**Predicting feed intake and feed efficiency in lactating dairy cows using digesta marker techniques**

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**Supplementary Figure S1** Relationship between estimated (using Cr-mordanted fibre) and observed faecal DM output (kg/d) in dairy cows with mixed model regression analysis (a), and between centred estimated values and residuals (observed–estimated) faecal DM output (kg/d), (b), n=104. R2 and root mean square prediction error (RMSPE) are adjusted for random experiment effect. Estimated values were centred by subtracting the mean of all estimated values from each estimated value

a

b

**Supplementary Figure S2** Relationship between estimated (using Ytterbium) and observed faecal DM output (kg/d) in dairy cows with mixed model regression analysis (a), and between centred estimated values and residuals (observed–estimated) faecal DM output (kg/d), (b), n=353. R2 and root mean square prediction error (RMSPE) are adjusted for random experiment effect. Estimated values were centred by subtracting the mean of all estimated values from each estimated value

a

b

**Supplementary Figure S3** Relationship between estimated [using Co-Ethylenediaminetetraacetic acid (Co-EDTA)] and observed faecal DM output (kg/d) in dairy cows with mixed model regression analysis (a), and between centred estimated values and residuals (observed–estimated) faecal DM output (kg/d), (b), n=155. R2 and root mean square prediction error (RMSPE) are adjusted for random experiment effect. Estimated values were centred by subtracting the mean of all estimated values from each estimated value

a

b

**Supplementary Figure S4** Relationship between estimated [using Cr -ethylenediaminetetraacetic acid (Cr-EDTA)] and observed faecal DM output (kg/d) in dairy cows with mixed model regression analysis (a), and between centred estimated values and residuals (observed–estimated) faecal DM output (kg/d), (b), n=191. R2 and root mean square prediction error (RMSPE) are adjusted for random experiment effect. Estimated values were centred by subtracting the mean of all estimated values from each estimated value

a

b

**Supplementary Figure S5**Relationship between estimated [using indigestible neutral detergent fibre (iNDF)] and observed apparent total tract DM digestibility (g/kg DM) in dairy cows with mixed model regression analysis (a), and between centred estimated values and residuals (observed–estimated) apparent total tract DM digestibility (g/kg DM), (b), *n*=319. R2 and root mean square prediction error (RMSPE) are adjusted for random experiment effect. Estimated values were centred by subtracting the mean of all estimated values from each estimated value

a

b

**Supplementary Figure S6**Relationship between estimated [using acid insoluble ash (AIA)] and observed apparent total tract DM digestibility (g/kg DM) in dairy cows with mixed model regression analysis (a), and between centred estimated values and residuals (observed–estimated) apparent total tract DM digestibility (g/kg DM), (b), *n*=27. R2 and root mean square prediction error (RMSPE) are adjusted for random experiment effect. Estimated values were centred by subtracting the mean of all estimated values from each estimated value

a

b

**Supplementary Table S1**. List of studies, number of treatments (TRT) and markers from which individual cow data were used for the metanalysis

