THE EFFECT OF PROTEIN LEVEL AND DEGRADABILITY ON PARTIAL DIGESTION IN FEEDLOT STEERS

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Introduction

From an economic point of view, it is important to study conditions which favour optimization of protein supply to the duodenum with the least possible protein input. Du Plessis (unpublished) indicated that protein supply to 300–350 kg steers can be reduced to less than NRC recommendation, but this obviously will depend on the success of microbial production. It is known e.g. that the efficiency of microbial production is reduced on high concentrate diets (Van Soest et al., 1982), partially because rumen turnover and dilution rate decrease (Owens et al., 1984). This implies that protein supply to the duodenum may sometimes be limiting which should evoke a response to non-degradable protein.

In the present study degradability was altered at NRC recommended levels for 330 kg steers but protein was fed also at a lower level. The effects on OM, N and starch digestion were studied.

Materials and Methods

Twelve steers cannulated in the rumen and duodenum were allocated to one of three treatments. The treatments differed in N supplement only, containing respectively 1.44 % urea, 0.96 % urea and 0.47 % urea plus 5.6 % fish meal. The remainder of the diets consisted of about 80 %

TABLE 1. DIGESTA FLOW AND SITE OF DISAPPEARANCE AS INFLUENCED BY PROTEIN LEVEL AND DEGRADABILITY

	Treatment			SEM
	1.44% urea	0.96% urea	0.47% urea; 5.6% fish meal	
OM intake (kg/day)	5.68	5.70	5.70	0.27
N intake (g/day)	122^{b}	109^{a}	124^{b}	2.86
Degradable N (g/day)	88.3^{b}	75.1^{a}	75.2^{b}	2.03
Non-degradable N (g/day)	33.5	33.7	48.7	0.83
Starch intake (kg/day)	3.48	3.50	3.33	0.06
Rumen NH_3 (mg/100 ml)	29.5	27.3	22.3	5.44
Rumen pH	6.04	6.03	6.00	0.16
Duodenal fluid (ℓ/hr)	1.66	1.85	2.38	0.44
Duodenal OM (g/hr)	84.4^{a}	84.9^{ab}	138^{b}	19.5
Disap. before duodenum:				
OM (prop. of intake)	0.60	0.64	0.40	0.09
N (prop. of intake)	0.37	0.40	0.09	0.17
Starch (prop. of intake)	0.90^{b}	0.86^{b}	0.76^{a}	0.03
Disap. after duodenum:				
OM (prop. of intake)	0.16	0.11	0.32	0.10
N (prop. of intake)	0.32^{ab}	0.23^{a}	0.60^{b}	0.18
Starch (prop. of intake)	0.05^{a}	0.09^{ab}	0.17^{b}	0.04

^{a,b}Different superscripts in the same line denote significant differences ($p < 0.05$)

maize meal, 11 % cottonseed hulls, vitamins and minerals, buffers and an ionophore. The steers were fed at a level of 80 g feed DM/kg $W^{0.75}$/day which supplied degradable and non-degradable N in amounts as shown in table 1. Flow of OM, N and starch was calculated by reference to Na-dichromate and Co-EDTA markers that were mixed into the feed.

Results and Discussion

The results are displayed in table 1. Passage of OM and fluid past the duodenum was faster for the fish meal treatment. This apparently coincided with a faster output of digesta from the rumen which lead to proportionally more N and starch being digested post-duodenally. The shift in digestion apparently did not alter N and starch availability, because total tract digestibility of N was 0.68, 0.63 and 0.69 and of starch 0.94, 0.94 and 0.93 for the three treatments respectively, which was not significanly different. The reasons why the fish meal treatment increased passage rate from the rumen call for speculation which is not appropriate here. However, it explains partially why a 60:40 ratio of degradable to non-degradable protein which corresponds with the fish meal treatment, gave the best results in fattening trials (du Preez and Meissner, unpublished). It is of course known that more amino acids at the duodenum and small intestine digestion of starch would improve efficiency of growth (Owens et al., 1984).

There were no significant differences between the 1.44 % urea and 0.96 % urea treatments. This implies that the lower supply of degradable protein was sufficient but that a growth response should be realized if somewhat more non-degradable protein is supplied. It is proposed that less protein than NRC recommendation can be given to 300-350 kg steers, provided the ratio is 60:40 degradable to non-degradable.

(Key Words: Protein, Digestion, Steers)

Literature Cited

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