How does nutrient intake affect methane emission from slurry in pigs?

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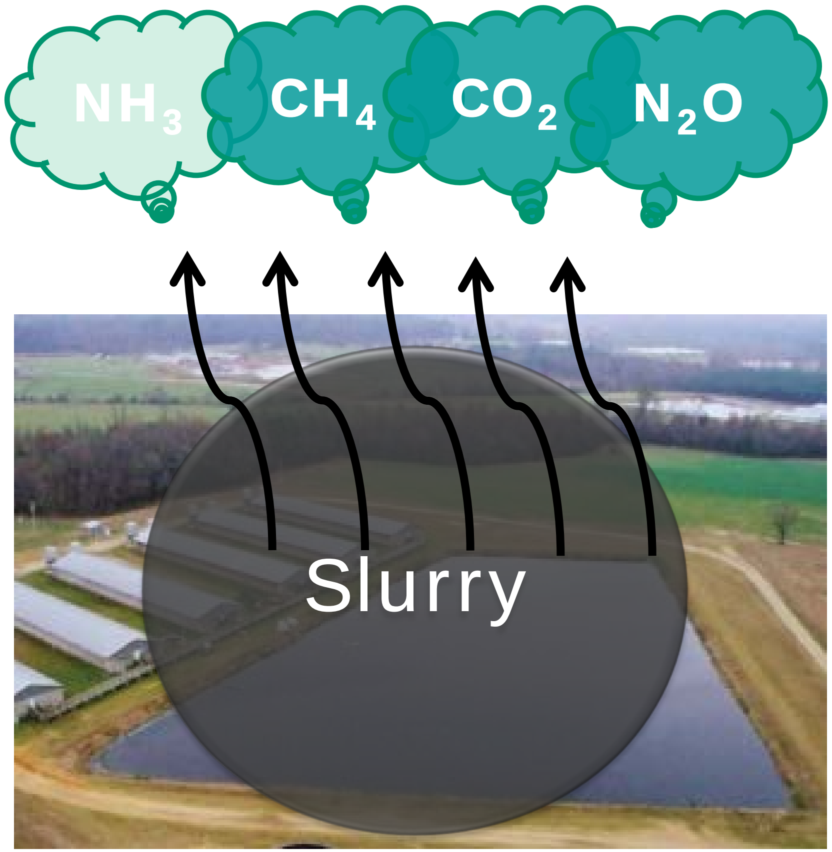
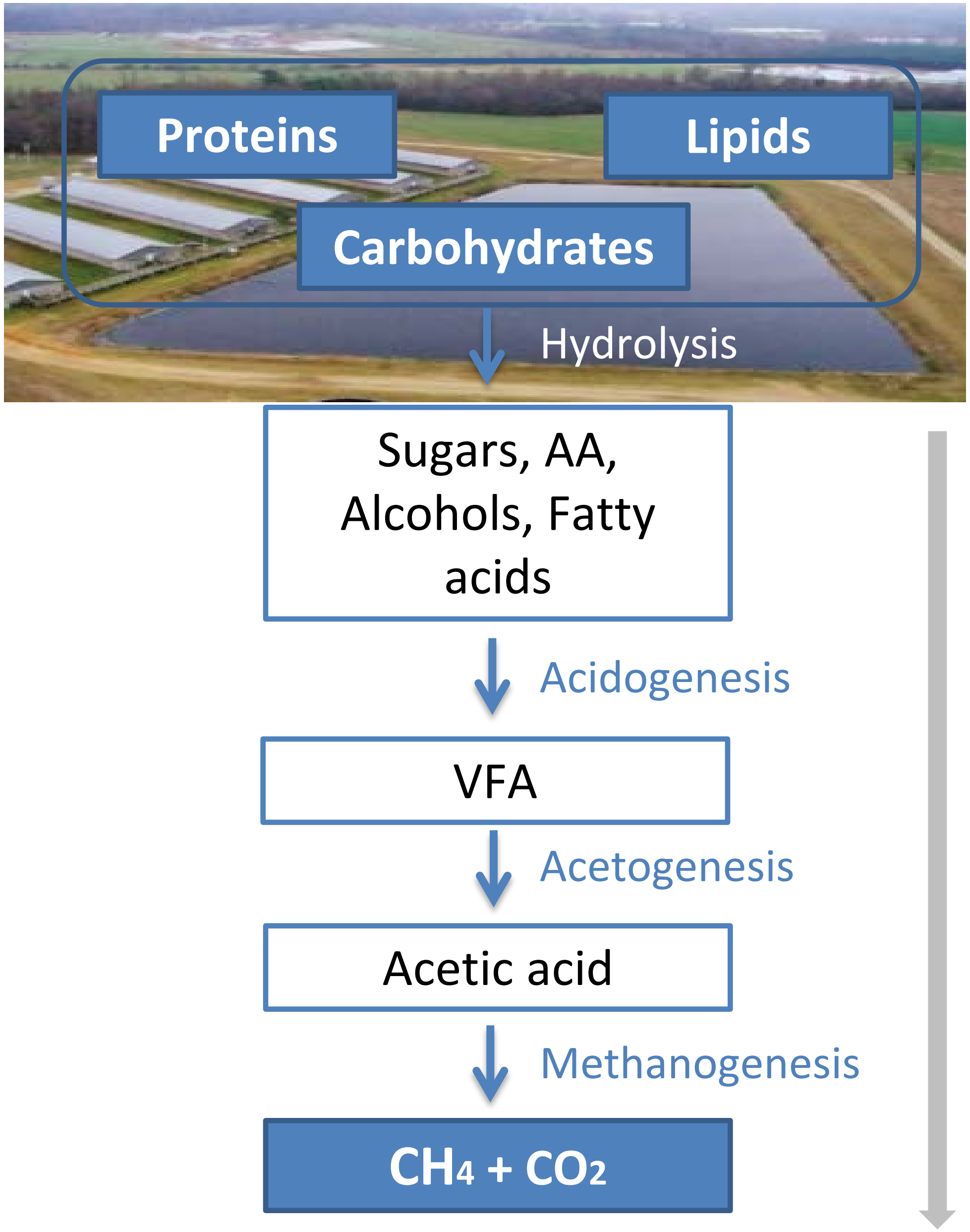
INTRODUCTION



