# An evaluation of the accuracy and precision of methane prediction equations for beef cattle fed high-forage and high-grain diets

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**Supplementary Table S1.** Summary of studies included in the complete database.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Author(s) | Animal category | Breed | CH4 measurement method | CH41 (g/d) | Treatment description  |
| Beauchemin and McGinn (2005) | Steers | Angus | Chambers | 62.1 | Barley and corn grain in different proportions |
| Beauchemin and McGinn (2006a) | Heifers | Angus | Chambers | 141.5 | Forage and grain in different proportions and unrestricted and restricted intake levels |
| Beauchemin and McGinn (2006b) | Steers | Angus | Chambers | 108.0 | Lipids, fumaric acid, spice extract, high proportion of forage and high proportion of grain under restricted feeding |
| Beauchemin *et al.* (2007a) | Steers | Angus | Chambers | 119.6 | Different sources of lipids |
| Beauchemin *et al*. (2007b) | Steers / heifers | Angus | Chambers | 98.7 | Different concentration of Quebracho tannins |
| Boadi and Wittenberg (2002) | Heifers | Holstein and Charolais × Simmental | SF6 | 127.6 | Different qualities of diets assessed as IVOMD |
| Boadi *et al*. (2001) | Steers | Red Angus | SF6 | 169.1 | Different proportions of alfalfa, bromegrass pastures with barley |
| Boadi *et al.* (2004) | Steers | Continental × British crossbred | SF6 | 59.4 | Different proportions of forage and grain |
| Boland *et al*. (2013) | Heifers | Limousin | SF6 | 127.0 | Availability of herbage mass |
| Chaves *et al.* (2006) | Heifers | Angus | SF6 | 150.9 | Grazing different types of alfalfa or grass pasture |
| Chung *et al.* (2013) | Heifers | Crossbred | Chambers | 90.0 | Proportions of alfalfa and sainfoin at different stages of maturity |
| Chung *et al*. (2011) | Steers | Holstein | SF6 | 261.0 | Different yeast strains (*Sacharomyces cerevisiae*) |
| Chung *et al*. (2013) | Heifers | Crossbred | Chambers | 90.0 | Proportions of alfalfa and sainfoin at different stages of maturity |
| Cooprider *et al*. (2011) | Steers | Angus cross steers | Chambers | 281.8 | Conventional management (estrogen+monensin+others) vs management without antibiotics, estrogenic hormones and others |
| Doreau *et al*. (2011) | Bulls | Blond d'Aquitaine | SF6 | 62.3 | Different diets of corn grain, grass hay and corn silage |
| Dos Santos Pedreira *et al*. (2012) | Steers | 3/4 Holstein × Zebu | SF6 | 113.0 | Cultivars of sugarcane plus urea |
| Fiorentini *et al*. (2014) | Steers | Nellore | SF6 | 91.7 | Lipid sources with different fatty acid profiles  |
| Fitzsimons *et al*. (2013) | Heifers | Simmental | SF6 | 260.0 | Different residual feed intakes using 100 grass silage |
| Grainger *et al*. (2008) | Steers | Holstein | SF6 | 399.0 | Supplementation with whole cottonseed |
| Gutierrez *et al*. (2007) | Steers | Holstein | SF6 | 113.8 | Concentrations of nitroethane plus dry rolled corn |
| Hales *et al*. (2012) | Steers | Jersey | Chambers | 38.8 | Different corn processing methods plus inclusion of WDGS |
| Hales *et al*. (2013) | Steers | Jersey | Chambers | 46.1 | Increments of WDGS in steam flaked corn based diets |
| Hales *et al*. (2014a) | Steers | Cross | Portable head boxes | 93.3 | Levels of dietary roughage using dry rolled corn and WDGS diets |
| Hales *et al*. (2014b) | Steers | MARC 1 | Portable head boxes | 107.5 | Levels of glycerin on energy metabolism, nutrient balance and eCH4 |
| Hart *et al*. (2009) | Heifers | Charolais cross | SF6 | 138.0 | Levels of sward dry matter digestibility |
