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Dietary Protein Requirement for Maintenance and Growth of Southern Thai Indigenous Cattle

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Abstract: This experiment was conducted to study protein requirements for maintenance and growth of Southern indigenous cattle. Feeding trial was conducted. Sixteen indigenous male cattle initial average body weight of 134.2 ± 30.52 kg with about 2 years old were given a difference levels of protein in feed at 7.3, 8.3, 10.3 and 12.5% with the same amount of energy intake (219.2± 4.59 kcal/kg$W^{0.75}$ /day) for 90 days. The dietary intakes of DM and GE were not significantly different ($p>0.05$). The nitrogen intake was significantly different ($p<0.01$) ranged from 1.05 to 1.86 g N/kg $W^{0.75}$/day. The average dairy gain (ADG) was significantly ($p<0.01$) increased with an increase level of protein, ADG were 393.06, 497.50, 756.94 and 791.03 g/d in animal given 7.3, 8.3, 10.3 and 12.5% CP, respectively. The relationship between the N intake and ADG was: N intake = 0.356 ADG + 3.263 (R^2 = 0.662). The protein requirement for maintenance and growth rate at 1 g /kg$W^{0.75}$/day of growing male indigenous cattle was 0.522 g N/kg $W^{0.75}$/day (3.26 g CP/kg $W^{0.75}$/day) and 0.0569 g N/ kg $W^{0.75}$/day (0.356 g CP/kg $W^{0.75}$/day), respectively. Increasing protein intake to 65% (from 7.3 to 12.5% CP) was efficient in term of feed conversion rate (FCR) and body weight gain ($p<0.01$).

Key words: Thai southern indigenous cattle, Protein requirement.

1. Introduction

In southern Thailand, agriculture is primarily based on crop production. Livestock, particularly ruminant production is grossly insufficient in meeting the local demands for meat. Until very recently, cattle in southern of Thailand were kept mainly to fighting and to date, the bulk of the cattle are still owned by the traditional farmers in the villages. Nutrition is a major input in commercial animal production and in many instances the dominant economic factor which determines the success or failure of a particular livestock enterprise. Knowledge of the nutritional requirements of the animals is needed so that feed resources can be efficiently used to optimize output. The appropriate of feed requirement for beef cattle in Thailand were not yet clearly

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defined, so that much more elucidation is required. There has been little scientific evaluation of whether either of these nutrient requirement systems is suitable for Thai southern indigenous cattle. ARC (1996) suggested that growing Bos indicus cattle require about 10% less metabolizable energy requirement for maintenance as compared to Bos Taurus cattle. The protein requirement of Thai Native cattle would be lower than Thai crossbred (14%) and lower than Bos Taurus cattle 40 and 50% as recommended by NRC (2000) and ARC (1984), respectively (Chaokaur and Sommart, 2008). However, the accuracy of protein requirement for Thai southern indigenous cattle has not been yet evaluated. Therefore the experiment for Thai southern indigenous cattle reared under farm condition should be carried out to provide additional information for development of beef cattle production in Thailand.

2. Methodology

Sixteen growing males southern indigenous cattle, with an average initial body weight of 134.2 ± 30.52 kg were used. The animals were housed in individual stalls at a private farm and fed with total mixed ration (TMR) 60% oil palm frond (OPF) and 40% concentrate (DM basis). The chemical compositions of TMR is shown in Table 1. The energy content of diets was formulated to contain gross energy intake which was 2 times higher than in maintenance (M) requirement (assuming M = 101.58 kcal/ $kgW^{0.75}$ /day) established earlier for Malaysian indigenous cattle (Liang et al, 1988). The protein levels were 7.3, 8.3, 10.3 and 12.5% in TMR (L1 to L4). The animals were weighed at the beginning and every two weeks until the end of the experimental period. The experiment consisted of 90 day feeding periods. The experimental design was CRD. Each animal was assigned to four feeding treatment levels (crude protein). The animals were fed twice a day at 08:00 h and 16.00 h and had free access to drinking water. The refusal (feed offered but refused) was collected, recorded daily and was sampled separately from the feed at the end of experimental period for dry matter (DM), gross energy (GE) and crude protein analyses (AOAC, 1984). Crude protein intakes were calculated as DM intake multiplied by CP content in TMR. The average CP intakes (g CP/$kgW^{0.75}$ /day) of each head of cattle were used to estimate dietary protein requirement. The values of ADG (g/$kgW^{0.75}$ /day) were plotted vs. CP intake according to the model suggested by Steen et al. (1997). The maintenance protein requirement predicted from the protein intake regression when ADG equals to zero.

The proximate nutritional values of feeds throughout this study were determined according to AOAC procedures (1984). The acid detergent fiber (ADF) and neutral detergent fiber (NDF) contents were determined by the method of Goering and Van Soest (1970).

Statistical Analysis

The effect of protein feeding levels on ADG was analysed by two way analysis of variance using SAS program (SAS, Institute Inc., North Carolina, 1988). Orthogonal polynomials were used to describe the response of ADG by linear and quadratic effects to levels of protein intake. Responses in ADG was regressed against their respective CP intake using linear regression analyses.

Results and Discussion

The total mix ration composed of 60% OPF and 40% concentrate (Table1). All the TMR (L1 to L4) seem to have the same amount of gross energy per kg. On the other hand, protein composition increases from L1 to L4. L1 had the lowest CP (7.3%), followed by L2, L3 and L4 (8.3, 10.3 and 12.5 %, respectively).

