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Protein Requirements for Maintenance of Thai Native Male Cattle Fed Rice Straw Based Diets

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Abstract: The objective of this study was to determine the protein requirement for the maintenance of male Thai native cattle. About 18 cattle with body weight of 125±4.9 kg were arranged in a randomized complete block design with 6 replications (block) and 4 treatments. Cattle were fed with dietary Crude Protein (CP) levels of 5.0, 8.0 and 11.0% CP with similar amounts of metabolizable energy. Dry matter, organic matter, crude protein and neutral detergent fiber digestibility increased ($p<0.05$) with increasing levels of CP. Moreover, Nitrogen (N) intake, N absorption and N retention increased ($p<0.05$) with increasing levels of CP. Prediction equation CP intake (g CP kg^{-1} $BW^{0.75}$) with relation to average daily gain (ADG, g kg^{-1} $BW^{0.75}$) was CP intake = 0.409 ADG + 4.22 ($R^2 = 0.883$, SE = 0.624, $p<0.01$, n = 18). From these equations, it can be explained that the CP requirement for the maintenance of male Thai native cattle is 4.22 gCP kg^{-1} $BW^{0.75}$.

Key words: Protein, Thai native cattle, average daily gain, maintenance, metabolizable, energy, Thailand

INTRODUCTION

The appropriate feeding standards for beef cattle in Thailand were not yet clearly defined so that a lot more elucidation is required. There is a general belief that native ruminants possess an inherent ability to utilize dietary fiber better than improved breeds (Kawashima, 2007). Native Thai cattle had been classified as *Bos indicus* and used as draught animal for researche in the past. Thailand has a population of 8.0 million head of beef cattle and approximately 5.6 million cattle or about 70.4% are Thai native breed (Department of Livestock Development, 2006). However, Thailand has no recommendation of feeding standard for Thai native beef cattle. Protein is one of the limiting factors in beef production also protein requirement in feeding standards for male cattle are not yet clearly defined and very few studies. Information from National Research Council (1996) (USA) and Agricultural Research Council (ARC, UK) are commonly adopted for feeding application. Since the difference in animal breeds, feedstuffs, the climate, the age of the cow, stage of production and level of production. Kearl (1982) estimated protein requirements of cattle in developing countries from the limited data in the topics in comparison with the values established in the temperate zone. Regarding tropical breeds of cattle, Vercoe (1970) reported that the fasting metabolism of Brahman cattle was 14% lower than that of Hereford x Shorthorn cattle. The National Research Council (1996) concluded that in growing cattle, *Bos indicus* breeds of cattle require about 10% less energy for maintenance than beef breeds of *Bos taurus* cattle. The purpose of this study is to quantify dietary protein requirements for maintenance of Thai native beef cattle fed rice straw based diets.

MATERIALS AND METHODS

About 18 male Thai native beef cattle (*Bos indicus*) with body weight of 125 (SD±4.9) kg were kept in individual pens and arranged in a Randomized Complete Block Design (RCBD) with 6 replications (blocks) and 3 treatments. Cattle were allowed an adjustment period of 2 weeks and treated against anthelmintics and intestinal parasites using Ivermectin. Cattle were fed dietary Crude Protein (CP) levels of 5.0, 8.0 and 11.0% CP with similar amounts of Metabolizable Energy (ME) in Total Mixed Ratio (TMR). The total feed intake was fixed at 2.5% of body weight. The daily ratios were offered to the animals in two equal portions at 0830 and 1530 h. Refusals were weighed daily prior to the morning feeding to determined daily Dry Matter Intake (DMI). Body weight of each animal was measured twice monthly immediately before the morning feeding. Drinking water was freely available. The experiment consisted of 14 weeks, 2 weeks of adaptation, following by 12 weeks of experimental or feeding periods. The last week of feeding period consisted of 2 days of adaptation to the metabolic crates, 7 days of digestibility and N balance studies. Samples of

feed refusal, faeces and urine were collected before feeding morning to determine digestibility and N balance. Daily fecal output of each cattle was measured and a 10% sub-sample collected and stored at -20°C. The samples were dried (60°C), ground through 1 mm sieve and stored for chemical analysis. Daily urine output was collected into a plastic container, 10% of the urine were later sampled and frozen and stored at -20°C until the analysis for energy and N contents. Representative samples of feed and faeces collected during the digestibility trial were analyzed according to AOAC (1985), ash and CP and fiber components (Van Soest *et al*., 1991). Apparent digestion coefficients were calculated using equations of Schneider and Flatt (1975).

A general linear model and correlation were used to evaluate the relationship between crude protein or Nitrogen (N) intake and their excretion via feces and urine. The data was analyzed by the general linear models procedure of the Statistical Analysis System Institute SAS (1996). Using Duncan's New Multiple Range Test (Steel and Torrie, 1980) compare treatment means.

RESULTS AND DISCUSSION

Total dry matter feed intake, nutrients digestibility and ADG in cattle fed with different levels of CP are shown in Table 1. There were no effects of crude protein levels on total dry matter intake (kg, BW% and g kg^{-1} $BW^{0.75}$). Dry matter, OM, CP and NDF digestibility in cattle fed with 11% CP was the highest and significantly higher ($p<0.05$) than those fed 8 and 5% CP. Moreover, all nutrients digestibility of cattle fed with 8% CP was significantly higher ($p<0.05$) than that of cattle fed with 5% CP. Average daily gain increased ($p<0.05$) with increasing CP levels, similar cattle fed with 11% CP was significantly higher ($p<0.05$) than those fed 8 and 5% CP and. AGD of cattle fed with 8% CP was significantly higher ($p<0.05$) than cattle fed with 5% CP.

