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Use of alkanes and alcohols for hay intake estimation in stabled horses

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INTRODUCTION

Horses are herbivore animals that spend most of their time in foraging activities.

When stabled, this behaviour should be kept, and *ad libitum* hay intake is one way to promote this

Maxfield et al., 2019

INTRODUCTION

Knowledge on the amount of hay that a stabled horse consumes is important to adequately manage diet to the animal's nutritional requirements.

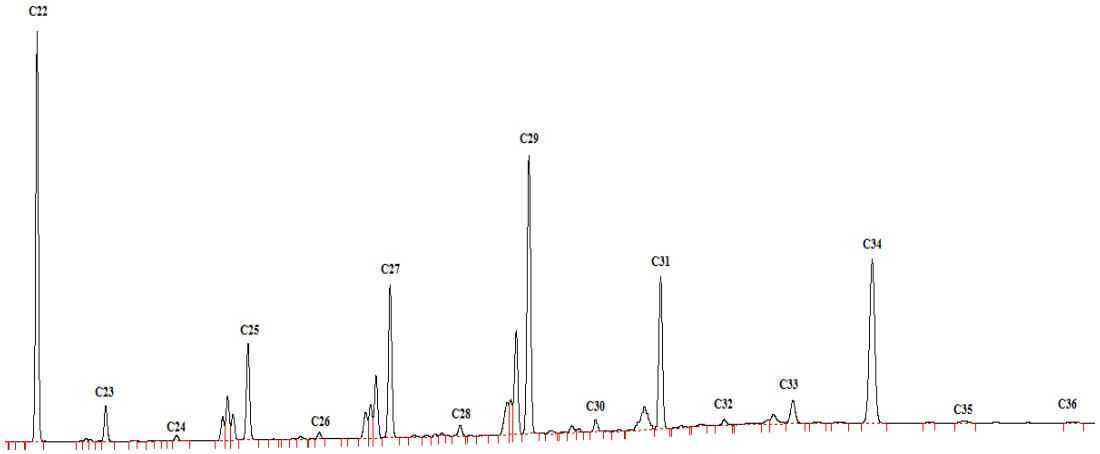
Given the wide variety and importance of hay in horse feeding, the correct evaluation of its nutritional characteristics, including voluntary intake, is important.

However, knowing the accurate amount of voluntary intake of hay can be complicated when horses are stabled in groups or outdoors.

Maxfield et al., 2019

INTRODUCTION

Internal markers such as alcanes and alcoohols have been sucessfully used for estimation of pasture intake in horses (Ferreira et al, 2009, 2015) and in Donkeys (Couto et al, 2014).



In this study, we intended to assess the use of alcanes and alcohools to estimate hay intake in stabled horses.

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MATERIALS AND METHODS

Animals and diets

Four male Lusitano horses (19 ± 4 years) with an average bodyweight of 468 ± 12.5 kg housed in individual boxes

3 diets composed of varying proportions of concentrate and hay:

- Diet 1 - 5% concentrate and 95% hay
- Diet 2 - 10% concentrate and 90% hay
- Diet 3 - 20% concentrate and 80% hay

According to Martin-Rosset (2012) and were modified to individual ingestive behaviour of the horses.

Each experimental trial was conducted over an eleven-day period:

- Seven-day adaptation period
- Four-day total faecal collection and sampling for future chemical analysis.

Collected faecal samples were immediately refrigerated at 4ºC until analysis was conducted.

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MATERIALS AND METHODS

Labelling concentrate feed

To provide a distinct alkane profile to the concentrate feed, 0.32kg of beeswax was liquified in 700ml of heptane.

- Solution was mixed with concentrate feed ensuring total surface area coverage
- Labelled concentrate feed was evenly spread out over plastic and was left for four days to ensure the evaporation of the heptane and to prevent palatability issues for the animals.
- Labelling was not necessary for the hay portion of the diet due to the presence of natural alkanes in the epicuticular layer of plants (Bachmann et al. 2016)

MATERIALS AND METHODS

Alkane and long-chain alcohol analysis

The concentration of n-alkanes and long chain alcohols in the feed and faeces samples were analysed in duplicate using gas chromatography methodology as described by Dove and Mayes (2006).

