The Effect of concentrate Supplementation on Methane Emission Intensity of Cattle grazing tropical Pastures in the dry Season

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The purpose of this study was to establish the relationship between the level of concentrate supplementation for grazing animals and methane (CH_4) emission intensity (Ei, kg CH_4/kg average daily weight gain).
First, a polynomial regression was developed to predict average daily weight gain (ADG) with increasing levels of supplement (DMIsup, g/kg live weight) for grazing beef cattle using meta-analytical data (n = 24) from Brazilian published scientific papers: ADG, kg/d = 0.1773 (SE ± 0.07976) + 0.06225 (± 0.02929) × DMIsup - 0.00122 (± 0.002105) × $DMIsup^2$ ($P < 0.05$; Eq. 1). Total dry matter intake and diet quality information were estimated upon the same dataset referred above (n = 24) using the Invernada Simulation Model (Embrapa Invernada), a software developed by Embrapa. A principal component analysis was performed followed by multiple linear regression analysis to predict enteric methane emission derived from another dataset (n = 36 studies), based also on grazing animals using the hexafluoride method (SF6): CH_4, kg/d = - 0.1011 (± 0.02903) + 0.02062 (± 0.002834) × DMI + 0.001648 (± 0.000417) × NDF ($P < 0.05$; Eq. 2). Then a polynomial regression was used to predict the CH_4 emission for each kg of ADG: Ei, kg CH_4/kg ADG = 0.4182 (± 0.0618) + 0.712 (± 0. 2244) × ADG + 0.4872 (± 0.2914) × ADG^2 ($P < 0.01$; Eq. 3). In all equations, experiment was considered as a random effect as well as the intercept using mixed modeling performed with the SAS system. ADG values used in the Eq. 3 were derived from Eq. 1 varying DMIsup from 0 to 12 g/kg live weight.
Methane emission intensity was drastically reduced as supplementation level increased. Without supplementation, Ei was estimated as 0.39 kg CH_4/kg live weight while 12 g concentrate/kg live weight reduced the emissions estimate to 0.16 CH_4/kg live weight equivalent to a 60% reduction. The reported effect is due to a combination of increased gain, as forage is used more efficiently, and the improvement in diet digestibility due to a direct (higher digestibility) and indirect effect (improved rumen fermentation) caused by concentrate supplementation. It can be concluded that supplementation is an effective strategy to reduce GHG emission intensity in tropical areas with a well-defined and long lasting dry season as it occurs in Brazil.