Cross-sectional analyses show no association between fibre intake and faecal butyrate level

Elizabeth A. Williams¹, Daphne Y. L. Lai², Jonathan P. Bury³, Stuart A. Riley⁴, Sue Plummer⁵, Julian R. Marchesi⁶ and Bernard M. Corfe²

¹Human Nutrition Unit, Department of Oncology, University of Sheffield, ²Molecular Gastroenterology Research Group, Department of Oncology, University of Sheffield, ³Department of Pathology, Northern General Hospital, Sheffield, ⁴Department of Gastroenterology, Northern General Hospital, Sheffield, ⁵Obsidian Research Ltd, Port Talbot and ⁶Cardiff School of Biosciences, Cardiff, UK

Background: Dietary fibre and the fermentation product butyrate have been implicated in promotion of colonic health. The prevailing paradigm is that dietary fibre consumption leads to increased levels of short-chain fatty acids including butyrate, yielding a potential mechanism of action. This concept has been supported by intervention studies of fibre supplementation; however, the evidence-base from cross-sectional analyses is sparse.

Objective: We aimed to evaluate the strength of support for a linear relationship between fibre intake and faecal butyrate in the absence of a perturbation/intervention. Two studies were undertaken: (i) a cross-sectional analysis of the relationship between habitual fibre intake and faecal butyrate; (ii) a cross-sectional analysis of the relationship between recent (24 hr) fibre intake and faecal butyrate.

Methods: Seventy six subjects were recruited from gastroenterology clinics to a cross-sectional analysis of habitual fibre intake using a validated food frequency questionnaire. Sixteen healthy subjects were recruited to a cross-sectional analysis of recent fibre intake using multiple pass 24 hr recall, sampling was undertaken on 4 occasions, 3 weeks apart. Faecal SCFA were extracted within 3 hr of passing stool and were later analysed by gas chromatography.

Results: When faecal butyrate was compared against habitual fibre intake, no relationship was found ($r = 0.09$, $P = 0.438$ (n = 76, all subjects)); $r = 0.092$, $P = 0.597$ (n = 35, subjects without a pathology). When faecal butyrate was compared against recent fibre intake no relationship was found ($r = 0.124$, $P = 0.331$ – AOAC fibre; $r = 0.068$, $P = 0.596$ – Englyst fibre). When published cross-sectional studies of the fibre-butyrate relationship were reviewed, generally no relationship had been found.

Conclusions: This study suggests that the assumed linear relationship between dietary fibre intake and faecal butyrate does not hold. Both datasets agree with other cross-sectional studies investigating the fibre-butyrate relationship. The hypothesized relationship between fibre intake and faecal butyrate should be re-evaluated.