Milk urea content as affected by roughage type

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Milk urea content (MUC) is used to manage protein nutrition and predict nitrogen excretion of dairy cows. However, MUC might depend on the roughage type offered. To evaluate that, three diets were compared using 18 lactating Holstein cows: 100% maize silage (MS), 50%/50% MS/grass silage (GS) and 100% GS. For all treatments, cows were fed to supply 105% of their net energy and digestible protein requirements. For the 100% groups, N balance was determined.
MS and MS/GS treatments had higher DM-intake (19.5 and 19.6 vs. 18.7 kg/d; $P<0.001$) and improved milking performance: 26.7 and 26.5 vs. 24.3 kg milk/d; 1163 and 1138 vs. 1050 g milk fat/d and 854 and 845 vs. 752 g milk protein/d ($P<0.001$). MS and GS fed cows ingested the same amount of degraded protein balance (73 g/d), while the MS/GS group ingested 106 g/d. MUC of MS (230 mg/l) and MS/GS (214 mg/l) was significantly ($P<0.001$) different from GS (171 mg/l). N balances indicated that for the MS diet, 33.2, 32.8 and 34.0% of the excreted N (392 g/d), was excreted with the faeces, urine and milk respectively, while for the GS diet this was 40.0, 30.1 and 29.9% (total excretion: 389 g/d). These results suggest that MUC is roughage dependent and that a system to predict N excretion can not merely be based on MUC.

Introduction

MUC has been suggested to monitor protein supply and estimate N excretion. Some nutritional factors are cited to influence MUC:

- feed protein intake
- ratio energy/protein intake
- rumen degraded protein balance

A possible effect of the roughage type has rarely been investigated

Indications for influence of roughage type

- De Brabander et al (1999) for maize silage/grass silage based diets (36 treatments, 585 cow observations):

MUC (mg/l) =
145 - 1.85 x %NEL + 2.32 x % DPI + 0.28 x g RDPB

Indication for correction for roughage type:
100% PGS: - 48 mg/l
100% MS: + 85 mg/l

Indications for influence of roughage type

Van Duinkerken et al. (2003): MUC-values
Corrected MUC values according to De Brabander et al. (1999) based on nutrient intake from Van Duinkerken et al. (2003)

RDPB-level	Proportion MS		
g/day	0%	50%	100%
0	139 (135)	159 (148)	219 (236)
500	265 (244)	302 (297)	379 (384)
1000	390 (403)	445 (461)	539 (541)

Feeding trial: material and methods

- Latin square 3 x 3
- 18 cows
- roughage diets:
  - MS: 100% maize silage
  - MS/PGS: 50%/50% maize sil./prew. grass sil.
  - PGS: 100% prewilted grass silage
- all diets formulated : similar energy (NEL) and protein supply (CP, DPI, RDPB)

Feeding trial: material and methods

Analysed dietary composition (/kg DM)

	MS	MS/PGS	PGS
NEL (MJ)	6.7	6.6	6.7
CP (g)	137	135	134
DPI (g)	82.4	76.3	74.2
RDPB (g)	-0.7	3.7	3.9

Results: daily DMI (kg)

	MS	MS/PGS	PGS
total	*19.5*	*19.6*	*18.7*
maize silage	15.8	8.3	-
grass silage	-	7.9	11.6
citrus pulp	-	-	5.1
soybean meal	2.2	0.8	-
concentrates	1.5	2.6	1.9

Results: energy and protein intake

	MS	MS/PGS	PGS
RDPB (g d^{-1})	-16^{a}	71^{b}	73^{b}
DPI (g d^{-1})	1608^{a}	1505^{b}	1392^{c}
NEL (MJ d^{-1})	131^{a}	129^{a}	125^{b}
DPI (% requir.)	111^{a}	104^{b}	108^{a}
NEL (% requir.)	104^{a}	104^{a}	108^{b}

a,b significantly different P<0.01

Results: milking performance

	MS	MS/PGS	PGS	P-value
MUC (mg l^{-1})	***230^{a}***	***214^{a}***	***171^{b}***	***<0.001***
corr for nutr. intake	217	193	146	
corr for LW-gain	216	187	128	
Milk yield (kg d^{-1})	26.7^{a}	26.5^{a}	24.3^{b}	<0.001
Fat content (%)	4.37	4.32	4.38	0.708
Protein content (%)	3.22^{a}	3.21^{a}	3.12^{b}	0.006
Weight gain (kg d^{-1})	0.22^{a}	0.07^{ab}	-0.12^{b}	0.036

Balance trial: material and methods

- cross-over
- 4 cows
- 2 diets from feeding trial:
  - MS: 100% maize silage
  - PGS: 100% prew. grass silage

Results: N-balance

	MS	PGS
DM-intake (kg/d)	17.1	16.7
N-flows (g/d)		
Intake	388	356
Faeces	130	155
Urine	129	117
Excretion to environment	259	272
Milk	133	116
Total excretion	392	389
Apparent retention	-5	-32

no significant differences (P>0.10)

Results: N-balance

	MS	PGS	P-value
Excretion (g/d)			
Environment	259	272	0.492
Total	392	389	0.902
Excretion (% of intake)			
Environment	67.2	76.8	0.064
MUC (mg/l)	***248***	***180***	***0.095***
corr for nutr. intake	252	168	
Milk (kg/d)	24.7	20.4	0.199
Urine production (kg/day)	14.4	35.0	<0.001

Conclusions

- Important influence of roughage type on MUC
- Probably, other feedstuffs may also influence MUC
- This should be studied in detail before N-excretion estimation from MUC can be applied in practice

References

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