

Changes in the pattern of fermentation in the caecum of rats

TL Hanstock¹, EH Clayton²

¹Department of Psychology, University of New England, NSW, 2351

²TLC Research, PO Box 50, The Oaks, NSW, 2570

Diets promoting fermentation in the caecum and colon are commonly being prescribed as preventatives for colonic cancer (1). Evidence from animal studies indicates that diets promoting high levels of fermentation may not be beneficial to the gastrointestinal tract or immune function. The aim of the current experiment was to examine the difference in fermentation pattern, in terms of volatile fatty acids (VFA's) and lactic acid, in the hind-gut of rats when fed two different commercial diets and one diet promoting increased fermentation.

Thirty six male Wistar rats were fed one of 3 pelleted complete rations (n = 12). Two rations were purchased from commercial outlets, Chow (16.6 MJ ME/kg DM, 22.4% CP, Ridley Agriproducts), Wheat Based (17.1 MJ ME/kg DM, 19.1% CP, Breeders Choice Seeds) and one, Rice Based, was formulated to the same specifications as the Wheat Based ration (16.9 MJ ME/kg DM, 18.2% CP, M. Evans). All rations were fed for 3 hours per day for 11 days. Animals were euthanased for collection of gut contents at either 3 or 21 hours after the time of feeding. Samples of digesta from the caecum, colon and rectum of each rat were collected and analysed for pH and VFA and lactic acid concentration. Data are presented for caecal measurements combined for 3 or 21 hours after feeding.

Caecal butyrate concentration (mmol/l) was significantly ($P < 0.05$) higher in rats fed the Rice Based ration than Chow or Wheat Based rations. The higher concentration of butyrate in the caecum and rectum (data not shown) has previously been thought to be beneficial to the health of the hind-gut in terms of colonic cancer prevention (1,2). However, the concentration of total lactate and acetate was significantly higher with the Rice Based ration compared to the Chow ration. These fermentation end products may not be beneficial, as acetate has previously been shown to induce ulcerative colitis in rats (3) and lactic acid has reported detrimental effects on gut health and immune function (4).

Two of the 3 rations used in the current experiment were commercially available and are commonly used as control rations in rat research. The level and pattern of fermentation, however, varied with ration. A broader approach aimed at assessing the total impact of a dietary change needs to be taken when formulating diets for rodent or human consumption. In particular, diets that promote higher rates of fermentation in the hind-gut may not be beneficial in terms of overall gut health.

Measurement	Chow	Wheat	Rice	Diet (P-value)
DEI ¹ (kJ/g body wt/d)	1.42	1.34	1.40	0.148
CP ² (mg/g body wt/d)	19.15 ^a	14.98 ^b	15.10 ^b	< 0.0001
Total lactate (mmol/l)	6.19 ^a	9.04 ^b	11.29 ^b	0.006
Acetate (mmol/l)	326.07 ^a	643.89 ^b	557.49 ^c	< 0.0001
Propionate (mmol/l)	50.03 ^a	104.62 ^b	117.85 ^b	< 0.0001
Butyrate (mmol/l)	85.81 ^a	94.93 ^a	122.05 ^b	0.017

¹DEI = Digestible energy intake; ²CP = Crude protein.

References

1. Topping DL, Bird AR. Foods, nutrients and digestive health. *Aust J Nutr and Diet* 1999; 56: S22–34.
2. Kruh J. Effects of sodium butyrate, a new pharmacological agent, on cells in culture. *Moll Cell Biochem* 1982; 42: 65–82.
3. Fedorak RN, Empey LR, MacArthur C, Jewell LD. Misoprotosol provides a colonic mucosal protective effect during acetic acid-induced colitis in rats. *Gastroenterology* 1990; 98: 615–25.
4. Clayton EH, Jones GPD. Preliminary observations of tumour necrosis factor-alpha in the faeces of sheep following acute lactic acidosis. *Aust J Agric Res* 2001; 52: 869–73.

Supported by Dr. P Mallet (UNE), P Pittolo (Weston Animal Nutrition) and Dr. RD Taylor (Uni Newc)

Key words: fermentation, lactic acid, rat