The animals used in this study were still growing as their weights (134.2 ± 30.52 kg) have not reached maturity weights of 300 kg. Body weights, average daily gain and feed consumed by Thai southern indigenous cattle are shown in Table 2. According to the concept of this study, there was a significant ($p<0.01$) increase in protein intake of the cattle as the crude protein concentration in the feeds increased. There were no significant differences in DM and GE intake among cattle receiving different protein feeding levels. The average daily gain was significantly ($p<0.01$) affected by the different protein intake. The highest average daily gain was shown by the cattle that was fed with 12.5% CP (791.03 g/day) followed by 10.3% (756.94 g/day), 8.3 % (497.50 g/day) and 7.3% (393.06 g/day). The average daily gain of the cattle fed with L4 was significantly ($p<0.01$) higher than for all the other diets. The values of ADG and protein intake were regressed linearly for the determination of dietary protein requirement for growth. The regression equation relationship between ADG and protein intake is protein intake (g/kg$W^{0.75}$/day) = 0.356 x ADG (g/kg$W^{0.75}$/day) + 3.263 (R^2 = 0.662). The protein requirement for maintenance was determine by the intercepts of the respective equations were 3.26 g CP/kg$W^{0.75}$/day or 0.522 gN/ kg$W^{0.75}$/day. The slopes of the regression line indicated the increase 0.356 g CP/kg$W^{0.75}$/day per unit of increase 1 g/ kg$W^{0.75}$/day or 0.0569 gN/ kg$W^{0.75}$/day. The protein requirement for maintenance from this study 3.26 gCP/ kg $W^{0.75}$/day was close to 4.34 gCP/ kg $W^{0.75}$/day of average protein requirement for maintenance of overall breed of cattle in Thailand (Department of livestock development, 2008). However, the value was lower than 5.03 gCP/ kg $W^{0.75}$/day of Native breed as reported by Department of livestock development (2008). The value was in the range of 2.13-4.36 gCP/ kg $W^{0.75}$/day for native cattle in Northeast part of Thailand as reported by Senarath et al. (2008); Kawashima et al. (2000) and close to 3.58 gCP/kg $W^{0.75}$/day for Brahman cattle in Thailand (Chaokaur et al., 2008). The protein requirement for growth every 1 g of kg $W^{0.75}$ from this study is 0.356 gCP/ kg $W^{0.75}$/day or 35 gCP for every 100 g of $W^{0.75}$, was lower

than 0.38, 0.56, 0.59 gCP/ kg $W^{0.75}$/day for native cattle, Brahman and Brahman crossbred, respectively as reported by Chaokaur et al.(2008). The value also lower than for native cattle, Brahman and Brahman crossbred as 0.43, 0.60 and 0.64 gCP/ kg $W^{0.75}$/day (Department of livestock development, 2008). However if compared to European cattle, the cattle in Thailand was required lower protein than NRC(2000) and ARC (1984) by 65.28 and 68.97%, respectively. The value of protein requirement for maintenance and growth of Thai indigenous cattle predicted from the protein intake regression vs. ADG were quite low. The value could be explained by feed utilization and low quality of feed digestion of indigenous cattle or the nutrient recycle, similar to buffalo in situation of poor nutrient and limited resources of feed or depended on breed of animal. It therefore need more experiment to explain.

Table 1 Chemical compositions of total mixed ration (TMR).

(Composition, DM basis)	TMR offered			
	L1	L2	L3	L4
DM	90.1	88.7	89.9	89.7
Ash	5.0	4.7	4.8	4.9
CP	7.3	8.3	10.3	12.5
NDF	58.0	55.5	57.0	56.7
ADF	43.6	41.9	43.3	43.2
ADL	4.0	4.0	4.0	4.0
GE (cal/g)	2332.1	2303.0	2305.7	2303.6

Table 2 The effect of varying the protein levels on feed intake and the ADG of Thai southern indigenous cattle.

Item	Levels of protein intake				SEM	Significance level	
	L1	L2	L3	L4		L	Q
Body weight, kg	143.38	118.08	142.33	132.90	32.04	NS	NS
Average daily gain, g/d	393.06	497.50	756.94	791.03	97.00	**	NS
DM intake kg/d	3.72	3.27	3.95	3.68	0.88	NS	NS
FCR g DMI/g gain	9.73	6.60	5.17	4.62	1.56	**	NS
N intake g/day	43.58	43.11	64.78	73.05	15.02	*	NS
N intake g CP/kg$W^{0.75}$/day	1.05	1.20	1.56	1.86	0.09	**	NS
CP intake g/d	272.35	269.43	404.87	456.54	93.92	*	NS
CP intake g/kg$W^{0.75}$/d	6.56	7.52	9.75	11.61	0.61	**	NS
GE intake kcal/ kg$W^{0.75}$/d	208.79	212.96	221.84	218.47	14.87	NS	NS

SEM: standard error of the means, L,Q: Linear and quadratic effect of different levels CP intake NS: Not significantly different ($p>0.05$), * ($p<0.05$) and ** ($p<0.01$).

3. Conclusions

The relationship between the protein intake and ADG for Thai southern indigenous cattle in this experiment was found to be protein intake = 0.356 x ADG + 3.263 (R^2 = 0.662). The value of protein requirement for maintenance is 3.26 gCP/kg$W^{0.75}$ /day and the value for growth is 0.356 g CP/kg$W^{0.75}$/day for every 1g of metabolic weight. The both values were lower than other experiment and also lower than value reported by Department of livestock development (2008).

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