The use of polyethyleneglycol as a marker of faecal output in cows feed hay at two feeding levels

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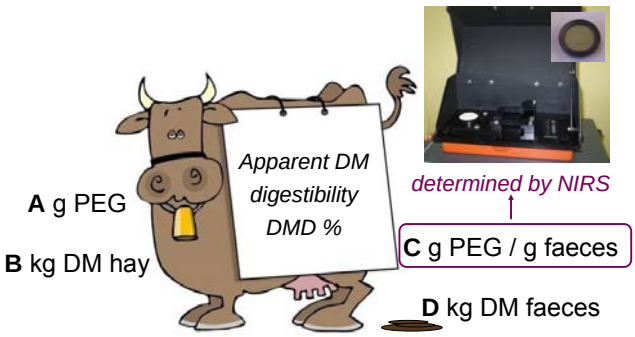
- The knowledge of feed intake by ruminants is key to understand their performance
- Some methods are based on estimating total faecal output, given a known diet digestibility, with indigestible markers
- Simple, cheap and accurate methods are required

OBJECTIVE

To validate the use of PEG as an indigestible external marker of faecal output in cows as assessed by NIRS analysis, and to determine the effect of feeding level.



Materials and Methods

Animals and diets: 8 dry Parda de Montaña beef cows, fed mountain meadow hay (9.29% CP, 68.03% NDF)

1. *Calibration of PEG concentration in faeces:*

- Blank faecal samples from cows fed hay *ad libitum*
- Dried, ground & mixed with PEG-6000 at increments of 0.5%

0% 0.5 1.0 . . . . . 9.5 10.0 %

- Spectra NIRS-scanned (reflectance 1100-2500 nm)
- Calibration equations: MPLS method, WinISI III software

2. *In vivo validation:*

- Cows in digestibility cages, **two feeding levels** (FL): **High** (12 kg hay/d) vs. **Low** (9 kg hay/d)
- Orally dosed PEG daily during 10 days
  175 (Low) or 235 (High FL) g PEG/cow/day
- Total faecal collection in the last 4 days
- Faecal samples dried & ground, spectra NIRS-scanned
- PEG content predicted using the calibration equations

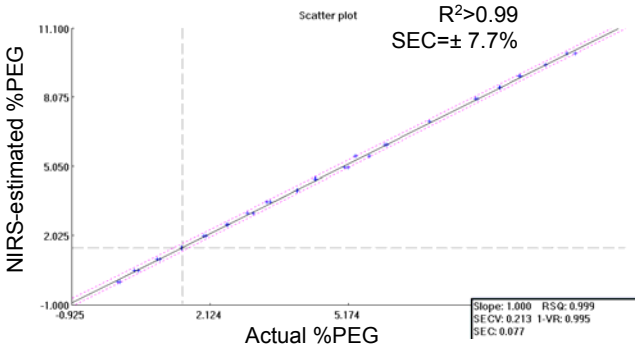
Comparison (paired t-Tests):

Actual faecal output vs. Estimated faecal output (total PEG dosed / NIRS estimate of faecal PEG concentration)

Actual diet intake vs. Estimated diet intake (Estimated faecal output * [1 – average apparent DM digestibility])

Results

Calibration: good correlation between actual and NIRS-estimated PEG values



	Low	s.e.	High	s.e.	Feeding level
Diet intake, kg DM/d					
Actual	8.11	*0.09*	10.18	*0.11*	***
Estimated	7.98	*0.16*	10.11	*0.18*	***
Faecal output, kg DM/d					
Actual	3.05	*0.08*	3.81	*0.09*	***
Estimated	3.09	*0.06*	3.91	*0.07*	***
PEG faecal content, %					
Actual	5.71	*0.16*	6.11	*0.18*	**NS**
NIRS estimate	5.68	*0.11*	6.04	*0.12*	*
Digestibility, %	62.14	*0.78*	60.71	*0.86*	**NS**
PEG recovery, % [a]	97.1	*1.5*	95.0	*1.6*	**NS**
Faecal output prediction, % [b]	3.4	*1.6*	5.6	*1.7*	**NS**
Diet intake prediction, % [c]	0.0	*1.9*	6.0	*2.1*	*

[a] PEG recovery = NIRS estimated faecal PEG content / PEG dosed

[b] Faecal output prediction = [Estimated faecal output – Actual faecal output] / Actual faecal output

[c] Diet intake prediction = [Estimated diet intake – Actual diet intake] / Actual diet intake

CONCLUSIONS

PEG recovery was not complete, and therefore faecal output and diet intake were slightly overestimated, particularly in the High feeding level. It can be used as a marker of fecal output in cows fed diets of a known DM digestibility, the accuracy of intake prediction depending on feeding level.

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Polyethyleneglycol 6000 (PEG) was selected as a potential indigestible estimator of fecal output in cattle, due to its simple detection by NIRS. Calibration equations of PEG fecal content were obtained adding PEG at 0.5% increments to feces from 2 cows fed a meadow hay (9.3% CP, 68.0% NDF), to final PEG concentrations from 0 to 10%, in duplicates. Spectra were NIRS-scanned (Foss NIRSystems 5000), and predictive equations were derived. Then a digestibility trial was conducted with 8 Parda de Montaña dry cows (622 kg), placed in digestibility cages for two 3-wk periods, during each of which half the cows received either a High (12 kg hay, as fed) or Low (9 kg hay) feeding level (FL). During the last 10 d cows were dosed either 175 (Low) or 235 (High FL) g PEG/d, and in the last 4 d total feces were collected. Fecal samples were scanned to determine fecal PEG content with the prediction equations. Individual data for actual and estimated fecal PEG content, fecal output and feed intake, fecal PEG recovery and diet DM digestibility were analyzed using PROC MIXED, and actual and estimated values were compared by paired T-tests. PEG recovery in feces was 95.7%, with differences ($P<0.001$) between actual values (5.71 vs. 6.11% in the Low and High FL, NS) and NIRS estimates (5.68 vs. 6.04%, $P<0.05$). Therefore, fecal output was slightly overestimated (+5.2%) and the difference between actual (3.05 vs. 3.81 kg DM/d in the Low and High FL, $P<0.001$) and estimated values (3.09 vs. 3.91 kg DM/d, $P<0.001$) was significant ($P<0.001$). Feed intake calculated from fecal output and average DM digestibility (61.3%) was overestimated, but the difference between actual (8.11 vs. 10.18 kg DM/d in the Low and High FL, $P<0.001$) and estimated values (7.98 vs. 10.11 kg DM/d, $P<0.001$) was only significant in the High FL, while estimates were accurate in the Low FL. In conclusion, PEG can be used as a marker of fecal output in dry cows fed hay diets, the accuracy of intake prediction depending on feeding level.