A systematic review on the effect of fermentable oligosaccharide, disaccharide, monosaccharide and polyol (FODMAP) manipulation on bifidobacteria abundance and gastrointestinal symptoms. Implications when following a low FODMAP diet.

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With thanks to Sarah Illingworth, Dietetics Academic Group Leader, London Metropolitan University, for her guidance and support with the systematic review process.

FODMAPs

Group of poorly absorbed, fermentable short-chain carbohydrates

- Enter proximal colon undigested
- Undergo rapid fermentation by commensal bacteria
- Resulting in abdominal distension and gas production
- Irritable bowel syndrome (IBS): ↑ visceral sensitivity elicits GI symptoms

FODMAPs

Fermentable

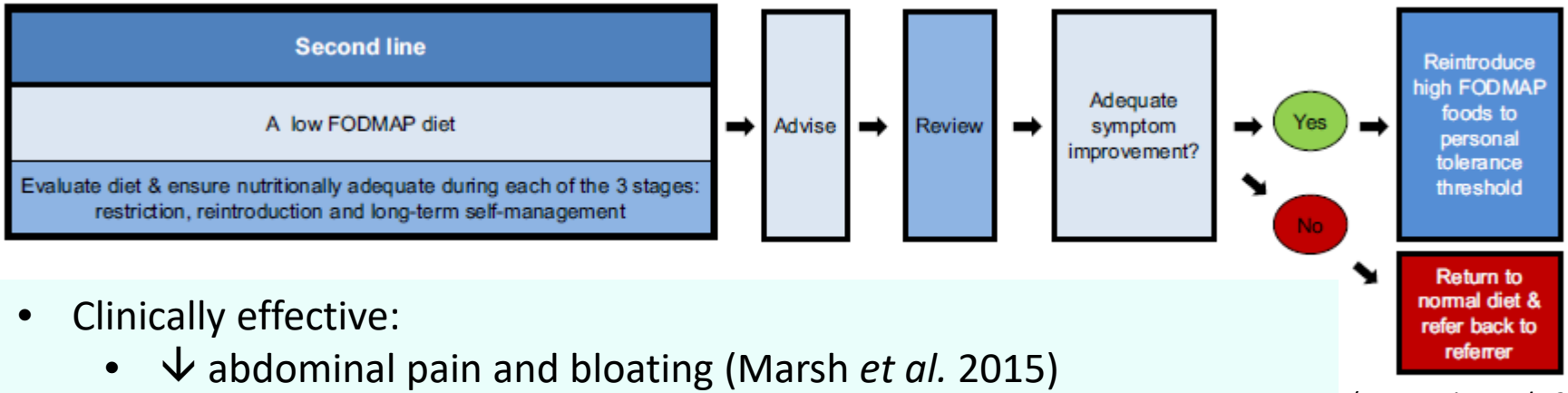
Oligosaccharides	**Fructans**: inulin, oligo-fructose (wheat, onions) **Galacto-oligosaccharides**: raffinose, stachyose (beans, pulses)
Disaccharides	**Lactose, lactulose** (milk)
Monosaccharides	**Fructose** (apples, pears)
Polyols	**Polydextrose, sorbitol** (broccoli), **mannitol** (cauliflower), **xylitol, erythritol, isomalt, maltitol** (sweeteners)

(Guy's and St Thomas' NHS Foundation Trust and Kings College London, 2014)

Low FODMAP diet (LFD)

British Dietetic Association (BDA) second-line IBS dietary guidelines

- 3 Stages: (1) Restriction, (2) reintroduction, (3) long-term self management



- Clinically effective:
  - ↓ abdominal pain and bloating (Marsh *et al.* 2015)
  - ↓ flatulence, ↓ urgency, ↓ borborygmi, ↑ stool satisfaction; improves overall symptoms (IBS-D, IBS-M) (McKenzie *et al.*, 2016)

(McKenzie *et al.*, 2016)

- Stages 1 & 2: **Dietitian-lead**
  1. 3-6 weeks FODMAP restriction
  2. Stepwise reintroduction of high FODMAP foods, to individual tolerance
- Stage 3: **Patient-led, long-term, self management**

Est. 84% of patients continue to restrict some high FODMAP foods long term, particularly wheat, onions and lactose-containing milk (Maagaard *et al.*, 2016).

FODMAPs as prebiotics

- **Some oligosaccharides are shown to act as prebiotics, stimulating the growth of *Bifidobacterium* spp. (Roberfroid and Gibson, 2010)**

- **Benefits of bifidobacteria**
  - Inhibit pathogenic bacteria colonisation
  - Assist gut-barrier integrity
  - Involved in vitamin synthesis
  - Emerging evidence of metabolic and immunomodulatory effects

- **Bifidobacteria in IBS**
  - Lower bifidobacteria levels have been observed in IBS (Rajilić-Stojanović *et al.,* 2011)
  - Lower bifidobacteria *may* be associated with ↑ pain (Parkes *et al*. 2012)

? **Does a low FODMAP diet ↓ bifidobacteria abundance and, if so,**
? **Is ↓ bifidobacteria abundance correlated with GI symptoms**

Aims & objectives

Aim:

- examine outcomes on **bifidobacteria abundance** and **gastrointestinal** (**GI) symptoms** associated with changes to FODMAP intake, to establish whether a LFD is a safe, as well as effective, treatment for IBS.