Pigs: 9.5% GHG
of the livestock sector
(1/3 slurry management, FAO 2016)



CH4 produced by biological anaerobic degradation of OM

The velocity and amount of CH4 depend on the **proportion** and **biodegradability** of nutrients in the slurry (slurry characteristics)

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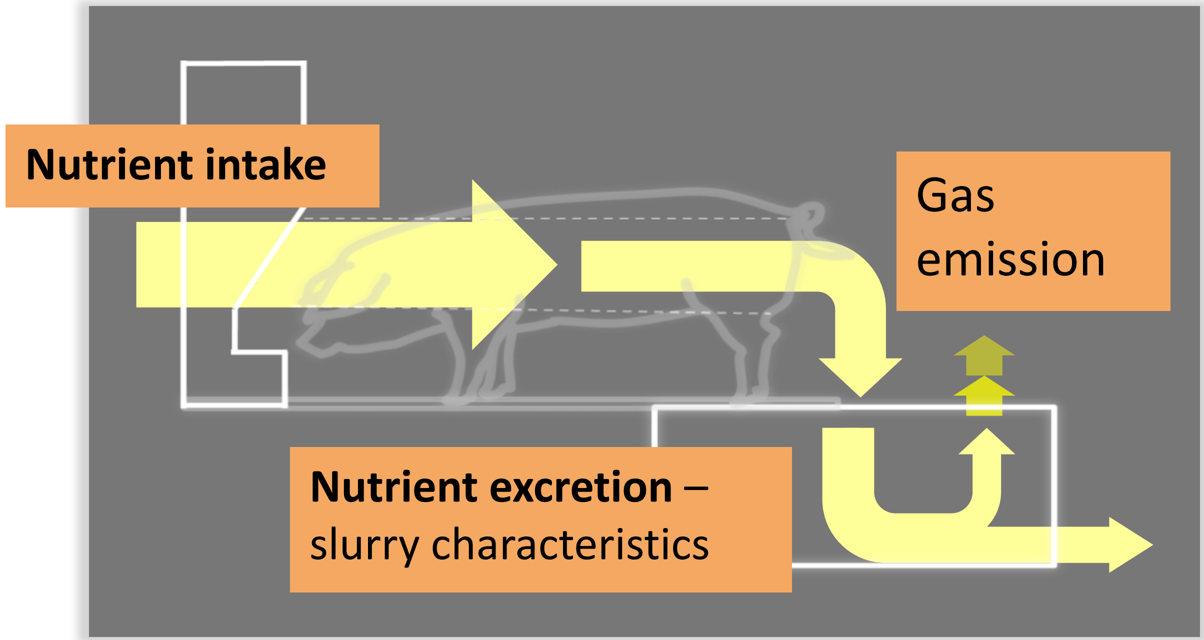

