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Feasibility of near-infrared spectroscopy to predict dry matter digestibility in broilers

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Introduction

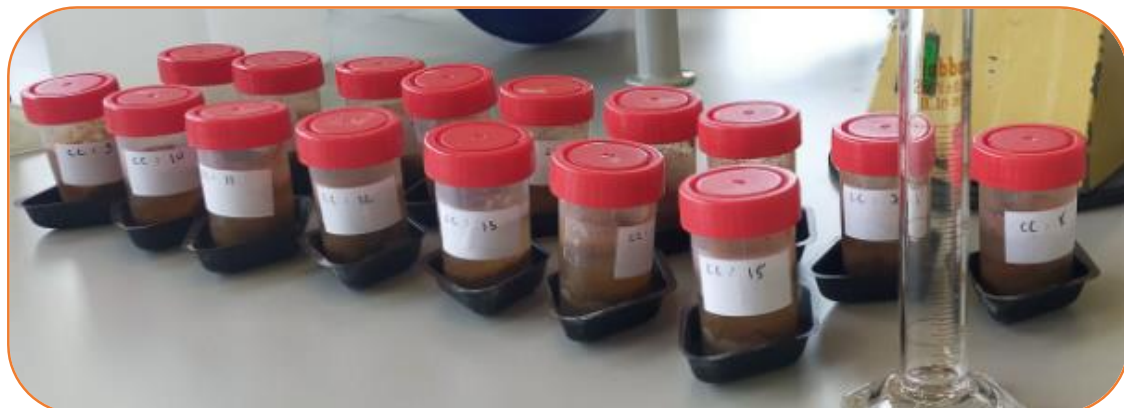


Determining feed digestibility is crucial for optimizing broiler nutrition. Inert markers play a key role in estimating feed digestibility, but their determination by wet chemistry limits their applicability

The **aim** was to **assess** the potential of near-infrared spectroscopy (**NIRS**) to **predict Yb, Ti** and polyethylene glycol (**PEG**) content in broiler excreta, and dry matter digestibility (**DMD**) from these values

Material & Methods

- **Animals:** 576 male Ross 308 strain chicks
- **Digestibility markers:** **TiO₂: 2 g/kg + Yb₂O₃: 50 mg/kg + PEG: 5 g/kg**
- **Samples:** 192 excreta samples collected from day 14 to 25
- **Reference method:**
 - Ti and Yb → 5900 ICP-OES, Agilent
 - PEG → ad-hoc NIRS model; $R^2_{CAL}=1.00$; SEC = 0.06
- **Chemometrics:**
 - From 1100 to 2500 nm, every 2 nm
 - Scanned in duplicate, recorded as $\log(1/\text{Reflectance})$
 - MPLS external validation (75:25)
 - Traits: Ti, Yb, DMD_{Yb} , DMD_{Ti} , DMD_{PEG}