Table 1: Feed intake, nutrients digestibility, Average Daily Gain (ADG) and Nitrogen (N) balance of male Thai native cattle fed different protein levels

	Dietary treatments			
Parameters	CP (5%)	CP (8%)	CP (11%)	SEM
Total feed intake				
kg day^{-1}	3.16	3.15	3.17	0.03
BW (%)	2.50	2.54	2.52	0.01
g kg^{-1} $BW^{0.75}$	83.8	84.7	84.4	1.30
Digestibility (%)				
Dry matter	56.8^{c}	62.8^{b}	67.0^{a}	1.12
Organic matter	57.5^{c}	64.1^{b}	67.7^{a}	1.13
Crude Protein (CP)	53.6^{c}	65.0^{b}	68.7^{a}	1.67
Neutral detergent fiber	52.3^{c}	61.5^{b}	65.3^{a}	1.53
Average Daily Gain (ADG) (kg day^{-1})	0.02^{c}	0.29^{b}	0.41^{a}	0.04
ADG (kg day^{-1})	0.00^{c}	0.29^{b}	0.41^{a}	0.05
Nitrogen balance (g N kg^{-1} $BW^{0.75}$)				
N intake	0.67^{c}	1.08^{b}	1.48^{a}	0.09
Faecal N	0.31^{b}	0.38^{b}	0.47^{a}	0.02
Urine N	0.37^{a}	0.35^{b}	0.34^{b}	0.01
N absorption	0.36^{c}	0.71^{b}	1.02^{a}	0.07
N retention	-0.01^{c}	0.36^{b}	0.68^{a}	0.07

^{a,b,c}Values on the same row under each main effect with different superscripts differ significantly ($p<0.05$)

Nitrogen intake (gN kg^{-1} $BW^{0.75}$) was significantly different ($p<0.05$) and increased with increasing levels of CP in diets. Fecal N of cattle fed with 11% CP was significantly higher ($p<0.05$) than those of cattle fed with 8 and 5% CP. However, urine N of cattle fed with 5 and 8% CP were significantly lower ($p<0.05$) than that of cattle fed 11% CP. Nitrogen absorption (gN kg^{-1} $BW^{0.75}$) and N retention (gN kg^{-1} $BW^{0.75}$) were significantly different ($p<0.05$) and increased with increasing levels of CP in diets. In accordance with Gabler and Heinrichs (2003), Yuangklang (2009) and Chantiratikul and Chumpawadee (2009). Prediction equation CP intake (gCP kg^{-1} $BW^{0.75}$) with relation to average daily gain (g kg^{-1} $BW^{0.75}$) was obtained from simple linear regression (Fig. 1) was:

$$\text{CP intake} = 0.409\ \text{ADG} + 4.22\begin{pmatrix}\text{R2} = 0.883,\ \text{SE} = 0.624,\\ p<0.01,\ n = 18\end{pmatrix}$$

From these equations, it can be explained that the CP requirement for the maintenance of male Thai native cattle is 4.22 gCP kg^{-1} $BW^{0.75}$. This value was similar to Sereethai *et al*., 2009) who reported that yearling Thai native cattle required CP for maintenance 4.36 gCP kg^{-1} $BW^{0.75}$. This value is approximately 20.38% lower than the NRC recommendation (5.3 g CP kg^{-1} $BW^{0.75}$) and was lower than Tangjitwattanachi and Sommart (2009) (5.03 gCP kg^{-1} $BW^{0.75}$) and Wilkerson *et al.* (1993) (5.94 g CP kg^{-1} $BW^{0.75}$). Kearl (1982) who reported that (beef cattle 150-300 kg) required 5.35-5.38, this value is approximately 20.38% lower than the NRC recommendation (5.3 g CP kg^{-1} $BW^{0.75}$).

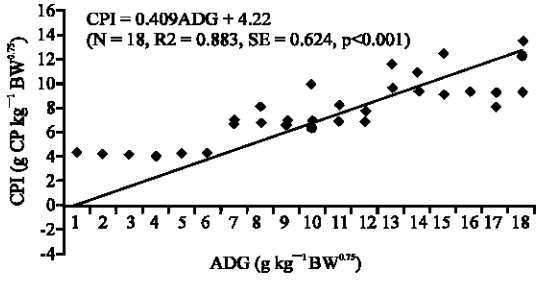

Fig. 1: Relationship between Crude Protein Intake (CPI, g CP kg^{-1} $BW^{0.75}$) and average daily gain (ADG, g kg^{-1} $BW^{0.75}$) for male Thai native cattle

CONCLUSION

In this study, nutrients digestibility and ADG increased ($p<0.05$) as CP level increased. The results from this study indicate that the CP requirement for the maintenance of male Thai native cattle is 4.22 g CP kg^{-1} $BW^{0.75}$. If cattle in the topics are utilized more in order to exploit available low quality feed, it may contribute to the sustainable development of agriculture as well as animal production. Thai native is clearly suitable to utilize low quality roughage. Well-balanced introduction of these animals would contribute to sustainable development of not only animal production but also crop production in Thailand.

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