Calculations and statistics

The proportion of hay (PH) and the porportion of concentrate (PC) where estimated using an optimization procedure of the square deviations between their proportions in both feaces and feeds.

Due to the use of labelled supplement, total voluntary dietary intake (I) was estimated from the proportion of hay (PH) and the proportion of labelled concentrate (PC) in the diet. Given this information and the known quantity of concentrate daily supplied (QS):

$$I=QS\times PC/PH$$

Statistical analysis was conducted using (SAS,2015). The effect on using labelled supplement to estimate voluntary dietary intake was assessed using a one-way ANOVA.

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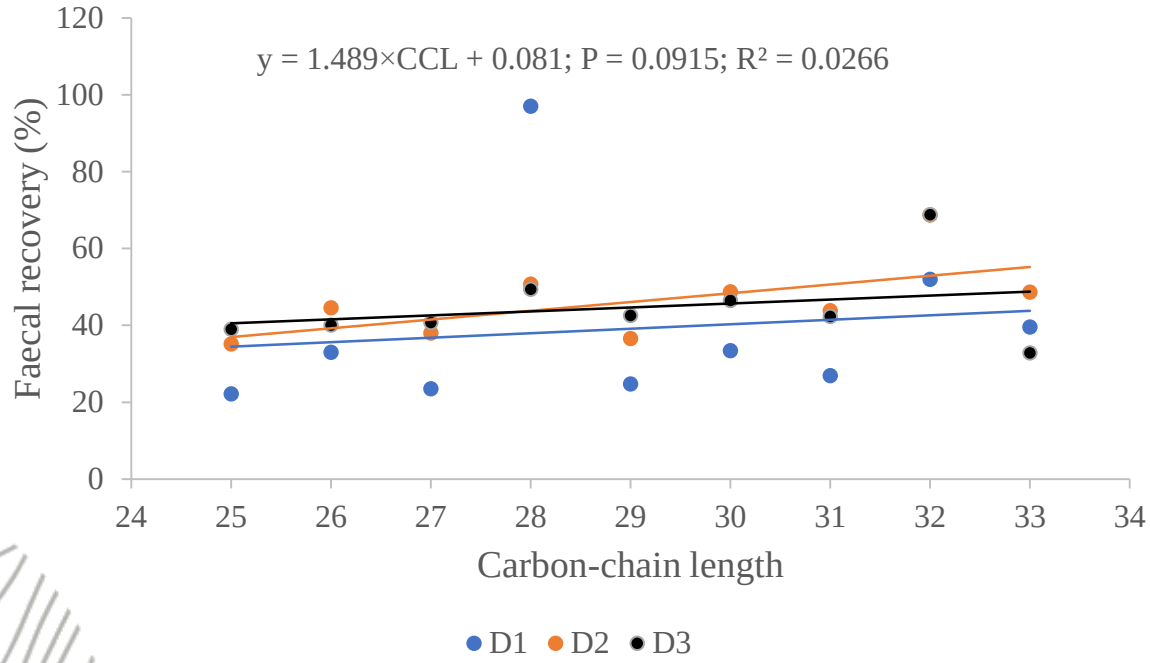
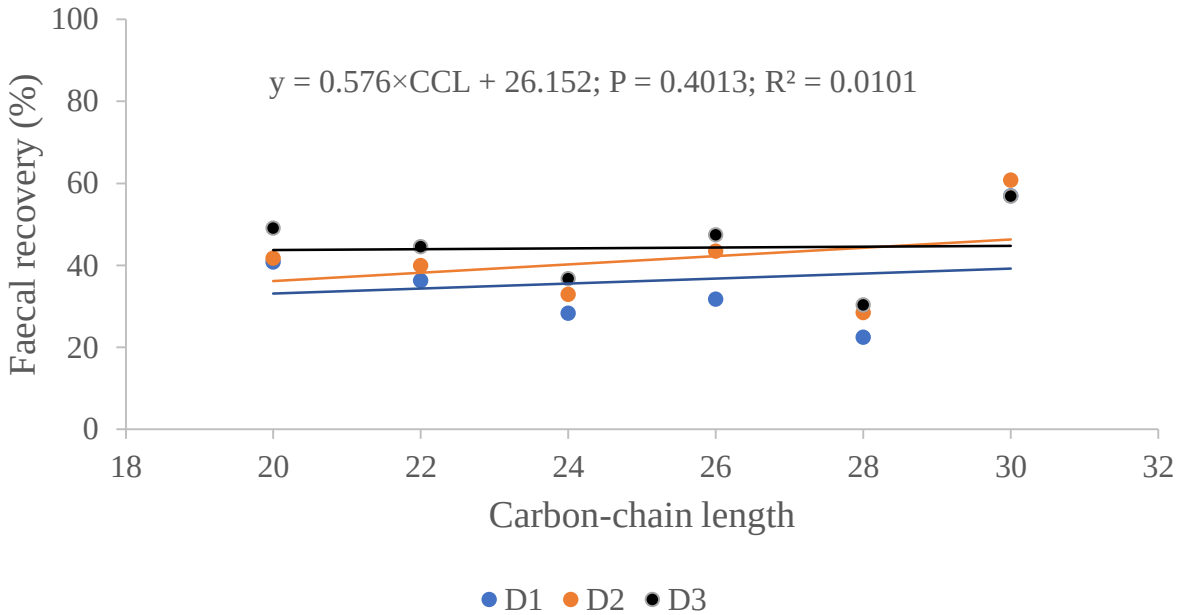
RESULTS AND DISCUSSION