| Henry *et al*. (2015) | Heifers | Crossbreed | SF6 | 87.5 | Effects of chitosan on nutrient digestibility |
| Hegarty *et al*. (2007) | Steers | Angus | SF6 | 142.3 | Greater and lower residual feed intake |
| Hosoda *et al*. (2012) | Steers | Holstein | Chambers | 99.9 | Levels of soy sauce cake |
| Hulshof *et al*. (2012) | Steers | Nellore × Guzera | SF6 | 85.0 | Effects of nitrate supplementation of sugarcane based diets |
| Hunerberg *et al*. (2013a,b) | Heifers | Crossbred | Chambers | 119.0 | Effects of DDGS using finishing and growing beef cattle diets |
| Jiao *et al*. (2013) | Heifers | Holstein | Chambers | 96.4 | Efficiency of energy using UK diets  |
| Jones *et al*. (2011) | Steers | Angus | FTIR | 125.1 | High and low residual feed intake with low and high quality of pasture |
| Jordan *et al*. (2006a) | Steers | Charolais - Limousin cross | SF6 | 55.4 | Effects of refined soy oil and whole soybeans |
| Jordan *et al*. (2006b) | Heifers | Charolais - Limousin cross | SF6 | 55.4 | Effects of refined coconut oil or copra meal |
| Lee *et al*. (2015) | Heifers | Crossbred | Chambers | 183.0 | Effect of source of nitrate |
| Li *et al*. (2012) | Steers | Holstein | Chambers | 82.4 | Sources of saponins |
| Lila *et al*. (2005) | Steers | Holstein | Chambers | 77.0 | Effects of sarsaponin on ruminal fermentation |
| Lovett *et al*. (2003) | Heifers | Charolais cross | SF6 | 112.2 | Different ratios of forage and grain with or without coconut oil |
| Mc Geough *et al*. (2010a) | Steers | Continental crossbred | SF6 | 180.0 | Different ratios of wheat grain and straw/chaff |
| Mc Geough *et al*. (2010 b) | Steers | Crossbred | SF6 | 228.0 | Stages of silage corn maturity |
| McGinn et al. (2004) | Steers | Holstein | Chambers | 129.0 | Monensin, sunflower oil, enzymes, yeast and fumaric acid |
| McGinn *et al*. (2009) | Steers | Hereford | SF6 | 177.0 | Effects of DDGS |
| Molano *et al*. (2006) | Steers | Hereford × friesian | SF6 | 89.1 | Effects of New Zealand hill pasture in different seasons |
| Newbold *et al*. (2014) | Steers | Holstein | Chambers | 86.8 | Effects of dietary nitrate levels |
| Pinares-Patiño *et al*. (2003) | Steers | Charolais | SF6 | 204.4 | Physiological stages of Timothy grass |
| Romero-Pérez *et al*. (2014) | Heifers | Angus | Chambers | 203. | Use of 3-nitrooxypropanol  |
| Romero-Pérez *et al*. (2015) | Heifers | Angus | Chambers | 157.9 | Long term use of 3-nitrooxypropanol |
| Stackhouse *et al*. (2011) | Steers | Angus | Chambers | 68.4 | Emissions from Holstein Angus-cross feedlot steers during representative growth stages |
| Stackhouse *et al*. (2013) | Steers | Angus | Chambers | 239.0 | Effects of growth promoting technologies on animal performance and emission rates |
| Staerfl *et al*. (2012) | Steers | Brown Swiss × Limousin | Chambers | 37.4 | Long term evaluation of feeding acacia tannin, garlic, maca and lupine to bulls fattened on grass or corn silage |
| Troy *et al*. (2015) | Steers | Charolais and Luing | Chambers | 194.3 | Effects of nitrate addition and oil |
| Vyas *et al*. (2014a) | Heifers | Crossbred | Chambers | 177.5 | *Propionibacterium* strains using high forage diets |
| Vyas *et al*. (2014b) | Heifers | Crossbred | Chambers | 138.5 | *Propionibacterium* strains using corn grain based diets |
| Vyas *et al*. (2015) | Heifers | Crossbred | Chambers | 187.8 | Effects on vivo of *Propionibacterium* strains  |
| Vyas *et al*. (unpublished) | Steers | Crossbred | Chambers | 125.9 | Use of 3-nitrooxypropanol for backgrounding and finishing cattle |