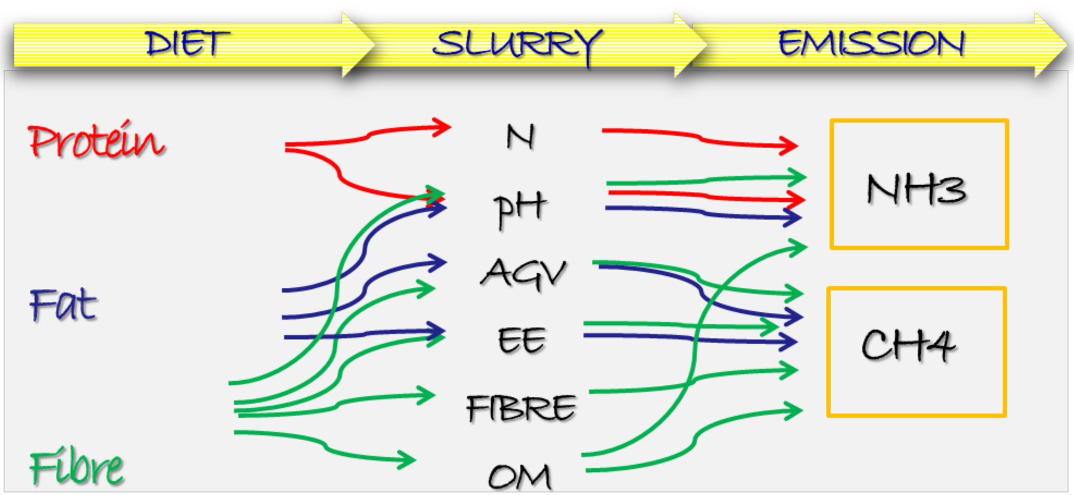

OBJECTIVE: Study the relationship between **nutrient intake** (g kg PV$^{-0.75}$ d $^{-1}$), **nutrient excretion** (g kg PV$^{-0.75}$ d $^{-1}$) and potential **methane** (CH_4, L kg PV$^{-0.75}$ d^{-1}) emission from slurry

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- Data from **3 studies** (**13 diets; 78 fattening pigs**)(AGL2011-30023-C03):
  - Protein (source): soybean meal *vs* sunflower meal *vs* wheat DDGS
  - Fibre (type and amount): 7.5 or 15% orange pulp *vs* carob meal
  - Fat (amount and interaction with fibre): 3.5 vs 7% calcium soap of palm fatty acids distillate *with or without* orange pulp

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- **Experimental procedure** (metabolic pens, CITA-IVIA)

- 52.3 to 114 kg BW males
- 14 days of adaptation to diets
- 7 consecutive days of intake control and total faeces and urine collection
- Feed *ad libitum* all the time

MATERIALS AND METHODS

- Data from **3 studies** (**13 diets; 78 fattening pigs**)(AGL2011-30023-C03):
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- **Experimental procedure**

- Feeds and faeces: dry matter, gross energy (GE), nitrogen (N), ether extract (EE), soluble fibre (SF) and fibre fractions (NDF, ADF and ADL), FND-N
- Urine: GE and N
- Potential CH_4 emission from slurry (*in vitro* batch assay, 100 days)
- The whole data set was analysed using the **CORR procedure** of SAS®

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1. Correlation (r) between **nutrient intake** (g kg $BW^{-0.75}$ d^{-1} or MJ kg $BW^{-0.75}$ d^{-1}), **excretion** (g kg $BW^{-0.75}$ d^{-1} or MJ kg $BW^{-0.75}$ d^{-1}) and the **potential CH4 emission** from slurry (L kg$BW^{-0.75}$ d^{-1})

2. Correlation (r) between **metabolizable nutrient intake** (g kg $BW^{-0.75}$ d^{-1} or MJ kg $BW^{-0.75}$ d^{-1}) and the **potential CH4 emission** from slurry (L kg$BW^{-0.75}$ d^{-1})

3. **Energy balance** in animals with low, medium and high potential CH4 emission from slurry.