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Country | EXP | Author and year of publication | Forage | TRT | Cow(Period) observations | External markers | Internal Markers |
| Finland | 1 | Unpublished | Grass silage | 3 | 9 | Cr-mordanted fibre, Co-EDTA | iNDF, AIA |
| Finland | 2 | Ahvenjärvi *et al*., 2006. | Grass silage | 4 | 15 | Yb, Cr-mordanted fibre, Co-EDTA | iNDF |
| Finland | 3 | Shingfield *et al*., 2003 | Grass silage | 4 | 16 | Yb, Cr-mordanted fibre, Co-EDTA | iNDF |
| Finland | 4 | Shingfield *et al*., 2008 | Grass silage | 4 | 16 | Yb, Cr-mordanted fibre, Co-EDTA | iNDF |
| Finland | 5 | Shingfield *et al*., 2006 | Grass silage | 4 | 15 | Yb, Cr-mordanted fibre, Co-EDTA | iNDF |
| Finland | 6 | Choi *et al*., 2003 | Grass silage | 4 | 16 | Yb, Cr-mordanted fibre, Co-EDTA | iNDF |
| Finland | 7 | Kuoppala *et al*., 2010 | Grass silage | 4 | 16 | Yb, Cr-mordanted fibre, Co-EDTA | iNDF |
| Finland | 8 | Unpublished | Ensiled field pea | 4 | 16 | Yb, Co-EDTA | iNDF |
| Finland | 9 | Kuoppala *et al*., 2009 | Grass silage, red clover silage | 5 | 27 | Yb, Cr-EDTA | iNDF |
| Finland | 10 | Kairenius et al., 2018 | Grass silage | 4 | 16 | Yb, Co-EDTA | iNDF |
| Finland | 11 | Unpublished | Grass silage | 4 | 15 | Yb, Cr-EDTA | iNDF |
| Finland | 12 | Rinne et al., 2015. | Grass silage, red clover silage | 5 | 20 | Yb, Co-EDTA | iNDF |
| Finland | 13 | Unpublished | Grass silage | 4 | 16 | Yb, Cr-EDTA | iNDF |
| Finland | 14 | Halmemies-Beauchet-Filleau *et al*., 2013 | Grass silage, hay | 2 | 10 | Yb, Co-EDTA | iNDF |
| Finland | 15 | Halmemies-Beauchet-Filleau *et al*., 2014 | Grass silage, fresh grass, hay, | 3 | 15 | Yb, Cr-EDTA | iNDF |
| Finland | 16 | Unpublished | Grass silage | 4 | 16 | Yb, Co-EDTA | iNDF |
| Finland | 17 | Halmemies-Beauchet-Filleau *et al*., 2013; 2014 | Grass silage, red clover silage | 4 | 16 | Yb, Cr-EDTA | iNDF |
| Finland | 18 | Sairanen *et al*., 2005 | Fresh grass | 3 | 18 | Yb, Co-EDTA | iNDF, AIA |
| Norway | 19 | Prestløkken and Harstad 2001 | Grass silage | 3 | 9 | Yb, Co-EDTA | - |
| Norway | 20 | Unpublished | Grass silage | 2 | 8 | Yb, Co-EDTA | - |
| Norway | 21 | Prestløkken *et a*l., 2011 | Grass silage | 3 | 18 | Yb, Co-EDTA | - |
| Norway | 22 | Unpublished | Grass silage | 4 | 16 | Yb, Co-EDTA | iNDF |
| Norway | 23 | Unpublished | Grass silage | 3 | 9 | Yb, Cr-EDTA | iNDF |
| Norway | 24 | Unpublished | Grass silage | 2 | 8 | Yb, Cr-EDTA | iNDF |
| Denmark | 25 | Lund *et al*., 2006; 2007a; 2007b | Hay, pea silage, lucerne silage | 4 | 16 | Cr-mordanted fibre | iNDF |
| Denmark | 26 | Lund *et al*., 2006; 2007a; 2007b | Grass silage, grass-clover silage, whole crop barley silage, maize silage, pea silage, grass hay, lucerne hay | 4 | 15 | Cr-mordanted fibre | iNDF |
| Denmark | 27 | Lund *et al*., 2004 | Grass- clover silage | 4 | 16 | Cr-mordanted fibre, Yb | - |
| Denmark | 28 | Tothi *et al*., 2004 | Grass silage, red clover silage | 4 | 19 | Cr-mordanted fibre, PEG | - |
| Denmark | 29 | Brask *et al* ., 2013 | Maize silage, grass silage | 6 | 24 | PEG | iNDF |

AIA = acid insoluble ash

EDTA =Ethylenediaminetetraacetic acid

iNDF = indigestible neutral detergent fibre

PEG = Polyethylene glycol

**Supplementary Material S1**. *The list of references used for the meta-analysis*

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