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Protein Requirements for Maintenance of Thai Native Male Cattle Fed Pangola Hay Based Diets

Pramote Paengkoum
School of Animal Production Technology, Institute of Agricultural Technology,
Suranaree University of Technology, Muang, Nakhon Ratchasima, 30000, Thailand

Abstract: The objective of this study was to determine the protein requirement for the maintenance of male Thai native cattle fed with Pangola hay as roughage. Eight cattle with body weight of 104±10.3 kg were arranged in double 4×4 Latin square design. Cattle were fed with dietary Crude Protein (CP) levels of 5.0, 7.0, 9.0 and 11.0% CP with similar amounts of metabolizable energy. Crude protein 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 N retention (g kg^{-1} $BW^{0.75}$) with relation to N intake (g kg^{-1} $BW^{0.75}$) was N retention = - 0.616 + 0.930 N intake ($R^2 = 0.993$, SE = 0.056, $p<0.001$, n = 8). From these equations, it can be explained that the CP requirement for the maintenance of male Thai native cattle is 0.662 gN kg^{-1} $BW^{0.75}$ or 4.14 gCP kg^{-1} $BW^{0.75}$.

Key words: Crude protein, Thai native cattle, maintenance, Pangola hay, diet, Thailand

INTRODUCTION

Native Thai cattle had been classified as *Bos indicus* and used as draught animal for work in the past. 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 (NRC, USA) and Agricultural Research Council (ARC, UK) are commonly adopted for feeding application.

Protein requirements of beef cattle depend on body size, genetics or species, stage, production, environment conditions and quality of feed (Paul *et al*., 2003). The lack of appropriate feeding standards for the region is one of the main constraints for further development of feeding management. As the breed of cattle, climate conditions and available feed resources are different from those in temperate zone, the CP requirements of cattle in Thailand may not be the same recommended by NRC (1996) or ARC. 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

Eight male Thai native beef cattle (*Bos indicus*) with body weight of 104 (SD±10.3) kg were kept in individual pens and were arranged in double 4×4 Latin square design. Cattle were fed with dietary Crude Protein (CP) levels of 5.0, 7.0, 9.0 and 11.0% CP with similar amounts of metabolizable energy. Cattle were allowed an adjustment period of 2 weeks and treated against anthelmintics and intestinal parasites using Ivermectin. 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 08:30 and 15:30 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 4 periods, each period consisted of 7 days of adaptation, following by 14 days of experimental period. The last week of experimental period consisted of 2 days of adaptation to the metabolic crates and 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, CP digestibility and N balance in male Thai native cattle fed with difference 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} $BW^{0.75}$).

Crude protein digestibility in cattle fed with 11% CP was the highest and significantly higher ($p<0.05$) than those cattle fed with 9, 7 and 5% CP. 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 that of cattle fed with 5% CP however, there were not significantly among treatment with cattle fed with 7 and 9% 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 N retention (gN kg^{-1} $BW^{0.75}$) with relation to N intake (gN kg^{-1} $BW^{0.75}$) was obtained from simple linear regression (Fig. 1) was: N retention = -0.616 + 0.930 N intake (R^2 = 0.993, SE = 0.056, $p<0.001$, n = 8).

Table 1: Effect of crude protein levels on feed intake, nutrients digestibility and Nitrogen (N) balance of male Thai native cattle fed with Pangola hay as roughage

	Dietary treatments				
Items	5% CP	7% CP	9% CP	11% CP	SEM
DMI day^{-1}					
Kilogram	2.64	2.65	2.69	2.67	0.05
BW (%)	2.49	2.53	2.50	2.53	0.02
g kg^{-1} $BW^{0.75}$	79.9	81.0	80.4	80.9	0.84
CP digestibility (%)	46.8^{d}	60.6^{c}	68.2^{b}	70.9^{a}	1.30
N balance (g kg^{-1} $BW^{0.75}$)					
N intake	0.64^{d}	0.91^{c}	1.16^{b}	1.42^{a}	0.06
Fecal N	0.34^{b}	0.35^{ab}	0.37^{ab}	0.41^{a}	0.01
Urine N	0.33	0.32	0.32	0.31	0.001
N absorption	0.30^{d}	0.55^{c}	0.79^{b}	1.01^{a}	0.05
N retention	-0.03^{d}	0.23^{c}	0.47^{b}	0.70^{a}	0.05

^{a,b,c,d}means with different superscripts among treatments significantly differ ($p<0.05$)

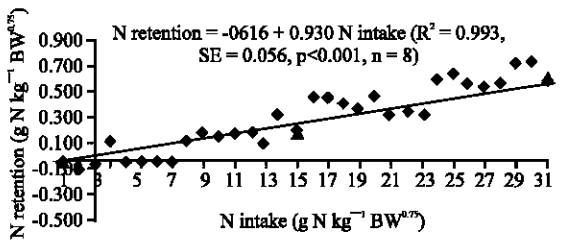

Fig. 1: Relationship between nitrogen retention (N retention, g N/kg $BW^{0.75}$) and nitrogen intake (N intake, g N kg^{-1} $BW^{0.75}$) for male Thai native cattle fed with Pangola hay as roughage

From these equations, it can be explained that the CP requirement for the maintenance of male Thai native cattle is 4.14 gCP kg^{-1} $BW^{0.75}$. This value was similar to than Senarath *et al.* (2009) who reported that yearling Thai native cattle required CP for maintenance 4.36 g CP kg^{-1} $BW^{0.75}$ or lower than about 5.05%. This value is approximately 23.06% lower than the NRC recommendation (5.3 g CP kg^{-1} $BW^{0.75}$) and was lower than Tangjitwattanachi and Sommart (2009) (5.03 g CP 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 g CP kg^{-1} $BW^{0.75}$.

CONCLUSION

In this study, CP digestibility and N balance increased ($p<0.05$) with increasing levels of CP in cattle fed with Pangola hay as roughage. The results from this study indicated that the CP requirement for the maintenance of male Thai native cattle is 4.14 g CP kg^{-1} $BW^{0.75}$.

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