RESULTS

1. Nutrient intake (g kg $BW^{-0.75}$ d^{-1} or MJ kg $BW^{-0.75}$ d^{-1}), excretion (g kg $BW^{-0.75}$ d^{-1} or MJ kg $BW^{-0.75}$ d^{-1}) and the potential CH4 emission from slurry (L kg$BW^{-0.75}$ d^{-1})

* p<0.05

Variables	General statistic parameters (n:78)		CH_4
	Average	SD	
Nutrient intake			
Crude protein	12.9	2.18	**0.43***
Gross Energy	1.43	0.22	**0.55***
Crude protein-NDF	1.60	0.40	**0.53***
Ether extract	4.81	1.30	**0.65***
Soluble fibre	7.53	4.69	**0.25***
Neutral detergent fibre	10.10	4.47	0.16
Acid detergent fibre	3.31	1.95	0.18
Acid detergent lignin	2.67	2.61	0.12
Nutrient excretion (faeces + urine)			
Crude protein	0.92	0.23	0.22
Gross Energy	0.27	0.05	**0.70***
Ether extract	1.35	0.64	**0.45***
Neutral detergent fibre	5.51	1.27	**0.47***
Acid detergent fibre	2.52	0.89	**0.36***
Acid detergent lignin	0.77	0.54	0.14

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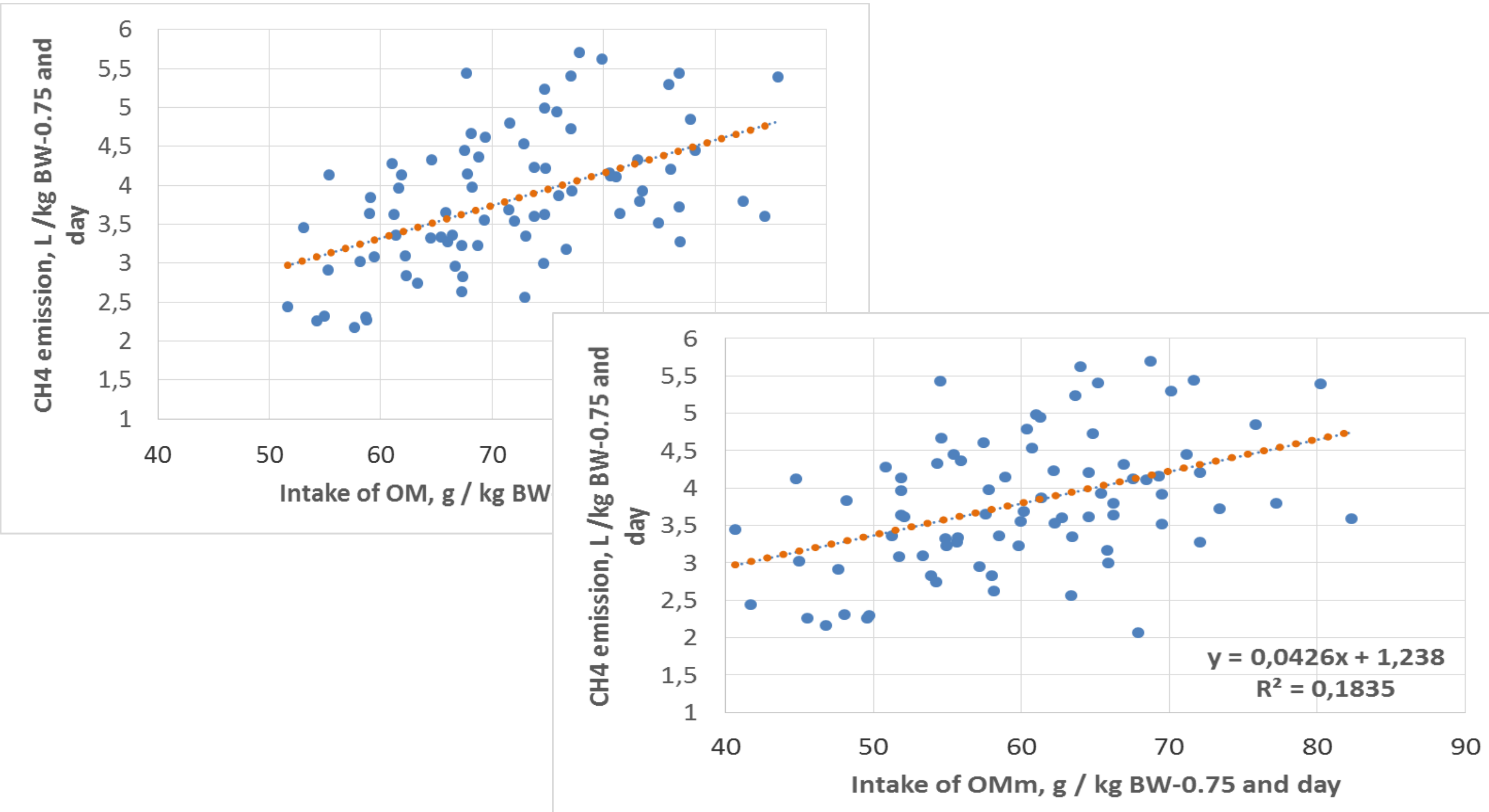
2. **Metabolizable nutrient intake** (g kg $BW^{-0.75}$ d^{-1} or MJ kg $BW^{-0.75}$ d^{-1}) and the **potential CH4 emission** from slurry (L kg$BW^{-0.75}$ d^{-1})



