

## MRI insight in abnormalities of small bowel water and colonic water content in diarrhoea-predominant Irritable Bowel Syndrome

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### Introduction:

Bloating, abdominal distension and pain are frequent symptoms in Irritable Bowel Syndrome (IBS) and they can often be exacerbated by bran [1]. The underlying mechanisms are currently poorly understood. We have previously shown that bran accelerates scintigraphic small bowel transit [1] and increases small bowel secretions in healthy controls [2]. Recent developments in magnetic resonance imaging (MRI) allow non-invasive, patient-acceptable monitoring of small bowel water content (SBWC), small bowel transit time (SBTT) and ascending colon water content (ACWC). The aim of this study was to test the hypothesis that diarrhoea-predominant IBS (IBS-D) patients show fasted and postprandial abnormalities in SBWC, SBTT and ACWC using MRI under physiological conditions.

### Methods:

9 IBS-D patients (4 male, 5 female), meeting Rome III criteria for IBS-D, in whom microscopic colitis and coeliac disease had been excluded, and 16 healthy controls (8 male, 8 female) attended at the MRI unit having fasted overnight. They were imaged at baseline, after which they ate a standard 331 kcal rice pudding with added 15 g of coarse wheat bran. Serial MRI imaging was then performed at 45 min intervals for 4.5 hours. The MRI sequences acquired on a 1.5 T Philips Achieva scanner included coronal TSE (MRCP) for the SBWC and ACWC, and Coronal Dual Echo FFE (Fat/Water in-phase and out-of-phase TEs) for SBTT and colonic contractions. The volume of fluid in the bowel at each time point was calculated by integrating all image pixels containing water signal above a given threshold [3].

### Results:

(mean±SEM) The IBS-D patients showed a significantly reduced fasting SBWC of 59±16 ml compared to 112±18 ml in controls,  $p < 0.04$ . The fasting ACWC was nine times greater in IBS-D patients than controls (10±3 ml versus 1.1±0.5 ml,  $p < 0.02$ ). Post-prandial SBTT was significantly faster in IBS-D (145±15 min) than in control subjects (239±15 min). The control data compared well with previous scintigraphic estimates of transit time for the same meal in controls (260±25 min) [2]. Four out of the nine patients also showed postprandial mass movements of the colonic contents whilst no controls showed such mass movements.

### Conclusion:

IBS-D patients showed accelerated small bowel transit and increased proximal colon water content which, when combined with increased postprandial colonic contractions, are likely to contribute to the postprandial urgency and loose stools characteristic of such patients. MRI provides a patient-acceptable method of documenting these changes and could be an ideal biomarker to objectively evaluate the efficacy of new treatments.

### References:

1. Hebden, J.M., et al., Abnormalities of GI transit in bloated irritable bowel syndrome: Effect of bran on transit and symptoms. *American Journal of Gastroenterology* 2002;97:2315-2320.
2. McIntyre, A., et al., Effect of bran, ispaghula, and inert plastic particles on gastric emptying and small bowel transit in humans: The role of physical factors. *Gut* 1997;40:223-227.
3. Hoad, C.L., et al, Optimization and validation of small bowel water content estimation using MRI. Abstract submitted to the 14<sup>th</sup> ISMRM, Berlin 2007.

**Figure 1** (a) is a coronal dual-echo FFE image (Fat/water out of phase) showing the ascending colon (AC) in a fasted control subject. (b) is the corresponding MRCP image showing the absence of bright water signal in the subject's AC. (c) shows the AC from a fasted IBS-D patient in a coronal dual-echo FFE and (d) is the corresponding MRCP image showing excess water content in the AC of a fasting IBS-D patient with bright water signal differences from the control in (b).

