Evaluation of an in vitro fibre fermentation method using feline faecal inocula: inter-individual variation

Guido Bosch, Lisa Heesen, Karine de Melo Santos, John W. Cone, Wilbert F. Pellikaan, Wouter H. Hendriks
Animal Nutrition Group, Wageningen University

Background

The properties of dietary fibres may affect the cat's health, digestive processes and faecal characteristics[1]. Fermentability of fibres can be characterised in vitro using faecal microbiota from individual cats as inoculum source. Knowledge of the inter-individual variation in fibre fermentation is important for understanding the impact of fibres on cats and the calculation of number of donors required for studies designed to characterise dietary fibres.

Objective

To evaluate the variation in in vitro fibre fermentation among cats.

Materials and methods

Animals, housing and care

- 10 healthy female European shorthair cats, 3-5 yr, 3.3±0.6 kg BW
- Housed in group rooms for socialisation and in metabolism cages for feeding and faeces collection
- Tray with non-absorbent polyethylene litter sterilised with 70% ethanol
- Fed a commercial dry extruded diet to maintain BW, water ad libitum

Substrates

- Citrus pectin (CP), fructooligosaccharides (FOS), guar gum (GG), sugar beet pulp (SBP), wheat middlings (WM)
- Used in other in vitro studies, in pet foods and contrasting in characteristics

Inoculum preparation and incubation

- 2 runs, 5 inocula (Fig.1) per run, inoculum-substrate combination in triplo, each incubated at 39°C for 48 h (Fig. 2)

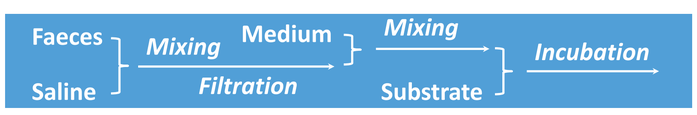

Figure 1. Scheme of inoculum preparation, all steps under CO_2 flow to ensure anaerobic conditions.

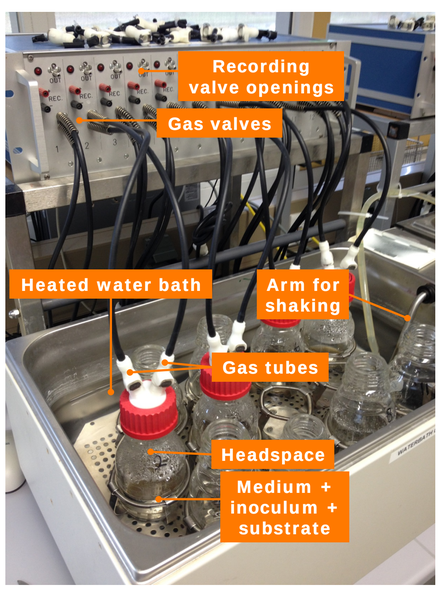

Figure 2. Unit for measurement of gas produced during incubation.

Measurements

- Short-chain fatty acids (SCFA) in fermentation liquids[2] at t=48 h
- Organic matter disappearance for SBP and WM[2] at t=48 h
- Gas production continuously during 48 h

Calculations

- Gas production fitted with monophasic model[3] and T_{max} (h) and R_{max} (ml/h) calculated from model parameters[4]
- Branched-chain proportion (BCP) calculated as (iso-butyrate + iso-valerate)/total SCFA × 100%
- Replicates averaged per inoculum-substrate combination
- Coefficient of variation (CV) for parameters calculated as standard deviation/mean × 100%

Results

- 9 of 10 cats produced faeces at days of inoculum preparation
- For one cat, SCFA analysis failed
- Inter-individual variation in total SCFA and gas production was larger for SBP and WM than for CP, FOS and GG (Fig. 3)
- Inter-individual variation in proportion of butyrate was larger than for propionate, which had larger variability than acetate (Fig. 3)