1Average for each study.

DDGS, dried distillers grains plus solubles; FTIR, Fourier transform infrared spectroscopy; IVOMD, in vitro organic matter digestibility; SF6, sulfur hexafluoride tracer gas technique; WDGS, wet distillers grains with solubles.

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|  **Supplementary Table S2.** Methane prediction (MJ/d) equations for beef cattle used in the study

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| --- | --- | --- |
| N | Original source and equation | Equation |
| 1 | IPCC (2006), Tier 2 | CH4 = | (DMI × 18.5 (MJ/kg DM) × Y*m* ) /55.65 (MJ/kg CH4) |
| 2 | Ellis *et al*. (2007), 1b | CH4 = | 4.38 + 0.0586 × MEI |
| 3 | Ellis *et al*. (2007), 2b | CH4 = | 3.96 + 0.561 × DMI |
| 4 | Ellis *et al*. (2007), 3b | CH4 = | 4.79 + 0.0492 × forage ( ) |
| 5 | Ellis *et al*. (2007), 4b | CH4 = | 5.263 + 6.93 × lignin |
| 6 | Ellis *et al*. (2007), 5b | CH4 = | 5.58 + 0.848 × NDF |
| 7 | Ellis *et al*. (2007), 6b | CH4 = | 5.70 + 1.41 × ADF |
| 8 | Ellis *et al*. (2007), 7b | CH4 = | 3.05 + 0.0371 × MEI + 0.801 × NDF |
| 9 | Ellis *et al*. (2007), 8b | CH4 = | 3.31 + 0.0382 × MEI + 1.05 × ADF |
| 10 | Ellis *et al*. (2007), 9b | CH4 = | 0.357 + 0.0591 × MEI + 0.0500 × forage ( ) |
| 11 | Ellis *et al*. (2007), 10b | CH4 = |  -1.02 + 0.681 × DMI + 0.0481 × forage ( ) |
| 12 | Ellis *et al*. (2007), 11b | CH4 = | 2.30 + 1.12 × DMI - 6.26 × lignin |
| 13 | Ellis *et al*. (2007), 12b | CH4 = | 2.7 + 1.16 × DMI - 15.8 × EE |
| 14 | Ellis *et al*. (2007), 13b | CH4 = | 0.183 + 0.0433 × MEI + 0.647 × NDF + 0.0372 × forage ( ) |
| 15 | Ellis *et al*. (2007), 14b | CH4 = | 2.94 + 0.0585 × MEI + 1.44 × ADF - 4.16 × lignin |
| 16 | Ellis *et al*. (2009), A | CH4 = | 2.29 + 0.670 × DMI |
| 17 | Ellis *et al*. (2009), B | CH4 = | 3.05 + 3.71 × CEL |
| 18 | Ellis *et al*. (2009), C | CH4 = | 4.72 + 1.13 × starch |
| 19 | Ellis *et al*. (2009), D | CH4 = | 6.01 + 0.345 × NFC |
| 20 | Ellis *et al*. (2009), E | CH4 = | 3.46 + 5.06 × sugar |
| 21 | Ellis *et al*. (2009), F | CH4 = | 3.32 - 1.23 × starch + 9.48 × sugar  |
| 22 | Ellis *et al*. (2009), G | CH4 = |  -1.01 + 2.76 × NDF + 0.722 × starch |
| 23 | Ellis *et al*. (2009), H | CH4 = | 2.26 + 5.02 × sugar + 0.0236 × forage ( ) |
| 24 | Ellis *et al*. (2009), I | CH4 = | 2.72 + 0.0937 × MEI + 4.31 × CEL - 6.49 × HC - 7.44 × fat  |