OMm = OM intake * (((OM intake-OM excretion faeces + urine)/OM intake)*100)

RESULTS

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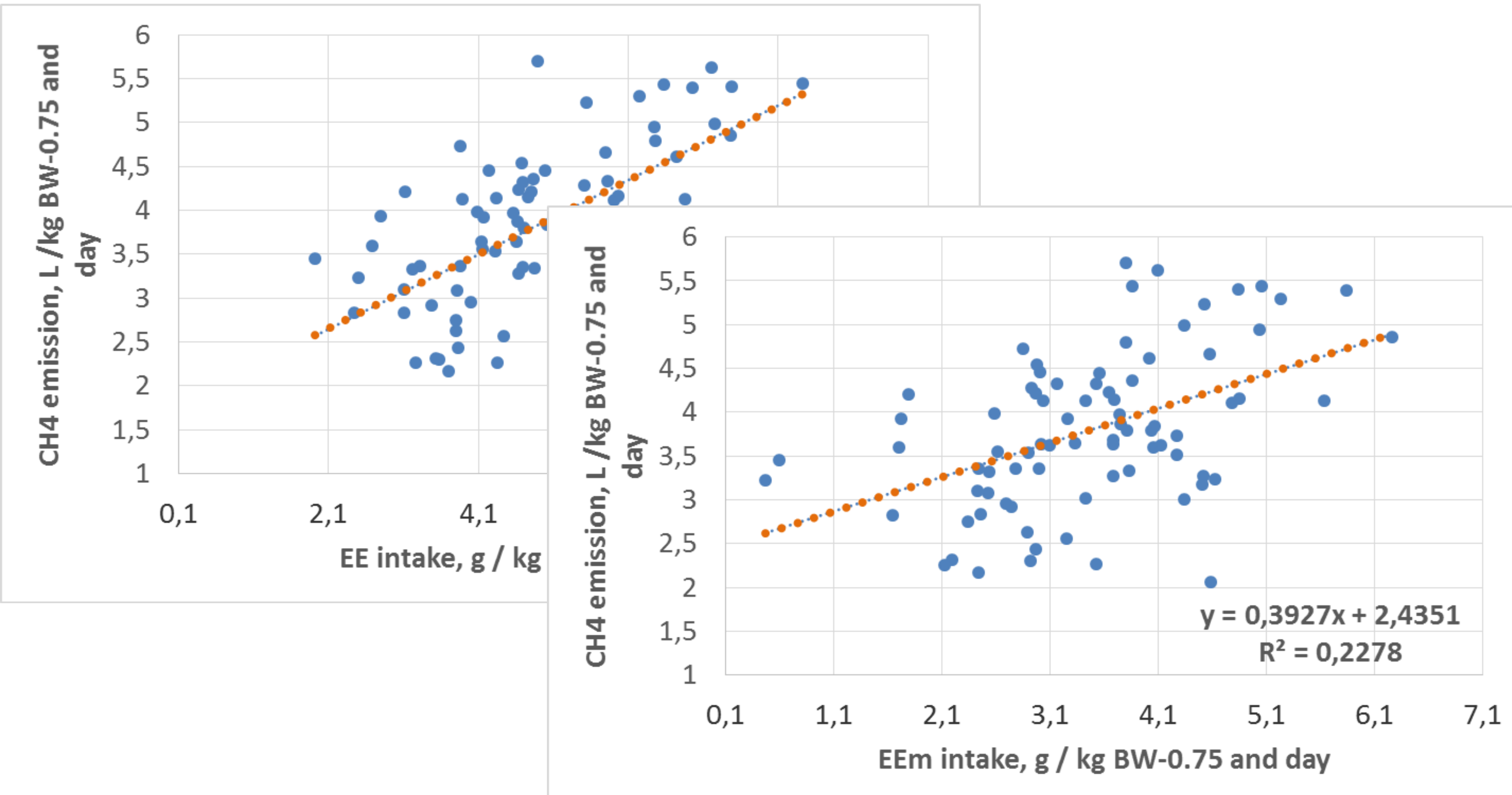