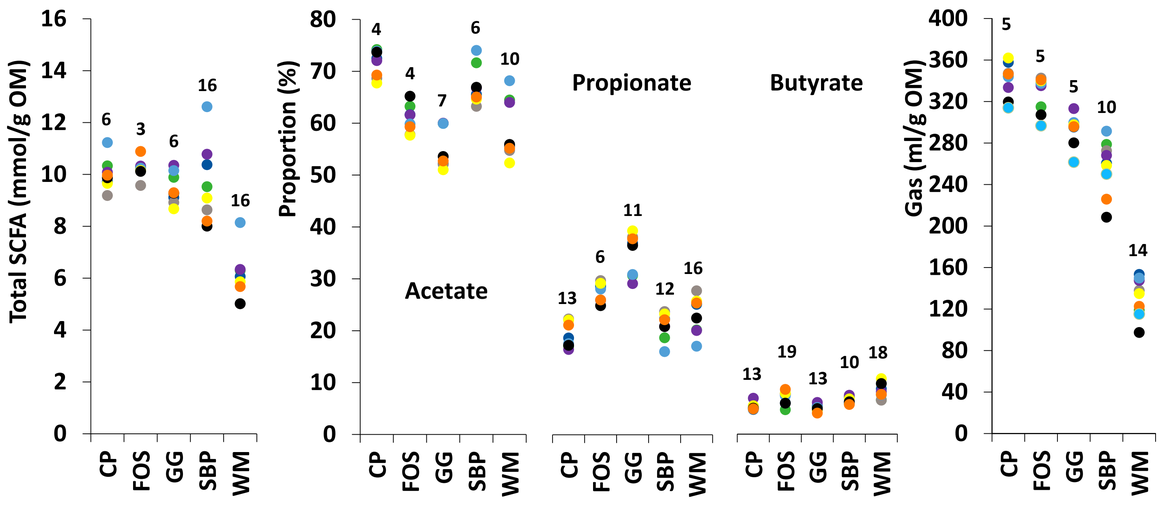

Figure 3. Inter-individual variation in in vitro SCFA (n=8) and gas (n=9) production from standard substrates. Coloured markers represent results from individual cats used as faecal donor. Coefficient of variation (%) per substrate is indicated above the markers.

- Inter-individual variation in BCP was in particular large for SBP and WM (Table)
- Fitting of model for gas production was not possible for SBP and WM
- Inter-individual variation in R_{max} and T_{max} was in particular large for GG (Table)
- SBP and WM differed in OMD and showed similar inter-individual variation (Table)

Table. Inter-individual variation in in vitro fermentation parameters

Parameter		Substrate				
		CP	FOS	GG	SBP	WM
BCP	Mean	2.3	2.3	2.9	2.8	5.7
	CV	10	9	11	22	19
R_{max}	Mean	87	85	51	-	-
	CV	15	11	32	-	-
T_{max}	Mean	3.8	4.1	5.0	-	-
	CV	12	17	23	-	-
OMD	Mean	-	-	-	86	49
	CV	-	-	-	12	12

Conclusions

Individual cats differ in their potential to degrade fibres, in particular the more complex fibres (SBP, WM). Impact of fibres may, therefore, differ among cats. For accurate in vitro characterisation, number of faecal donors should be multiple and adjusted according to the variability of the parameters of interest and the complexity of fibres.

Acknowledgements

D. Nijkamp-Van de Pol and S. Van Laar-Schuppen for assistance during the execution of the in vitro procedures and M. Breuer for SCFA analyses.

References

[1]Fahey et al. 2004. In *Dietary fibre: bio-active carbohydrates for food and feed* (Eds. Van der Kamp et al.) 295-328
[2]Bosch et al. 2008. *Journal of Animal Science* 89:3163-3169
[3]Groot et al. 1996. *Animal Feed Science & Technology* 64:77-89
[4]Bauer et al. 2003. *Journal of the Science of Food and Agriculture* 83:207-214

Animal Nutrition Group
P.O. Box 338, 6700 AH Wageningen
Contact: guido.bosch@wur.nl
www.wageningenUR.nl