| 25 | Ellis *et al*. (2009), J | CH4 = | 0.310 + 2.88 × CEL + 4.15 × CP - 3.97 × fat |
| 26 | Ellis *et al*. (2009), K | CH4 = | 0.561 + 5.86 × CEL + 0.526 × NFC  |
| 27 | Ellis *et al*. (2009), L | CH4 = | 2.61 + 0.0687 × MEI + 5.99 × sugar - 2.15 × starch |
| 28 | Ellis *et al*. (2009), M | CH4 = | 2.79 - 1.04 × (NFC:NDF) + 0.798 × DMI |
| 29 | Ellis *et al*. (2009), N | CH4 = | 2.68 - 1.14 × (starch:NDF) + 0.786 × DMI  |
| 30 | Ellis *et al*. (2009), O | CH4 = | 2.58 - 0.339 × (NFC:ADF) + 0.774 × DMI  |
| 31 | Ellis *et al*. (2009), P | CH4 = | 2.50 - 0.367 × (starch:ADF) + 0.766 × DMI  |
| 32 | Ellis *et al*. (2009), Q | CH4 = | 7.09 × {1 - exp[-18.9 × fat]} |
| 33 | Ellis *et al*. (2009), R | CH4 = | 8.53 × {1 - exp[-0.637 × NDF]} |
| 34 | Ellis *et al*. (2009), S | CH4 = | 8.76 × {1 - exp[-1.86 × HC]} |
| 35 | Ellis *et al*. (2009), T | CH4 = | 8.51 × {1 - exp[-5.50 × lignin]} |
| 36 | Ellis *et al*. (2009), U | CH4 = | 8.23 × {1 - exp[-1.68 × ADF]} |
| 37 | Ellis *et al*. (2009), V | CH4 = | 8.48 × {1 - exp[-0.0230 × MEI]} |
| 38 | Ellis *et al*. (2009), W | CH4 = | 10.8 × {1 - exp[-0.141 × DMI]} |
| 39 | Ellis *et al*. (2009), W1 | CH4 = | 10.8 × (1 - exp{-[-0.0127 × ( NFC: ADF ) + 0.220 ] × DMI}) |
| 40 | Ellis *et al*. (2009), W2 | CH4 = | 10.8 × (1 - exp{-[-0.0138 × ( starch:ADF ) + 0.211 ] × DMI}) |
| 41 | Ellis *et al*. (2009), W3 | CH4 = | 10.8 × (1 - exp{-[-0.034 × ( NFC: NDF ) + 0.228 ] × DMI }) |
| 42 | Yan *et al*. (2009), iib | CH4= | [[32.4 – 305.8 ME/GE + 199.1 DE/GE + 4.4 ME] DMI – 14.9] × 0.66] × 0.0556 |
| 43 | Yan *et al*. (2009), iiib | CH4= | [[1.749 – 12.18 ME/GE + 10.74 DE/GE] GEI – 14.0] × 0.66] × 0.0556 |
| 44 | Ricci *et al*. (2013), GEI | CH4 = | 74.34 + 0.57 × GEI - 10.61 × feed - 69.67 × stage - 0.22 × GEI × feed + 0.57 × GEI × stage |
| 45 | Ricci *et al*. (2013), DMI | CH4 = | 9.87 + 9.95 × DMI - 15.15 × feed - 74.48 × stage - 3.67 × DMI × feed + 10.90 × DMI × stage |
| 46 | Moraes *et al*. (2014), H-GEL | CH4 = | 1.289 + 0.051 × GEI |
| 47 | Moraes *et al*. (2014), H-DL | CH4 = | -0.163 + 0.051 × GEI + 0.038 × NDF ( ) |
| 48 | Moraes *et al*. (2014), H-AL | CH4 = | -1.487 + 0.046 × GEI + 0.032 × NDF ( ) + 0.006 × BW |
| 49 | Moraes *et al*. (2014), S-GEL | CH4 = | 0.743 + 0.054 × GEI  |
| 50 | Moraes *et al*. (2014), S-DL | CH4 = | 0.743 + 0.054 × GEI  |
| 51 | Moraes *et al*. (2014), S-AL | CH4 = | -0.221 + 0.048 × GEI + 0.005 × BW |

