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Abstract

Validation of an In Vitro Fermentation Model of Colonic Gas Production †

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Abstract: Background: The rapid production of gas during the colonic fermentation of highly soluble fermentable fibres may cause unpleasant gastrointestinal symptoms. In vivo feeding studies are often used to assess symptomatic response to fibres; however, in vitro fermentation studies are quicker, cheaper, and more reproducible. The aim of this study was to validate an in vitro colonic fermentation model of gas production against in vivo experiences of symptoms following inulin consumption. Methods: Healthy volunteers (n = 21, 18–65 y/o, M/F) provided a stool sample used to inoculate an in vitro colonic fermentation model. Fermentation bottles containing faecal slurry, a fermentation medium, and a fibre substrate (inulin) were incubated at 37 °C for 24 h in a shaking water bath. The total gas production (mL) over 24 h (minus control) was measured. Each stool donor added 15 g inulin to a low-fibre diet and recorded experiences of gastrointestinal symptoms for 48h. In vitro gas production and in vivo symptom experience were compared for each donor following tertile classification. Low in vitro gas production was classed as <45mL (<1st quartile of dataset), medium as 45–78 mL (1st quartile–3rd quartile), and high as >78 mL (>3rd quartile). In vivo symptom response was classed as low if symptoms were mild and/or short-lived (<1 h duration); medium if moderate and/or prolonged (1 h); and high when abdominal pain or multiple prolonged (3 h) symptoms occurred. Results: In vitro gas production was high in six cases (29%); medium in ten (48%); and low in five (24%). Symptom experience was high in seven cases (33%); medium in five (24%); and low in nine (43%). The same classification occurred in 57% of cases and classification into adjacent categories occurred in 43%; no complete misclassification occurred. Agreement between the methods was fair: weighted kappa = 0.378 ($p < 0.01$). Discussion: The level of agreement between the in vitro model of gas production and in vivo symptom reports, and the absence of any cases of complete misclassification, is promising. This simple in vitro batch-fermentation model may be used in future to screen fibres for their potential impact on gastrointestinal symptoms. This will help develop strategies to increase fibre consumption generally and optimise their use in food reformulation.

Keywords: dietary fibre; in vitro fermentation; gastrointestinal symptoms

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