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Stable carbon isotope fractionation may be diet dependent

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Conclusions

Stable carbon isotope fractionation may depend on the diet. Across trials, there was a significant linear decrease in fractionation with increasing (less negative) dietary $\delta^{13}C$ values.

Background

❑ Stable isotope analysis of animal tissues has potential for discriminating between diets, e.g. the $\delta^{13}C$ value is known to reflect the proportion of C_3 and C_4 plants in the diet.
❑ During metabolism, depletion of ^{13}C occurs (fractionation), resulting in $\delta^{13}C$ values in animal samples that differ from the corresponding dietary values (trophic shift).
❑ This trophic shift is often assumed to be constant for a given tissue.

Objective

❑ Verify whether the fractionation of ^{13}C in plasma is constant or depends on the dietary $\delta^{13}C$ value

Results

❑ Across trials and treatments, mean plasma $\delta^{13}C$ fractionation was +1.4‰, ranging between -1.3‰ and +3.8‰.
❑ There was a significant linear decrease in fractionation with increasing (less negative) dietary $\delta^{13}C$ values and increasing proportions of C_4 plant material in the diet.
❑ However, this dietary effect on plasma $\delta^{13}C$ fractionation appeared in two trials, wheras it was not obvious in two other trials.
❑ A non-constant trophic shift may have implications for back-calculation of diets, as was shown by Focken (2004).

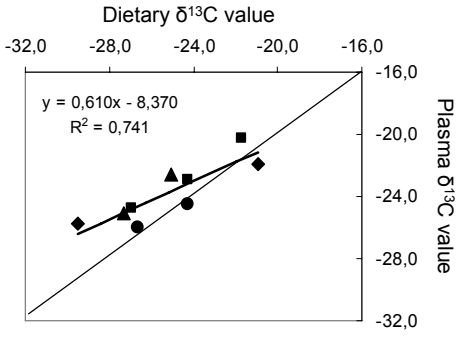

Figure 1. Plasma $\delta^{13}C$ values in relation to dietary $\delta^{13}C$ values

Material and methods

❑ Data from four trials with different animal types and diets differing in the proportion of C_4 plant material (maize). Values are treatment means.
❑ Determination of $\delta^{13}C$ values of plasma and dietary samples by ANCA-SL elemental analyser, connected to an isotope ratio mass spectrometer (PDZ-Europa, UK). Ratios $^{13}C/^{12}C$ are expressed as $\delta^{13}C$ values in per mill (‰) relative to VPDB standard. Values for fractionation = plasma – dietary values.
❑ Plasma samples had been taken after at least two months following a dietary change, so that equilibrium could be assumed.

Trial	Animal type	Group	# Animals	%C_4 in diet	Diet
◆	Adult wethers (Balcaen et al., 2003)	1	4	0	Ryegrass hay only (1) or with maize silage (2)
		2	4	46	
■	Growing bulls (De Smet et al., 2004)	1	16	0	High concentrate diets differing in content of grass/maize silage and in content of maize in concentrates
		2	7	13,5	
		3	8	35	
▲	Growing lambs (unpublished)	1	4	0	Hay/concentrate (50/50) without (1) or with maize (2)
		2	4	17,8	
●	Growing pigs (unpublished)	1	6	0	Fattening diet without (1) or with maize (2)
		2	6	15	

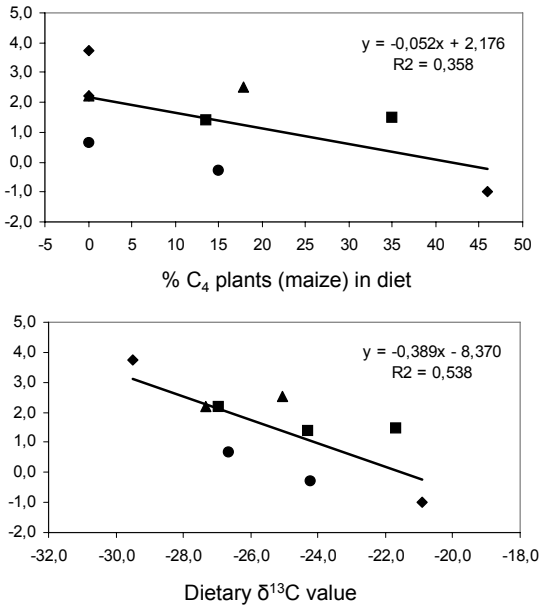

Figure 2. Plasma $\delta^{13}C$ fractionation in relation to % C_4 plant material in diet (upper graph) and dietary $\delta^{13}C$ value (lower graph)

References

Balcaen et al. (2003). Proc. Annual Meeting BSAS, p. 159.
De Smet et al. (2004). Rapid Communications in Mass Spectrometry 18: 2087-2092.
Focken (2004). Rapid Communications in Mass Spectrometry 18: 1227-1232.

Acknowledgements

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