Faecal recovery was independent to the carbon chain length of the n-alkanes and LCOH's.

Ferreira et al. (2007b), Ferreira et al. (2009) and López et al. (2016)

Estimates of diet compostion can be made without applying any correction gactor for incomplete feacal recovery



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RESULTS AND DISCUSSION

Table 2: Comparison of the known proportions of concentrate feed and DMI in stabled equines, estimated by the faecal markers n-alkanes (Alk), LCOH and their combination (Alk-LCOH).

Values in the same column with different letters for each diet are significantly different (P<0.05).

Method	Diet	Concentrate	DMI
Control	D1	0.049	8.170
Control	D2	0.098	9.096
Control	D3	0.197	9.767

Maxfield et al., 2019

RESULTS AND DISCUSSION

Table 2: Comparison of the known proportions of concentrate feed and DMI in stabled equines, estimated by the faecal markers n-alkanes (Alk), LCOH and their combination (Alk-LCOH).
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Method	Diet	Concentrate	DMI (kg)
Control	**D1**	**0.049^{b}**	**8.170^{a}**
Alk-LCOH		0.057^{b}	7.219^{a}
Alk		0.057^{b}	7.219^{a}
LCOH		0.141^{a}	2.932^{b}
Control	**D2**	**0.098^{b}**	**9.096^{ab}**
Alk-LCOH		0.088^{b}	10.048^{a}
Alk		0.088^{b}	10.048^{a}
LCOH		0.151^{a}	6.123^{b}
Control	**D3**	**0.197^{ab}**	**9.767^{a}**
Alk-LCOH		0.179^{b}	10.706^{a}
Alk		0.179^{b}	10.706^{a}
LCOH		0.235^{a}	8.555^{a}
Effects	Method (M)	<0.001	<0.001
	Diet (D)	<0.001	<0.001
	M x D	0.2564	0.2810

Results showed significant differences for estimate methodologies (p<0,001).

Best estimates where obtained when alcanes or the combination of alcanes+alcohols where used.

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FINAL CONSIDERATIONS

The results of the current study showed that the application of beewax in estimating equine intake was highly useful, as it provided the concentrate feed with a distinct unique profile of n-alkanes and LCOH's.

The confirmed accuracy of using wax markers, discarded the need to dose the animals with external synthetic markers or disrupt natural foraging behaviour.

The use of n-alkanes alone or combined with other wax compounds, such as LCOH's, demonstrated its increased capability to estimate hay intake in stabled horses presented with varying proportions of concentrate.

Overall, the method of using variated concentrate proportions did not influence the accuracy of the intake estimations.

This implies that we can accuratly estimate low amounts of concentrate feed (5%) in the diets of equines, as well as total DMI.

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THANK YOU FOR YOUR ATENTION

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