DWG, g/day	170^{c}	248^{bc}	345^{acb}	455^{ab}	537^{a}	0,006	58,05
FCR	18,9^{a}	15,7^{ab}	11,6^{ab}	10,6^{ab}	8,67^{b}	0,018	1,939

C0, C0.5, C1.0, C1.5 and C2.0 were 0, 0.5, 1.0, 1.5 and 2.0 kg concentrate supplementation (head/day), respectively. The numbers with different superscript letters in the same row were significantly different ($P<0.05$).

The nutrients digestibility was significantly different among diets. However, the value of NDF digestibility was not significantly among treatments from 64.0% to 68.4%. The DM digestibility of C2.0 treatment was significantly higher than C0 and C0.5 but it was not significantly different both C1.0 and C1.5 treatments (66.6% vs 58.1, 58.1, 61.6 and 64.5%, respectively). It was similar to findings to N T Ngu et al. (2019) being 60.8-66.8% and Dau Van Hai and Nguyen Thanh Van (2016) being 51.1-74.1%. The CP digestibility of C0 treatments (54.1%) was lower than among treatments. It was 63.0, 67.7, 73.0 and 76.9% for C0.5, C1.0, C1.5 and C2.0 treatments. Because, the bacterial population increased with an increased crude protein diet (Chanthakhoun et al., 2012). This was consistent with the results reported by Do Van Quang et al. (2011) being 57.0-73.0% and Nguyen Huu Van et al. (2012) being 63.9-77.5%

The daily weight gain of the experiment was significantly different among treatments. The value of C1.0, C1.5 and C2.0 treatments were not significantly different on the experiments but C2.0 treatments was significantly higher than C0 and C1.5 treatments (537 vs 170 and 248 g/day, respectively). The result of C2.0 treatment was higher than finding of Danh Mo (2018) supplemented with 40% concentrate in beef cattle diet being 393 g/day and Do Van Quang et al. (2015) being 577 g/day. The feed conversion ratio for experimental cattle decreased by increasing supplemental levels of concentrate. However, The FCR was significantly ($P<0.05$) improved for the C1, C1.5 and C2 treatments compared to the C0 treatment.

CONCLUSION

It was concluded that increasing concentration levels in beef cattle diets from 0 to 2.0 kg was gradually improved nutrient intake, digestibility and daily weight gain. The concentrate supplementation level from 1.0 to 1.5 kg per day in diets for (Brahman × Zebu crossbred) cattle at 13-15 months of age could be properly recommended for farmers' practice in terms of feed utilization and economic return.

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