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SOME CONSIDERATIONS ON ESTIMATING A VALUE OF THE RUMEN DEGRADABILITY OF PROTEIN OF THF MIXED RATION FOR EARLY WEANED CALVES FROM THE VALUES OF INGREDIENTS

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Introduction

Protein required for the ruminants was synthesized by amino acids absorbed from the intestine. Amino acids absorbed in the gut were supplied by the protein of microorganisms proliferated in the rumen and of dietary origin which was escaped from the degradation in the rumen. Thus, the protein requirement of ruminants consisted of the protein degraded in the rumen and that escaped from the degradation in the rumen. From this point of view, ARC[1)] postulated a new concept for the evaluation of dietary protein. The concept was based on the newly developed index expressed as the rumen degradability of protein (dg). This new system of evaluation for dietary protein has been fully reviewed by ASAHIDA[2)].

The dg value of a ration for early weaned growing calves has not been studied in the world. The purpose of the present study was to determine the dg value of protein for the ration fed to early weaned growing calves and to evaluate the possibility of the dg value of feedstuffs determined individually for application to the value of a ration as a mixture of individual feedstuffs.

Materials and Methods

Ten Holstein castrated male calves were cannulated at 3 to 4 weeks of age and were weaned at 6 weeks of age. Four kinds of iso-caloric and

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TABLE 1. Compositions of a ration fed to calves and used for the determination of the rumen degradability of protein

Ingredients	Ration			
	R1	R2	R3	R4
	%			
Rolled corn	24.0	16.8	42.6	33.6
Rolled grain sorghum	—	15.6	—	—
Wheat flour	6.6	4.8	—	6.0
Rolled oats	7.2	4.8	—	—
Molasses	1.2	0.6	—	—
Soybean meal	13.2	9.0	13.2	—
Linseed meal	—	—	1.8	—
Fish meal	—	3.0	—	1.8
Cotton seed meal	—	—	—	16.2
Dehydrated alfalfa meal	3.0	2.4	—	—
Miscellaneous and mineral mixture	4.8	3.0	2.4	2.4
Orchardgrass hay, 1st cut	40.0	40.0	40.0	40.0
Chemical composition				
Dry matter, %	84.2	84.5	84.2	84.9
Organic matter, % of DM	93.4	93.6	93.8	93.4
Crude protein, % of DM	14.7	14.0	15.5	15.1
Cell wall constituents, % of DM	38.6	38.7	35.8	39.3
Gross energy, MJ/kg of DM	18.8	18.7	18.7	18.7

iso-nitrogenic ration were a ration consisting of a commercial calf starter and 1st cut orchardgrass hay mixed with a ratio of 6 : 4 (R1), a ration consisting of R1 and supplements of grain sorghum and fish meal (R2), a ration with soybean meal as a main protein source (R3) and a ration with cottonseed meal as a main protein source (R4). The composition of ingredients for 4 rations were presented in table 1 together with their chemical composition and energy content. Dietary allowance was determined to fulfil the requirement of metabolizable energy to support daily gain of 0.5 kg (ARC[1]).

Determinations of the dg value for a calf starter and 4 rations were carried out using early weaned calves at 7 to 13 weeks of age weighing 59.0±2.6 kg to 81.8±1.8 kg on average by the methods described by ØRSKOV and MCDONALD[4] in the same manner as reported elsewhere (OKUBO *et al.*[3]).

Determinations for R1 were also conducted using 14-month-old steers in the same manner as described above. The estimated values of the dg for 4 rations and calf starter were calculated using the composition of ingredients in a diet and the dg values determined for individual ingredients reported by OKUBO *et al.*[3].

Results and Discussion

The effective dg values for a commercial calf starter and 4 rations were 74.0, 54.6, 47.4, 60.5 and 56.1% for the starter, R1, R2, R3 and R4, respectively as listed in table 2. The dg value for R1 measured using 14-month-old steers was 70.8% as shown in table 2.

TABLE 2. The dg values determined and estimated for compound feeds

Diet	Determined	Estimated[1]
	%	
Commercial calf starter	74.0	68.2
Mixed ration (Concentrate 6 : Hay 4)		
R1	54.6	68.9
R1	70.8[2]	68.9
R2	47.4	62.7
R3	60.5	63.0
R4	56.1	55.9

1) Calculated using the dg values of protein determined for individual ingredients and their composition of a ration.
2) Determined using 14-month-old steers.

The estimated values of dg for the starter and 4 rations were also listed in table 2. The estimated values of the starter showed a fair agreement with the measured one, although being somewhat lower than the measured one. The dg values determined for R1 and R2 were lower than those estimated. The dg value of R1 determined using 14-month-old steers well agreed with that estimated. This inconsistency suggests the effect of age on degradability of protein in a mixed ration. Calves developing ruminal function may have responded to R1 and R2 in a different manner as it might have expected to be additively estimated because of difference in a degree of rumen development. Steers fully developed their rumen may be able to respond as it might be.

The dg values estimated for R3 and R4 well agreed with those deter-

mined as shown in table 2. The composition of R3 and R4 was relatively simple as compared to R1 and R2 (Table 1). It shows, however, no evidence on the consistency based on the simplisity of the composition.

Results obtained in the present study demonstrated no clear evidence for the dg value to be estimated in an additive fashion by using the composition of ingredients and the dg values for individual ingredients. It appears, however, that the dg value may be estimated in the additive fashion for a ration fed to growing calves with highly developed rumen and/or composed with small number of feedstuffs, when results obtained in R1 on 14-month-old steers, R3 and R4 were considered.

Results obtained in the present study, however, suggested that the dg was partially influenced by the ruminal fermentation. Thus, for the practical application of the dg value determined for single feedstuff to a mixed ration, further studies are required on the relationship between rumen development and composition of the ration for growing calves.

Summary

The rumen degradability of protein was determined for 4 rations with different protein sources using ten 6-week-old weaned calves. Rations contained equal amounts of gross energy and nitrogen. The rumen degradability of protein for 4 rations were also estimated using previously reported values of ingredients of a ration.

The estimated dg values of 4 rations has a fair agreement with the measured ones with some exceptions. The estimation of dg values for a ration appears to be done in an additive fashion. For the practical application of the dg value determined for single feedstuff to a mixed ration, further studies are required on the relationship between the rumen development and the composition of the ration for growing calves.

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