Predictive modelling of dry matter intake in lactating dairy cows based on routinely available variables

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Introduction

Equations predicting dry matter intake (DMI) are mainly statistical regressions dependent on data quality used in their development. Dairy cows highly increased their production performance over the last decades. Hence, a need to update the DMI equations in use is pivotal to ensure the best economical and nutritional management of dairy herds.

Dataset and Statistical Analysis

RStudio v4.1.2

Data collection → Variable selection → Stepwise modelling → Model cross-validation

6202 weekly averaged daily observations in **413** lactations from **273** Holstein cows.

Correlation analysis with **ggpairs**: ggplot2 (**v3.5.1**) generalized pairs plot

Linear Mixed-Effects Models with **lme**: nlme (**v3.1-155**)

Root mean squared prediction error (RMSPE) analysis with **goodness.of.fit**: ZeBook (**v1.1**), concordance correlation coefficients analysis with **epi.ccc**: epiR (**v2.0.75**).

Results

Correlation analysis revealed that the most correlated variables to DMI during lactation are: parity, week of lactation (WOL), days in gestation, metabolic body weight, energy corrected milk (ECM), net energy for lactation, and dietary neutral detergent fiber (NDF) content. A total of seven models were built and evaluated; the best performing model is the following:

$$DMI_{(kg/d)} = 16.86 - (0.18 \times parity) + (0.24 \times ECM(kg/d)) - (0.02 \times NDF_{(g/kg\ DM)})) + (0.29 \times WOL) - (0.005 \times WOL^2)$$

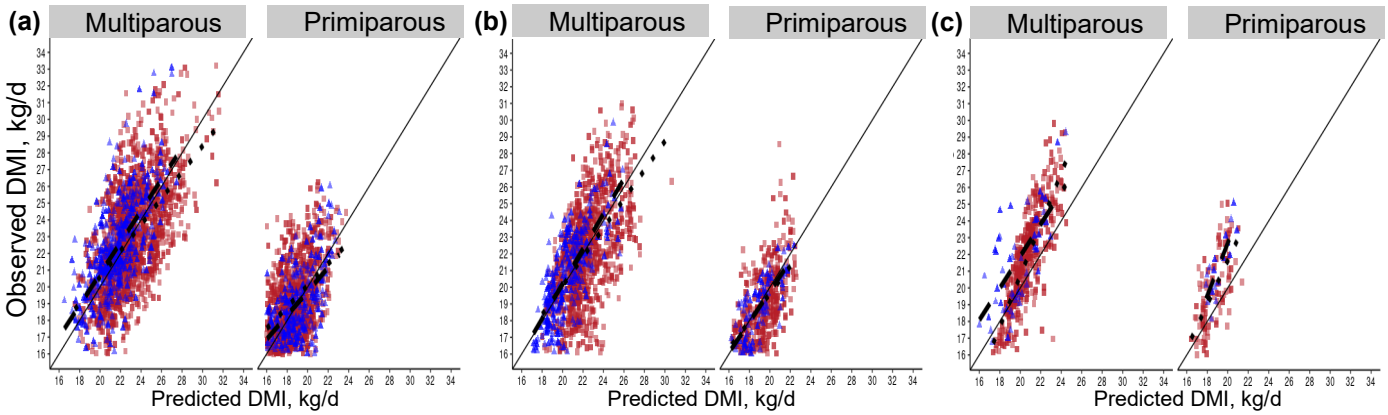

Figure 1. Observed weekly total DMI of lactating primiparous and multiparous Holstein-Friesian and Red Holstein dairy cows in **(a)** early (0–14 WOL), **(b)** mid (15-28 WOL) and **(c)** late (29-44 WOL) lactation versus that predicted by Agroscope (1994) (red squares, dotted line) and the proposed model (blue triangles, solid line).

Parameter	Mean DMI (kg/d)		SD	RMSPE		CCC
	Obs.	Pred.		kg/d	%	
Performance	20.2	20.3	3.40	1.45	7.16	0.874

Conclusions

The proposed model reported acceptable precision with high accuracy and fitness of prediction. Moreover, it has low systematic error in early and mid lactation, whereas it needs improvements in late lactation for both primiparous and multiparous cows.

References Agroscope. (1994). Apports alimentaires recommandés pour les ruminants (Livre vert), Ed. Agroscope, Posieux, Switzerland: chapter 7. https://ira.agroscope.ch/fr-CH/publication/46907

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