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Measurements of microbial N flow to the duodenum and urinary excretion of purine derivatives in bulls

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Accurate determination of microbial protein synthesis in the rumen is essential in ruminant nutrition and various procedures have been used in the past. Now, purine derivatives excreted in urine represents an attractive alternative technique for this purpose (Chen *et al*, 1990, Br J Nutr, 63, 197).

An experiment was carried out on six ruminally and duodenally fistulated Belgian White Blue bulls (initial live weight 287 ± 17 kg) in order to determine the relationship between microbial N flow to the duodenum and purine derivatives (PD) excretion in urine. The bulls were fed twice a day (8h30 and 20h30) in equal meals a mixed ration consisting of concentrates (75 % of DMI) and meadow hay (25 % of DMI). Two levels of intake (55 and 85 g of DM/kg $W^{0.75}$) were tested in two 9d measurement period following a 21d adaptation period, according to a cross-over design. Cr_2O_3 distributed with the diet (2 g/kg DMI) and PEG continuously infused in the rumen (75 g/d) served as indigestible markers for measurement of digesta flow to the duodenum. Microbial matter was continuously labelled with ^{15}N (1.65 g $(^{15}NH)_2SO_4$/d, 60 atoms %) 66 h before and during sample collection. Purines/N and ^{15}N/N ratios in duodenal digesta (8 samples) and solid associated bacteria (4 samples) extracted from whole rumen contents (Legay-Carmier and Bauchart, 1989, Br J Nutr, 61, 725) were used to determine microbial N flow to the duodenum (3 d) in relation to the purine derivatives excreted in urine (6 d). Purines (guanine and adenine) and PD (allantoin and uric acid) were analysed by HPLC (Lassalas *et al*, 1992, 7e Journ Alim Nutr Herbiv, INRA, Paris ; Balcells *et al*, 1992, J Chromato, 575, 153), isotopic ratios by mass spectrometry.

Increasing OM intake tended to depress OM apparently digested in the rumen (OMADR) and increased NAN flow to the duodenum, but did not affect microbial N fraction in NAN (80 %). Consequently, efficiency of microbial protein synthesis was greater for the high intake. Purines and ^{15}N provided similar estimates for microbial activity at the two levels of intake. PD excretion completely followed microbial N flow to the duodenum, because purine/N ratio (1.05 mmol/g) in solid associated bacteria was not affected by intake and purines leaving the rumen originated mostly from microbial matter. The relation between microbial N flow to the duodenum (g N/d x kg LW) and purine derivatives excreted in urine (mg N/d x kg LW) obtained was : PD = 6.4 (± 1.9) + 52.1 (± 6.1) microbial N, with s = 2.3, R^2 = 0.78 and P<0.001.

In conclusion, PD excretion in urine exhibited the effects of increasing DMI intake on duodenal microbial N flow and efficiency of ruminal microbial synthesis in bulls.

	Intake	
	55 g	85 g
OM intake (g/d)	3920	5915
OMADR (%)	53.8	49.7
N intake (g/d)	114	172
Duodenal NAN flow (g/d)		
Total	92.6	155.3
Microbial purines	76.1	124.6
^{15}N	72.5	122.4
Microbial N/OMADR (g/kg)		
Purines	36.1	42.4
^{15}N	34.4	41.6
PD excreted (mmol/d)	104.5	155.9
ADG (g/d)	278	1255

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