Daily faecal excretion of alkane C_{32} in beef cattle females grazing natural grasslands in southern Brazil and in Uruguay

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Introduction

The n-alkane technique is accepted as an appropriate method to estimate herbage intake by grazing ruminants. This method reinforces issues similar to those raised by other methods based on markers such as the effect of carrier matrix or dosing method and frequency on the excretion kinetics of the dosed n-alkanes (Dove *et al.* 2002; Molina *et al.* 2004, Oliván *et al.* 2007). The time of dosage needed to reach the dynamical equilibrium between the concentrations of alkanes in the diet and in the faeces of ruminants is still unclear for the natural grassland environments. The aim of this study was to determine the appropriate timing of oral administration of alkane C_{32} to estimate herbage intake in beef heifers on natural grassland environments.

Methods

The data were collected from two experiments conducted on native grasslands in South America. The first study was carried out at Bañados de Medina Experimental site in Cerro Largo, Uruguay, using beef cows grazing at two herbage allowances (HA): 4 and 2.5 kg DM/kg of live weight in a complete randomized block design with two replicates. Sixteen cows (n=4 for HA and blocks) grazed the plots continuously and HA levels were adjusted every 30 days using the put-and-take method.

The second study was conducted at EMBRAPA Sothern Region Animal Husbandry in Bagé, southern Brazil, in 2007 and 2008. Fifteen Brangus heifers grazed pastures continuously in a completely randomized block design with three replicates. Two plots of 7 ha natural grasslands were assigned to each of the three treatments: (1) natural grassland (NG); (2) NG plus fertilization (NGF) *i.e.* 70 kg/ha P_2O_5 in 2007 and 100 kg N/ha in 2008; and (iii) NGF plus over-seeding of annual ryegrass (*Lolium multiflorum*) and red clover (*Trifolium pretense*) (NGFS).

In spring 2008, the animals were dosed twice daily (at 8 am and 4 pm) with cellulose pellets containing 200 mg of dotriacontane (C_{32}), administrated for 12 days continuously. These animals were randomly chosen to monitor daily excretion of C_{32} and then to determine the time to reach a steady-state output. Faeces samples were collected from the first dosage administration to the last one (12^{th} day). The daily C_{32} concentration in the faeces was used to fit a non-linear model to verify the length of time needed to reach 95% of the C_{32} maximum concentration in faeces.

The faecal samples were identified and packed individually in plastic bags and stored frozen. After finishing the collection period, the samples were thawed and bulked by animal and day (a.m. and p.m.), unfrozen. The faecal samples of animals used to study the faecal excretion were grouped to compose a bulk sample per day, totalizing 12 samples per animal corresponding to 12 administration days.

The determination of n-alkanes of forage and faeces samples, within the range of C-chain between 27 and 35, was according to Dove and Mayes (2006). The number of days needed for the C_{32} dosage to reach 95% of the maximum concentration in the faeces was determined by a segmented equation:

$$Yij = L+U *(R < x) (R-x)+ \varepsilon ij) \text{ (broken line)}$$

Results

The daily evolution of alkane concentration dosed C_{32} in faeces and the adjustment of non-linear function is shown in Figure 1. The number of days necessary to reach 95% of the maximum concentration was unaffected (P>0.05) by the level of HA, fertilization and over-seeding pastures. The average length of time necessary to reach this concentration was 4 days.

Many researchers have obtained satisfactory results using the n-alkanes technique to estimate the dry matter intake (DMI) of different feeding sources in beef cattle (Dove and Mayes 2006). In this study, the n-alkane technique also showed similar efficiency when applied to complex and multi species natural grassland environments.

The results also showed that the maximum point of excretion was reached within 4 days of the alkane C_{32} dosage and administration, agreeing with the results reported by Oliván *et al.* (2007) and Molina *et al.* (2004). In addition, Oliván *et al.* (2007), measuring total faeces and applying daily dosage of C_{32}, found a steady state in the excretion

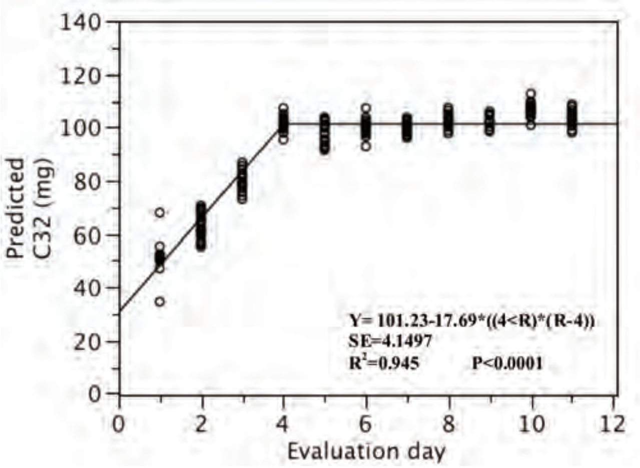

Figure 1. Daily evolution in the concentration of C_{32} dosed in faecal samples collected per rectum in beef females grazing on natural grassland with different anthropic levels.

after 5 days of dosage administration. Similarly, Molina *et al.* (2004) found that 4 and 5 days of dosage were needed to reach the balance in faeces of dairy cows when dosed with capsules of controlled liberation (CAPTEC) or jelly casules, respectively. In this study, a similar length of time was needed to reach the status of balance with heifers on natural grasslands and this was probably obtained because the frequency of daily dosage used was increased to twice a day.

The major consequence of such a short dosage time to reach the balance of an external marker is a decrease in costs associated with decreased chemical and labour usage and analysis. A potential error associated with one daily dosage for beef cattle is variation in the daily concentrations of the marker in faeces. This study confirmed that applying the twice-daily dosage in beef cattle grazing natural grasslands could reduce this error source.

Conclusion

The external marker C_{32} reached a steady state in faeces in a 4 day period for beef cattle grazing natural grasslands, regardless of the herbage allowance, fertilization or grassland overseeding.

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