ADF, acid detergent fiber (kg/d); AL, animal level; BW, body weight (kg); CEL, cellulose (kg/d); CP, crude protein (kg/d); DE, digestible energy (MJ/kg DM); DL, dietary level; DMI, dry matter intake (kg/d); GE, gross energy (MJ/kg DM); GEI, gross energy intake (MJ/d); GEL, gross energy level; H, heifers; HC, hemicellulose (kg/d); ME, metabolizable energy (MJ/kg DM); MEI, metabolizable energy intake (MJ/d); NDF, neutral detergent fiber (kg/d); NFC, non-fiber carbohydrate (kg/d); NSC, non-structural carbohydrates (kg/d); S, steers; stage, physiological stage (nonlactating or lactating); Y*m*, Methane conversion factor (6.5 for diets greater than 90 g forage/kg DM, 3 for diets equal to or less than 90 g forage/kgDM). |

**Supplementary Table S3.** Methane prediction (MJ/d) equations for beef cattle ordered according combined index for high forage dataset.

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Equation  | R2 adjusted | r*c* | C*b* | RMSPE (g/d) | ECT % | ER % | ED % | MEF | CD | CI | Ranking |
| IPCC 2006 | 0.577 | 0.715 | 0.95 | 39.81 | 1.23  | 0.03  | 98.74  | 0.56 | 1.81  | 24 | 1 |
| Moraes *et al*. (2014) S-AL | 0.632 | 0.725 | 0.90 | 42.85 | 8.90  | 3.93  | 87.17  | 0.59 | 2.17  | 39 | 2 |
| Moraes *et al.* (2014) S-SIM AL | 0.572 | 0.646 | 0.87 | 45.87 | 1.77  | 3.14  | 94.54  | 0.52 | 2.53  | 44 | 3 |
| Moraes *et al*. (2014) S-GEL | 0.425 | 0.678 | 0.86 | 45.76 | 12.80  | 5.44  | 81.76  | 0.53 | 2.45  | 53 | 4 |
| Ellis *et al.* (2009) - N  | 0.589 | 0.601 | 0.77 | 35.58 | 9.31  | 14.30  | 76.38  | 0.47 | 3.31  | 56 | 5 |
| Moraes *et al.* (2014) S-DL | 0.617 | 0.678 | 0.86 | 45.76 | 12.80  | 5.44  | 81.76  | 0.53 | 2.45  | 57 | 6 |
| Moraes *et al.* (2014) H-AL | 0.585 | 0.568 | 0.84 | 30.60 | 14.87  | 0.50  | 84.63  | 0.36 | 2.08  | 60 | 7 |
| Moraes *et al*. (2014) H-SIM DL | 0.522 | 0.643 | 0.84 | 29.30 | 27.79  | 0.91  | 71.30  | 0.41 | 1.56  | 61 | 8 |
| Moraes *et al.* (2014) S-SIM GEL | 0.597 | 0.600 | 0.84 | 48.70 | 3.59  | 3.72  | 92.16  | 0.46 | 2.87  | 63 | 9 |
| Yan *et al.* (2009) (iiib) | 0.554 | 0.816 | 0.91 | 37.31 | 46.64  | 1.61  | 52.10  | 0.61 | 0.89  | 63 | 10 |
| Ellis *et al*. (2007) - 14b  | 0.513 | 0.568 | 0.81 | 47.00 | 0.34  | 7.07  | 92.60  | 0.45 | 3.86  | 64 | 11 |
