Development of a dynamic energy-partitioning model for enteric methane emissions and milk production in goats using energy balance data from indirect calorimetry studies

C. Fernández[1†], I. Hernando[2], E. Moreno-Latorre[2] and J. J. Loor[3]

[1]Departamento de Ciencia Animal, Universitat Politècnica de Valencia, Spain; [2]Facultad de Magisterio y Ciencias de la Educación. Universidad Católica de Valencia, Spain; [3]Department of Animal Sciences, Division of Nutritional Sciences, University of Illinois, USA.

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Supplementary Material S1 R codes to build the model in dairy goats. See Table 2 for variable definition.

ENERGYGOAT_model = function (times, initial, Parms)

# FILE
BW = file
R_{BW} = 48
MBW = file #metabolic body weight
DMI = file
R_{DMI} = 2034
MEI = file
R_{MEI} = 1190 # average value
NDF = file
R_{NDF} = 40
EE = file
R_{EE} = 3
GE = file

f_{DMI} = (DMI/R_{DMI})^z
f_{NDF} = (NDF/R_{NDF})
f_{EE} = (R_{EE}/EE)
f_{CH4} = fDMI * fEE * fNDF
f_{BW} = (BW/R_{BW})

CONSTANTS (from experiment or literature)
k_d = 0.68
k_u = 0.057
k_g = 0.014
k_h = 1/(1 + (J/MEI))
k_l = (Emilk/(K + MEI))

FLUXES
F_{feed} = (DMI * GE)/MBW

F_{D_A} = k_d * Q_D
F_{D_feces} = (1 - k_d) *Q_D
F_{D_CH4} = k_{CH4} * fch4 * Q_D

F_{A_urine} = ku * Q_A
F_{A_heat} = kh * Q_A
F_{A_milk} = kl * Q_A
F_{A_R} = kg * Q_A

F_{R_A}= - F_{A_R}

# POOLS
dQ_D = F_{feed} - F_{D_feces} - F_{D_A} - F_{D_CH4}
dQ_A = F_{D_A} + F_{R_A} - F_{A_urine} - F_{A_heat} - F_g - F_{A_milk}
dQ_R = F_{A_R} - F_{R_A}

initial1 = c(Q_D = 0, Q_A=293, Q_R=20)
Parms1 = c(k_{CH4} = 0.067, z = 0.3, Emilk = 551, J = 715, K = 401)
out <- ode(y=initial1, parms=Parms1, times=0:24, func= ENERGYGOAT _model)