

Association of Habitual Dietary Fiber Intake and Fecal Microbiome Gene Abundance with Gastrointestinal Symptoms in an Irritable Bowel Syndrome Cohort

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Objectives: Dietary fibre supplementation is recognised as important for functional gastrointestinal disorders (FGID). The exact role of the microbiome in this relationship remains unclear. We explored differences in dietary fibre intake, GI symptoms and the fecal microbiome in those with FGID.

Methods: The COMFORT cohort is an observational case control study examining FGID, particularly irritable bowel syndrome (IBS) aetiology (Ethics 16/NTA/21). Participants prospectively completed a food and GI symptoms diary over 3 days. Severity of GI symptoms and mood disorders were assessed using clinical questionnaires; SAGIS and PROMIS for GI symptoms and HADS for anxiety and depression. Fecal samples were analysed by shotgun sequencing; 95 healthy controls (HC), 22 constipation IBS (IBS-C) and 50 diarrhea IBS (IBS-D).

Taxonomic classifications were assigned by aligning sequences against the NCBI non-redundant database using DIAMOND.

Results: Diet diaries were completed by 292 participants (176 cases, 71.2% female). Average daily fibre intake was higher in HC compared to FGID (23.99g, 95% CI = -2.06-0.55; 20.28g, 95% CI = -1.96-0.45; $P < 0.05$). Low fibre daily intake (< 15g) was associated with higher depression scores ($P < 0.05$) and increased anxiety in those with functional diarrhea ($r^2 = -0.554$, $P = 0.03$). A negative association between fibre consumption and increased bloating in IBS ($r^2 = -0.19$, $P = 0.04$) was also found. The GI microbiome in IBS was characterised by differences in Firmicutes belonging to the Lachnospiraceae family (e.g., *Blautia* and *Ruminococcus*, $P < 0.05$). Other differentiating taxa included *Bilophila* (higher in IBS-D) and *Methanobrevibacter* (lower in IBS-D) ($P < 0.05$). At the phylum level, bloating and constipation were correlated with Firmicutes relative abundance, and negatively correlated with Bacteroides (canonical $r > |0.5|$). At the genus level, *Blautia* were correlated with diarrhea and faecal incontinence (canonical $r > 0.5$).

Conclusions: Higher fibre consumption was associated with decreased bloating, anxiety and depression in different FGID subgroups. IBS was also associated with altered fecal microbiome composition including some taxa linked to carbohydrate and hydrogen metabolism.

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