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In Vitro Fermentation of Beet Fibre and Barley Bran, of their Insoluble Residues after Digestion and of Ileal Effluents

Anthony Fardet, Fabienne Guillon,* Christine Hoebler and Jean-Luc Barry

Human Nutrition Research Centre, Station of Technology Applied to Nutrition, INRA, BP 71627, 44316 Nantes Cédex 03, France

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Abstract: The main objective of this study was to determine the form in which beet and barley bran fibres reach the colon, and to evaluate the influence of endogeneous compounds on their patterns of fermentation. Raw fibres (RF), corresponding ileal effluents (IE) from pigs, and insoluble fibre residues (IR) extracted from IE, were fermented with human faecal inoculum for 24 h in an *in vitro* batch system. For beet fibre, rate but not extent of cell wall sugars degradation was increased (+34% at 6 h, $P < 0{\cdot}05$) after oroileal transit, due to a more porous structure. For barley bran, oroileal conditions degraded endosperm compounds such as β-glucans, leading to a lower extent of cell wall glucose fermentation compared with RF (−22% at 24 h, $P < 0{\cdot}05$). In the presence of endogeneous substances, degradation of beet fibre polysaccharides was delayed ($P < 0{\cdot}05$) at each incubation time but that of barley bran fibre was unaltered. Compared to RF, IR and IE significantly exhibited lower acetate production for beet fibre, and higher propionate and lower butyrate production for barley bran after 24 h. It is concluded that *in vivo* digestion modified fermentation patterns of both fibres in a manner depending on botanical structure.

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INTRODUCTION

Colonic fermentation in humans has important implications for health. Short-chain fatty acids (SCFAs) are the main end-products of dietary fibre fermentation, and they are extensively absorbed by the colonic mucosa before undergoing a variety of metabolic fates within the body (Cummings and McFarlene 1991), with beneficial physiological effects. Non-fermented substrates and the bacterial biomass, through their ability to hold water, may exert a mechanical physical action which helps regulate transit and faecal output (Cherbut *et al* 1991).

The quantity and nature of substrates available for colonic fermentation depends on the amount and type of diet eaten and on the ability of the small intestine to digest food components. Dietary fibre unabsorbed in the small intestine may provide a large proportion of the available substrates for bacteria (Nordgaard and Mortensen 1995). Not all dietary fibres are fermented to the same extent or lead to the same SCFA profile.

The identity of factors influencing fermentability of fibre substrates has been the subject of much research. They include monosaccharide composition (Salvador *et al* 1993), hydration properties (McBurney *et al* 1985), particle size and porosity (Auffret *et al* 1993). Fibre with high initial water-retention capacity is fermented more by faecal bacteria than fibre with low water-retention capacity (Stephen and Cummings 1979; McBurney *et al* 1985). Particle size and porosity determine the surface area in contact with bacteria (Auffret *et al* 1993). Porosity at the level of bacteria is related essentially to the

* To whom correspondence should be addressed.

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