| Ellis *et al.* (2009) - P | 0.401 | 0.550 | 0.76 | 37.30 | 6.54  | 10.23  | 83.23  | 0.42 | 3.70  | 65 | 12 |
| Moraes *et al*. (2014) S-SIM DL | 0.521 | 0.600 | 0.84 | 48.70 | 3.59  | 3.72  | 92.16  | 0.46 | 2.87  | 67 | 13 |
| Ellis *et al.* (2009) - M  | 0.803 | 0.574 | 0.75 | 37.16 | 14.06  | 12.12  | 73.82  | 0.43 | 3.03  | 70 | 14 |
| Ellis *et al.* (2009) - G  | 0.391 | 0.558 | 0.90 | 40.35 | 7.58  | 0.52  | 91.90  | 0.32 | 1.95  | 72 | 15 |
| Ellis *et al.* (2009) - O  | 0.588 | 0.533 | 0.76 | 38.38 | 8.36  | 7.01  | 84.63  | 0.39 | 3.41  | 74 | 16 |
| Yan *et al.* (2009) (iib) | 0.522 | 0.783 | 0.90 | 41.72 | 45.84  | 4.44  | 50.06  | 0.51 | 0.80  | 81 | 17 |
| Moraes *et al.* (2014) H-SIM AL | 0.761 | 0.636 | 0.89 | 27.96 | 7.87  | 0.80  | 91.33  | -2.02 | 0.15  | 83 | 18 |
| Ellis *et al.* (2009) - B  | 0.472 | 0.453 | 0.82 | 41.98 | 4.52  | 0.01  | 95.47  | 0.27 | 3.04  | 87 | 19 |
| Ellis *et al.* (2007) - 11b  | 0.319 | 0.534 | 0.87 | 50.45 | 1.06  | 0.17  | 98.78  | 0.37 | 2.89  | 89 | 20 |
| Moraes *et al.* (2014) H-SIM GEL | 0.756 | 0.639 | 0.80 | 31.12 | 43.96  | 0.56  | 55.48  | 0.34 | 1.20  | 90 | 21 |
| Yan *et al.* (2009) SIM - (iiib) | 0.538 | 0.738 | 0.87 | 44.09 | 49.74  | 0.39  | 50.20  | 0.46 | 0.93  | 90 | 22 |
| Ellis *et al.* (2007) - 1b  | 0.643 | 0.523 | 0.71 | 47.61 | 0.05  | 19.00  | 80.96  | 0.44 | 5.85  | 94 | 23 |
| Ellis *et al.* (2007) - 9b  | 0.602 | 0.520 | 0.75 | 49.22 | 4.03  | 8.38  | 87.59  | 0.40 | 4.14  | 95 | 24 |
| Ellis *et al*. (2007) - 7b  | 0.406 | 0.553 | 0.70 | 47.22 | 7.48  | 22.67  | 69.85  | 0.45 | 4.39  | 97 | 25 |
| Ellis *et al*. (2009) - J  | 0.469 | 0.566 | 0.90 | 42.84 | 16.04  | 3.23  | 80.73  | 0.24 | 1.36  | 97 | 26 |
| Moraes *et al*. (2014) H -DL | 0.486 | 0.556 | 0.78 | 33.40 | 35.25  | 0.27  | 64.48  | 0.24 | 1.40  | 101 | 27 |
| Ellis *et al*. (2009) - W1 | 0.746 | 0.370 | 0.57 | 41.01 | 0.51  | 16.98  | 82.51  | 0.30 | 9.97  | 105 | 28 |
| Ellis *et al*. (2007) - 13b | 0.491 | 0.543 | 0.74 | 49.22 | 12.30  | 10.94  | 76.75  | 0.40 | 3.29  | 108 | 29 |
| Yan *et al*. (2009) SIM - (iib) | 0.563 | 0.716 | 0.85 | 46.75 | 53.12  | 0.73  | 46.47  | 0.39 | 0.86  | 109 | 30 |

