

Relationships between feed efficiency related traits and faecal composition of lactating Italian Holstein cows

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Background

Feed efficiency has been studied to establish goals for productive and economic traits in dairy cattle.

Diet digestibility is a key point to determine feed efficiency and faecal composition provides an estimation of diet digestibility.

Near-infrared spectroscopy allows to collect phenotypes at population level in a relatively short time without using chemical reagents.

OBJECTIVE

To investigate relationships between feed efficiency related traits and faecal composition predicted using near-infrared spectroscopy in Italian Holsteins

CONCLUSIONS

Faecal composition is associated with feed efficiency related traits: NDF, ADF and CP are associated with MY, starch with ECM, and uNDF (%NDF) with BW. Despite not significant, uNDF (%NDF) is associated to Gross Feed Efficiency (GFE), and EE to DMI

Materials and Methods

Trial was conducted in an experimental farm from June to July 2018.

- 30 lactating Italian Holstein cows
- Faecal samples collected once a week
- Daily DMI (Dry Matter Intake) recorded with RICsystem
- Milk Yield (MY) recorded once a month
- Body Weight (BW) recorded once a week

Near-infrared spectroscopy analyses

- Average of 8 sub-spectra. Prediction values obtained as reported by Carlino et al. (ASPA congress, 2019, It. J. An.Sci.)

Statistical analyses

Linear Mixed Effects Model (software :SAS v 9.4 -PROC MIXED) where:

- y = faecal trait (dry matter, starch, fibre fractions, ash, crude protein and ethereal extracts)

Fixed effects :

- Parity (2 classes: primiparous and multiparous)
- DIM (2 classes: 1, DIM ≤170 d; 2, DIM > 170 d)

Included every time

- DMI (3 classes : Low, Medium and High)
- MY (3 classes: Low, Medium and High)
- ECM (3 classes : Low, Medium and High)
- BW (3 classes : Low, Medium and High)
- GFE (ECM/DMI) (3 classes: Low, Medium and High)

Included one at a time

Random effects:

- Animal ID (repeated observations) and residual effect.

RESULTS

Table 1. Descriptive statistics of efficiency traits (Dry Matter Intake, Milk Yield, Energy Corrected Milk, Body Weight, Gross Feed Efficiency) and lactation traits (Parity and Days in Milk) (n=60)

	Mean	SD	CV (%)
Parity	1.58	0.67	42.81
DIM (d)	176.78	60.66	34.32
DMI (kg/d)	20.27	3.81	18.78
MY (kg/d)	26.38	5.87	22.26
ECM (Kg/d)	27.34	7.08	25.90
BW (kg)	597.88	65.98	11.03
GFE	1.37	0.38	27.69

Table 2. Descriptive statistics of dry matter (DM), starch, fibre fractions, ash, crude protein (CP) and ethereal extracts (EE) in faecal samples (n=60).

Faecal traits	Mean	SD	CV (%)
DM (%)	88.78	0.96	1.09
Starch (% DM)	0.99	0.55	55.53
NDF (% DM)	59.80	4.12	6.89
uNDF (% DM)	46.42	3.25	6.99
uNDF (%NDF)	76.35	5.01	6.57
ADF (% DM)	33.70	3.09	9.18
ADL (% DM)	4.00	0.80	19.91
Ash (% DM)	11.93	0.80	6.70
CP (% DM)	12.38	2.25	18.19
EE (% DM)	1.25	0.14	11.45

Table 3. Least square means for DM, starch, fibre fractions, ash, crude protein (CP) and ethereal extracts (EE)

Traits ¹	DMI			MY			ECM			BW			GFE		
	High	Low	Sign. ³	High	Low	Sign.	High	Low	Sign.	High	Low	Sign.	High	Low	Sign.
DM %	88.72	88.80	ns	88.55	89.07	ns	88.61	89.01	ns	88.56	89.04	ns	88.53	88.95	ns
Starch	1.09	0.92	ns	1.17	0.86	ns	1.33	0.86	**	0.98	0.86	ns	1.13	0.97	ns
NDF	59.65	61.74	ns	57.93	61.34	*	58.15	60.53	ns	0.93	1.15	ns	59.43	60.13	ns
uNDF	46.10	47.26	ns	46.27	46.94	ns	46.70	46.92	ns	47.72	45.69	ns	47.27	46.32	ns
uNDF ²	76.64	75.84	ns	77.68	76.26	ns	78.56	75.29	ns	78.86	73.81	*	79.29	75.32	†
ADF	33.60	35.21	ns	32.28	34.97	*	32.37	34.31	ns	33.68	33.70	ns	33.19	34.02	ns
ADL	3.97	4.29	ns	4.02	4.16	ns	4.14	3.93	ns	4.09	3.79	ns	4.37	3.99	ns
Ash	11.99	11.75	ns	11.89	11.83	ns	12.10	11.89	ns	11.97	11.75	ns	12.11	11.80	ns
CP	12.38	11.20	ns	13.33	11.50	*	13.23	12.07	ns	12.22	12.72	ns	12.53	12.23	ns
EE	1.28	1.18	†	1.30	1.24	ns	1.27	1.25	ns	1.21	1.26	ns	1.24	1.23	ns

¹ (% DM); ² (%NDF); ³ significance: (ns) P-value ≥ 0.10; (†) P-value < 0.10; (*) P-value < 0.05; (**) P-value < 0.01 after Bonferroni correction.