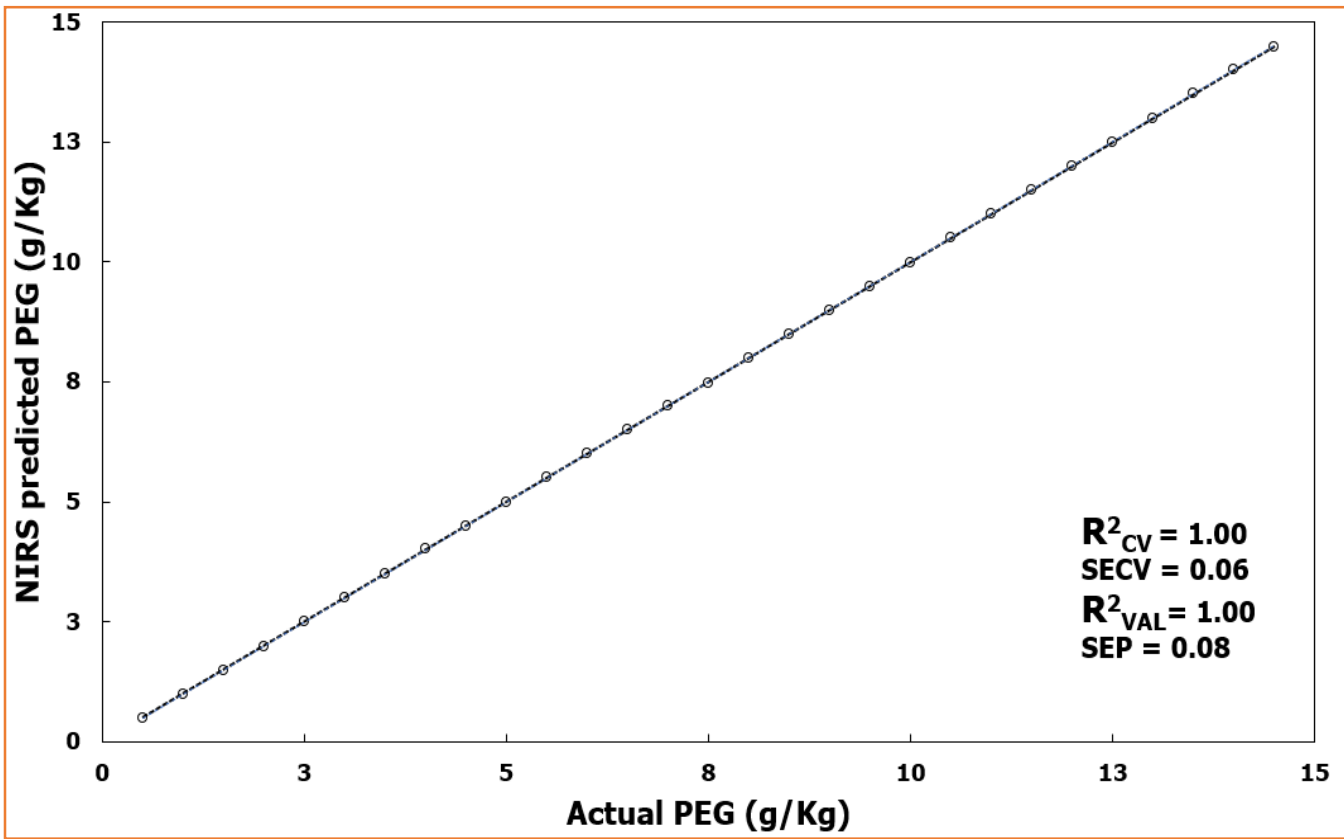
Excreta samples for the ad-hoc PEG calibration



NIRS Ø 48 mm quartz glass cup excreta samples



NIRSystems 5000; Foss, DK



Ad-hoc PEG calibration developed

Results

Trait	Calibration set					Validation set					
	Scatter + Math	R ² _{CAL}	SEC	R ² _{cv}	SECV	R ² _{VAL}	SEP	Bias	Slope	RPD	
Yb	MSC (2.5.5.1)	0.87	0.001	0.74	0.001	0.67	0.001	0	0.862	2.00	
Ti	SNV+D (2.4.4.1)	0.90	0.016	0.78	0.023	0.73	0.025	0	0.885	2.28	
DMD _{Yb}	SNV+D (2.4.4.1)	0.89	0.960	0.75	1.43	0.68	1.56	0.019	0.863	1.93	
DMD _{Ti}	MSC (2.4.4.1)	0.91	0.851	0.80	1.22	0.77	1.20	0.014	0.900	2.41	

- Challenge in predicting PEG in excreta using the developed equation
- Difficulties in developing DMD prediction models based on PEG
- Efficacy of PEG NIRS models might be influenced by the composition of the diet
- Good linear regression score between DMD based on Yb and Ti (**R² = 0.72**)
- Null linear regression score between DMD_{PEG} and DMD_{Yb} or DMD_{Ti} (**R² < 0.02**)

Conclusions

- **First study to evaluate potential of NIRS to assess Yb, Ti, and PEG content in broilers excreta and their DMD**
- **NIRS adequate as an initial screening tool for Yb and Ti content determination, and DMD based on Ti**
- **PEG ad-hoc calibration models revealed excellent accuracy**
- **PEG calibration might be diet-dependent, need for PEG tailored calibration models for each diet**