EEm = EE intake * (((EE intake-EE excretion faeces + urine)/EE intake)*100)

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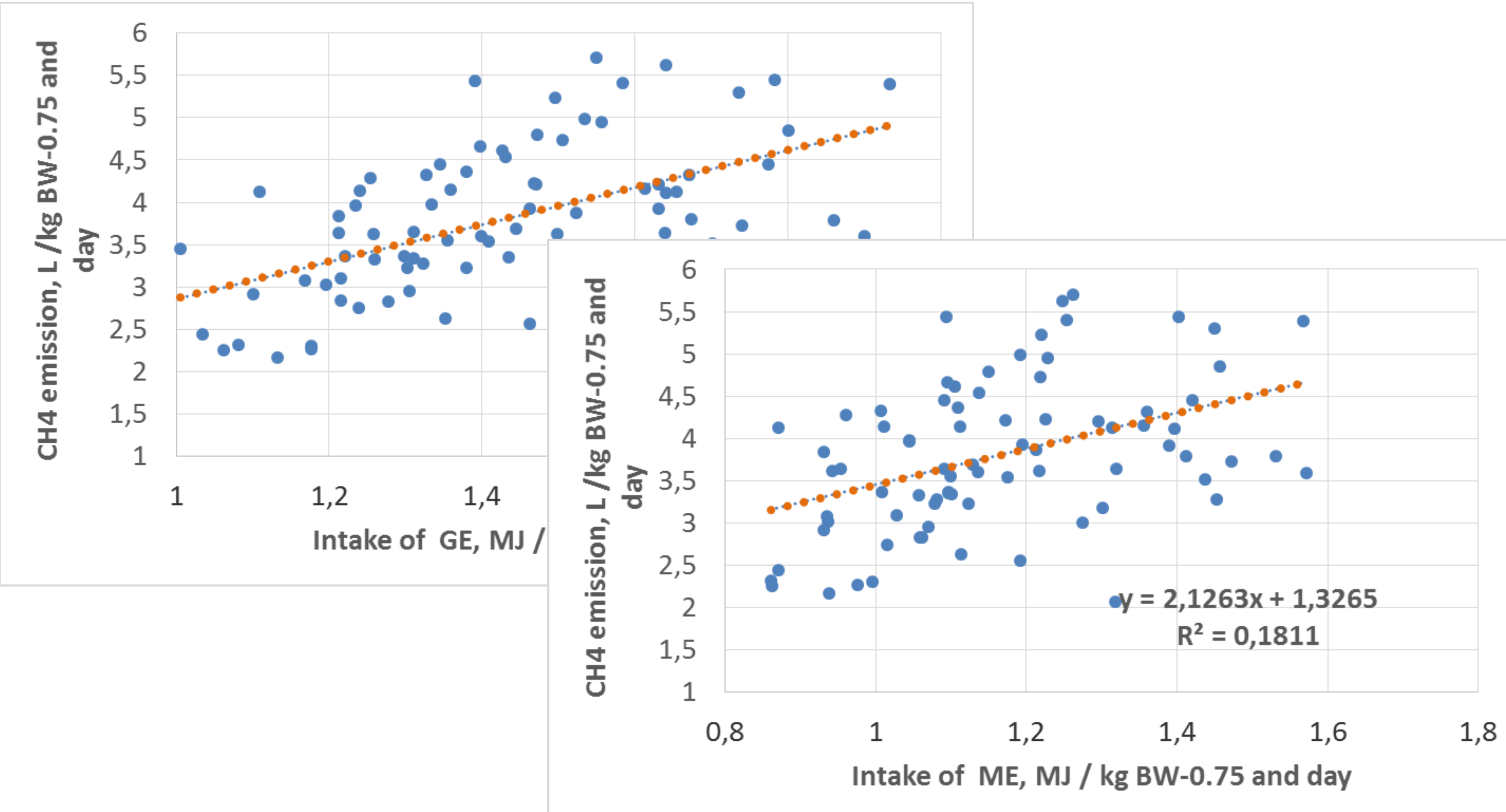
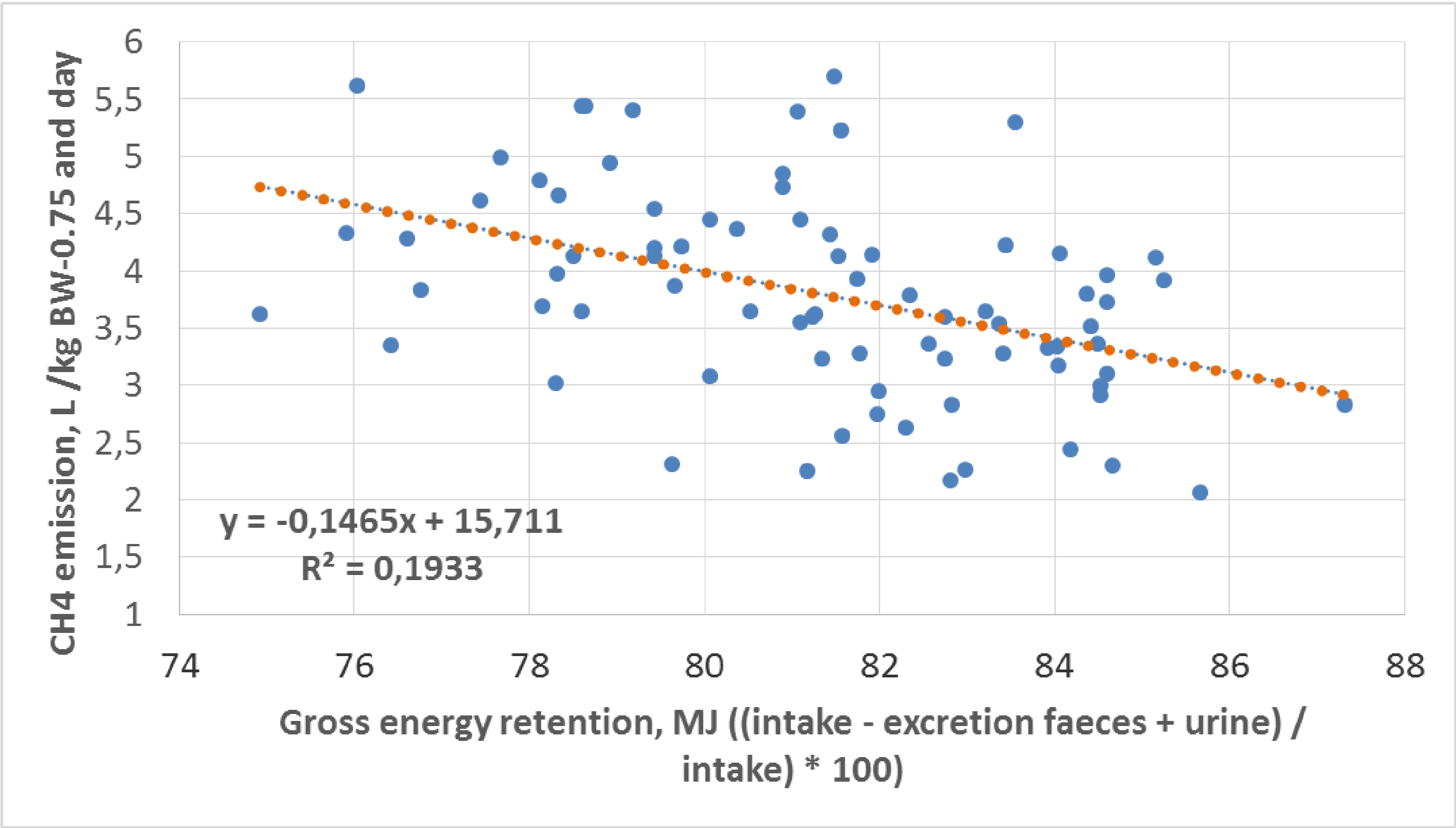


ME = GE intake * (((GE intake-GE excretion faeces + urine)/GE intake)*100)