AL, animal level; DL, dietary level; GE, gross energy (MJ/kg DM); GEI, gross energy intake (MJ/d); GEL, gross energy level; H, heifers; S, steers; SIM, calculated.

**Supplementary Table S4.** Methane prediction (MJ/d) equations for beef cattle ordered according combined index for high grain dataset.

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Equation | R2 adjusted | r*c* | C*b* | RMSPE(g/d) | ECT% | ER %  | ED% | MEF | CD | CI | Ranking |
| Ellis *et al*. (2009) - I  | 0.163 | 0.445 | 0.84 | 62.87 | 2.32  | 0.16  | 97.52  | 0.26 | 3.00  | 24 | 1 |
| Ricci *et al.* (2013) - GEI | 0.235 | 0.354 | 0.93 | 47.43 | 3.61  | 0.11  | 96.29  | 0.25 | 8.08  | 24 | 2 |
| Moraes *et al.* (2014) S-GEL | 0.294 | 0.406 | 0.71 | 56.35 | 6.02  | 2.67  | 91.31  | 0.27 | 1.68  | 26 | 3 |
| Moraes *et al*. (2014) S-DL | 0.294 | 0.406 | 0.71 | 56.35 | 6.02  | 2.67  | 91.31  | 0.27 | 1.68  | 30 | 4 |
| Moraes *et al.* (2014) S-AL | 0.204 | 0.376 | 0.66 | 57.41 | 7.78  | 3.99  | 88.23  | 0.24 | 5.18  | 37 | 5 |
| Moraes *et al*. (2014) S-SIM GEL | 0.625 | 0.521 | 0.67 | 53.88 | 3.41  | 27.83  | 72.52  | 0.44 | 2.20  | 37 | 6 |
| Ellis *et al*. (2009) - A  | 0.216 | 0.278 | 0.56 | 65.21 | 0.72  | 4.15  | 95.13  | 0.20 | 9.74  | 44 | 7 |
| Ellis *et al*. (2007) - 9b  | 0.253 | 0.341 | 0.61 | 64.92 | 9.84  | 4.07  | 86.10  | 0.20 | 4.56  | 47 | 8 |
| Moraes *et al*. (2014) S-SIM DL | 0.610 | 0.481 | 0.60 | 55.51 | 3.21  | 32.78  | 61.84  | 0.44 | 2.20  | 48 | 9 |
| Ellis *et al*. (2007) - 8b  | 0.185 | 0.253 | 0.51 | 65.08 | 0.59  | 5.95  | 93.46  | 0.19 | 12.34  | 49 | 10 |
| Ellis *et al.* (2007) - 7b  | 0.133 | 0.232 | 0.52 | 66.07 | 0.42  | 3.12  | 96.46  | 0.17 | 11.97  | 53 | 11 |
| Ellis *et al.* (2009) - C  | 0.251 | 0.351 | 0.67 | 66.46 | 11.26  | 1.28  | 87.46  | 0.17 | 3.67  | 54 | 12 |
| Ellis *et al*. (2007) - 2b  | 0.171 | 0.218 | 0.49 | 66.25 | 0.29  | 4.25  | 95.46  | 0.16 | 14.26  | 60 | 13 |
| Moraes *et al*. (2014) S-SIM AL | 0.583 | 0.429 | 0.55 | 58.15 | 11.64  | 31.03  | 59.23  | 0.35 | 7.16  | 60 | 14 |
| Ellis *et al*. (2007) - 14b | 0.178 | 0.325 | 0.63 | 67.12 | 13.22  | 1.71  | 85.08  | 0.14 | 3.68  | 62 | 15 |
| Ricci *et al*. (2013) - SIM GEI | 0.548 | 0.261 | 0.48 | 66.35 | 5.33  | 9.72  | 84.95  | 0.10 | 11.97  | 68 | 16 |
| Ricci *et al*. (2013) - DMI | 0.156 | 0.229 | 0.46 | 67.62 | 5.01  | 6.51  | 88.47  | 0.07 | 12.72  | 73 | 17 |
| Ellis *et al*. (2009) - W  | 0.262 | 0.203 | 0.38 | 68.11 | 5.37  | 12.52  | 82.11  | 0.13 | 11.22  | 81 | 18 |
| Ellis *et al*. (2009) - P | 0.049 | 0.244 | 0.64 | 75.29 | 19.21  | 0.36  | 80.43  | -0.06 | 2.49  | 88 | 19 |
| Moraes *et al*. (2014) H-DL | 0.752 | 0.649 | 0.72 | 32.79 | 59.26  | 27.87  | 12.87  | -0.50 | 0.31  | 92 | 20 |
| Ellis *et al*. (2007) - 1b  | 0.288 | 0.287 | 0.51 | 74.16 | 31.33  | 3.24  | 65.44  | -0.05 | 2.13  | 94 | 21 |
| Ellis *et al*. (2009) - O | 0.052 | 0.252 | 0.65 | 76.14 | 21.03  | 0.63  | 78.34  | -0.08 | 2.23  | 96 | 22 |
| Ellis *et al.* (2009) - D | 0.321 | 0.143 | 0.24 | 68.84 | 2.10  | 23.95  | 73.95  | 0.11 | 28.96  | 97 | 23 |
| Ellis *et al*. (2009) - V | 0.338 | 0.119 | 0.20 | 69.78 | 2.64  | 27.20  | 70.16  | 0.09 | 28.86  | 106 | 24 |
| Ellis *et al*. (2009) - W2 | -0.012 | 0.196 | 0.64 | 78.08 | 18.38  | 2.06  | 79.56  | -0.14 | 2.39  | 106 | 25 |
| Ellis *et al*. (2009) - W1 | -0.003 | 0.219 | 0.69 | 78.34 | 18.66  | 3.06  | 78.28  | -0.15 | 2.13  | 107 | 26 |
| Moraes *et al.* (2014) H-GEL | 0.809 | 0.544 | 0.60 | 43.99 | 66.75  | 26.97  | 6.29  | -1.70 | 0.20  | 109 | 27 |
| Ellis *et al*. (2007) - 11b | 0.155 | 0.278 | 0.60 | 78.96 | 34.11  | 0.05  | 65.84  | -0.19 | 1.55  | 110 | 28 |
| Ellis *et al*. (2009) - Q  | 0.066 | 0.028 | 0.09 | 75.93 | 9.92  | 6.52  | 83.56  | -0.08 | 9.14  | 110 | 29 |
| Ellis *et al*. (2007) - 13b | 0.128 | 0.208 | 0.44 | 76.45 | 27.95  | 2.49  | 69.56  | -0.11 | 2.46  | 112 | 30 |

AL, animal level; DL, dietary level; GE, gross energy (MJ/kg DM); GEI, gross energy intake (MJ/d); GEL, gross energy level; H, heifers; S, steers; SIM, calculated.

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