Evaluation of the repeatability of NIRS applied to faeces for predicting diet characteristics of grazing ruminants

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Objective

To estimate the repeatability of NIRS applied to faeces to predict *in vivo* organic matter digestibility (OMD) and organic matter voluntary intake (OMVI, g/kg metabolic weight) of grazing ruminants.

Material & Methods

- 10 faeces samples (grazing sheep or grazing heifers) as the most variable as possible

- 2 samples presentations
  sp1 = to fill 10 small ring cups
  sp2 = to fill 1 small ring cup and to transfer the matter successively 10 times in other cups

- 2 NIRS models : Global or Local MPLS

- Repeatability estimated through analysis of variance (ANOVA)
  variance components = sample (n=10); sample presentation (n=2); NIRS model (n=2)
  standard error of repeatability (s_r) = $\sqrt{\text{residual mean square error of the ANOVA}}$

Results & Discussion

Figure 1 . Variability of FNIRS prediction reported to samples (s1 to s10), NIR model (Local or Global), and sample presentation (sp1 and sp2)
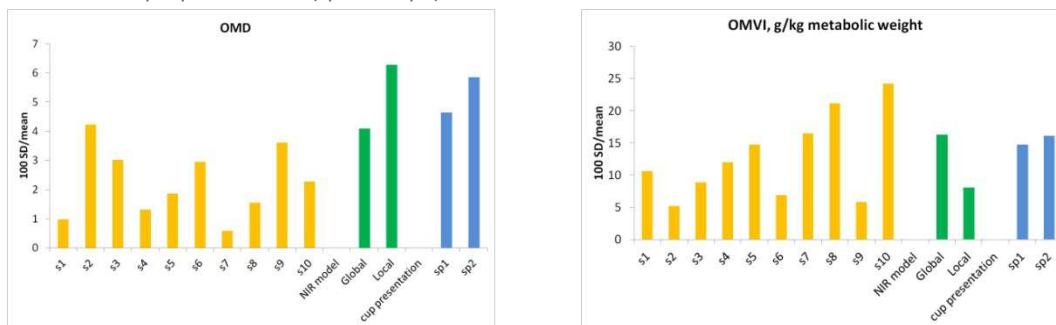
At the sample level, OMD coefficient of variation (100 SD/mean) was lower than 5, reflecting the good repeatability of the prediction . OMVI coefficient of variation was higher (figure 1). According to the analysis of variance, sample was the component with the highest variability for OMD suggesting that OMD FNIRS prediction repeatability was good. NIRS model was the component with the highest variability for OMVI, highlighting the difficulty to develop efficient FNIRS databases.

Table 1 . Repeatability of predicted OMD and OMVI compared to the FNIRS precision

	SECV	Mean	s_r	s_r %
OMD	0.0207	0.742	0.0099	1.33
OMVI	4.53	66.10	1.80	2.72

OMD : in vivo organic matter digestibility; OMVI : organic matter voluntary intake (g/kg metabolic weight); sr : repeatability standard error; sr% : sr/mean x 100; SECV : standard error of cross-validation of FNIRS calibration.

For both OMD and OMVI, repeatability standard errors (s_r %) were lower than 5 % of the mean (table 1). Compared to the accuracy of the calibrations (SECV), all repeatability standard error (s_r) were lower than the SECV for both parameters tested.

Conclusion

In regard to the difficulty to obtain *in vivo* diet characteristics with the reference method (digestibility trial), NIRS analysis of faeces can predict OMD and OMVI with a good repeatability. For OMVI, it appears more difficult to encompass intake level and grass availability. So, OMVI spectral databases must be improved to cover field variability and to be used for ruminant diet management.

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