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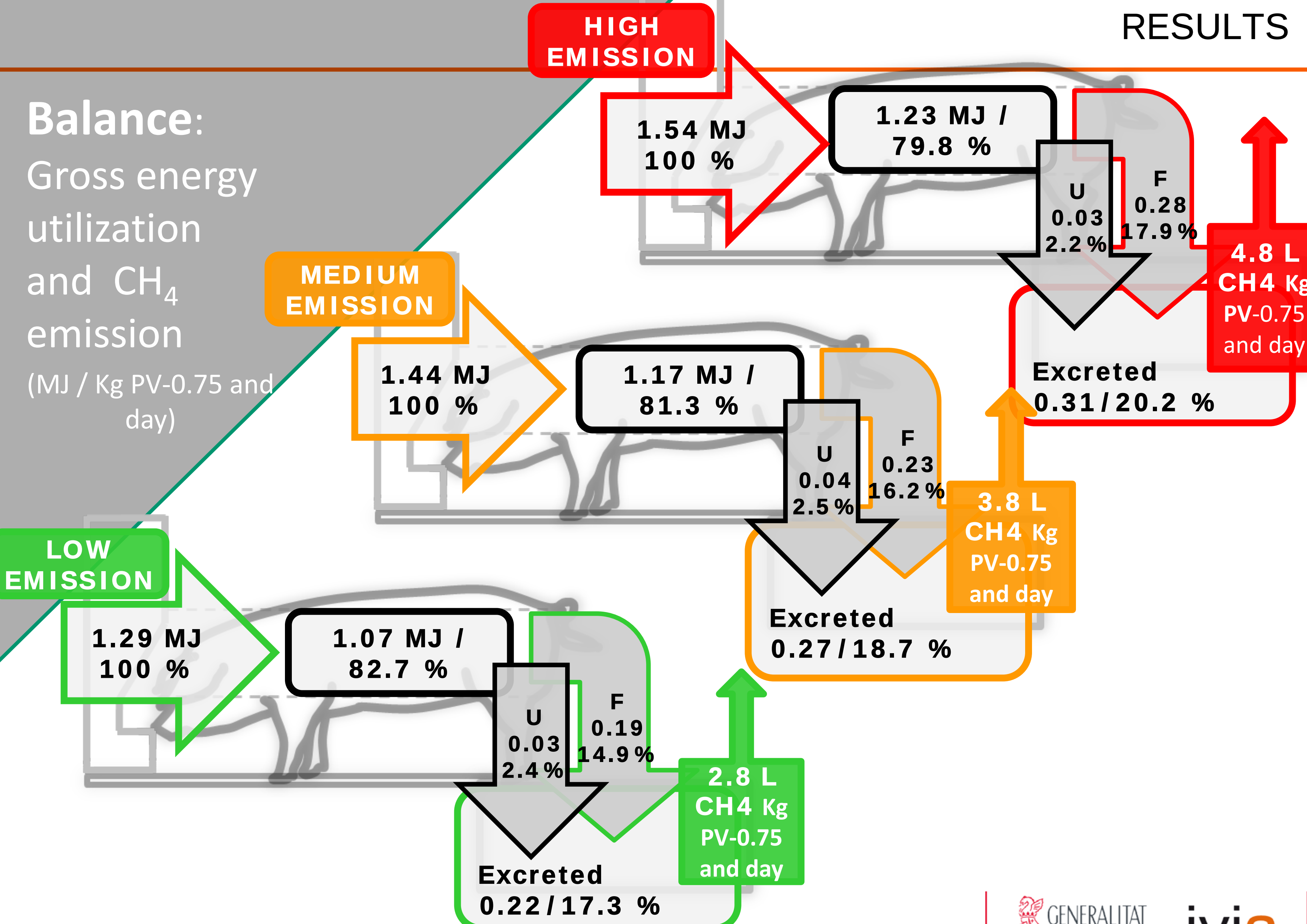
3. **Energy balance** in animals producing low, medium and high CH4 emission from slurry.

Low CH_4 emission (lower 1/3; n:26)	Medium CH_4 emission (medium 1/3; n:28)	High CH_4 emission (high 1/3; n:26)

RESULTS

Balance:
Gross energy utilization and CH_4 emission

(MJ / Kg PV-0.75 and day)



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Therefore:

- **Organic matter** intake is positively related with potential CH_4 emission from slurry
- Once at slurry, **GE** and, particularly, **EE** and **FND** excretion are the components that more influence CH_4 emission.
- Dietary factors affecting energy digestibility in pigs seem to be key factors to control CH_4 emission from slurry.
- More data is needed to deeply understand the relation and interaction among nutrient intake and gas emission.

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