Objectives:

Primary

1. Determine the effect of ↑ / ↓ FODMAP intake on **bifidobacteria abundance**

2. Determine the effect of ↑ / ↓ FODMAP intake on **GI symptoms** (abdominal pain, bloating and flatulence)

Secondary

3. Determine whether bifidobacteria abundance correlated with GI symptoms

4. Determine whether changes to bifidobacteria levels, if any, persisted once participants returned to baseline diet.

Methods

1. **Search strategy**
   - Definition of search terms
   - PUBMED, EMBASE, COCHRANE, WEB OF SCIENCE core collection and TRIP database
   - March 2006 to March 2016
   - Rigorous inclusion / exclusion criteria
   - Key search terms: “oligosaccharide”, “lactose”, “fructose”, “polyol”, “microbiota”, “bifidobacteria” and “irritable bowel syndrome”.

Summary of inclusion criteria

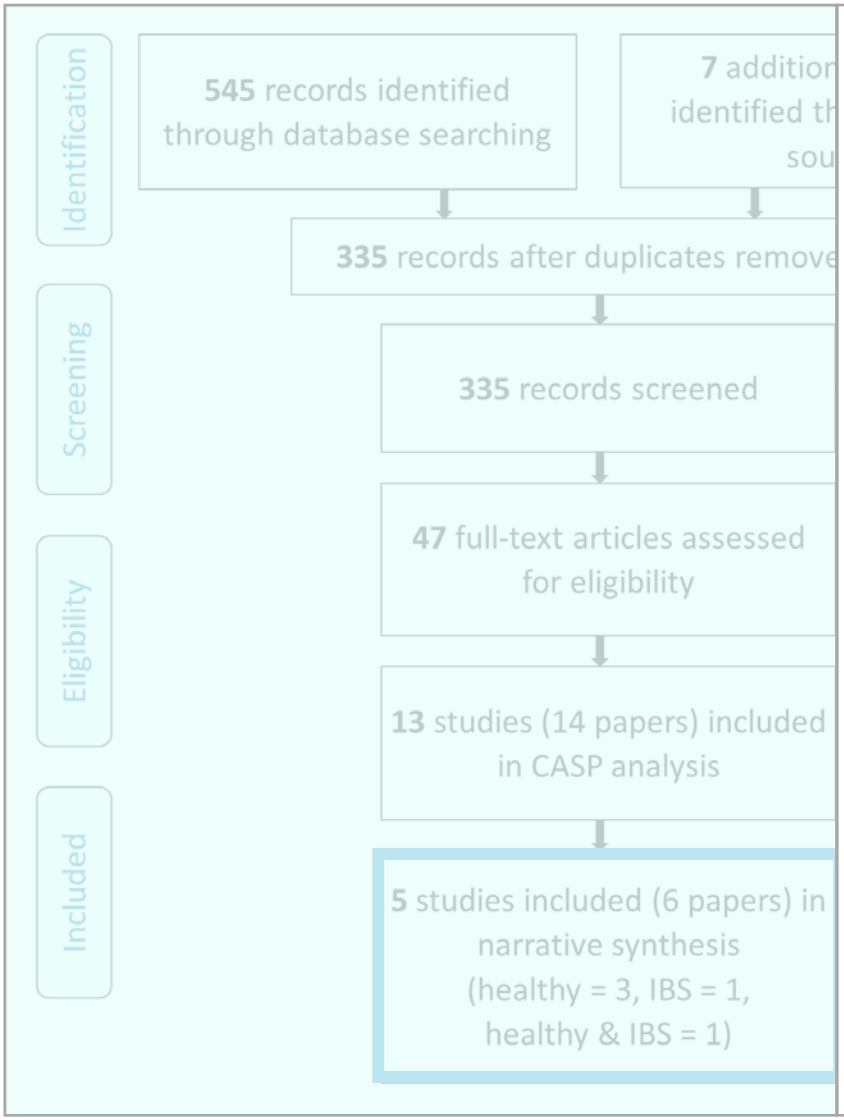
Human controlled trials
Adults 18-65 years inclusive
Healthy/IBS (Rome III)
Intact, functioning bowel
Dietary/supplemental FODMAP
Language: English

2. **Critical appraisal**
   - Critical Appraisal Skills Programme (CASP) tools

3. **Data extraction**

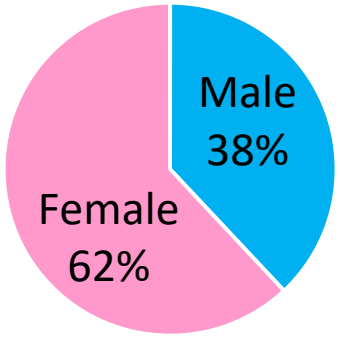
4. **Narrative synthesis**

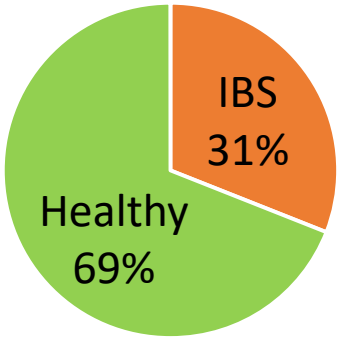
Study Selection



Study design and population characteristics

- 3/5 studies: **Inulin supplementation** in healthy individuals
- 1/5 studies: **FODMAP** ↓ in IBS
- 1/5 studies: **FODMAP** ↓ in IBS & healthy individuals





Participants: n=228

- All studies were carried out in industrialised countries, 3/5 in the UK.

Bifidobacteria abundance *(objectives 1 & 4)*

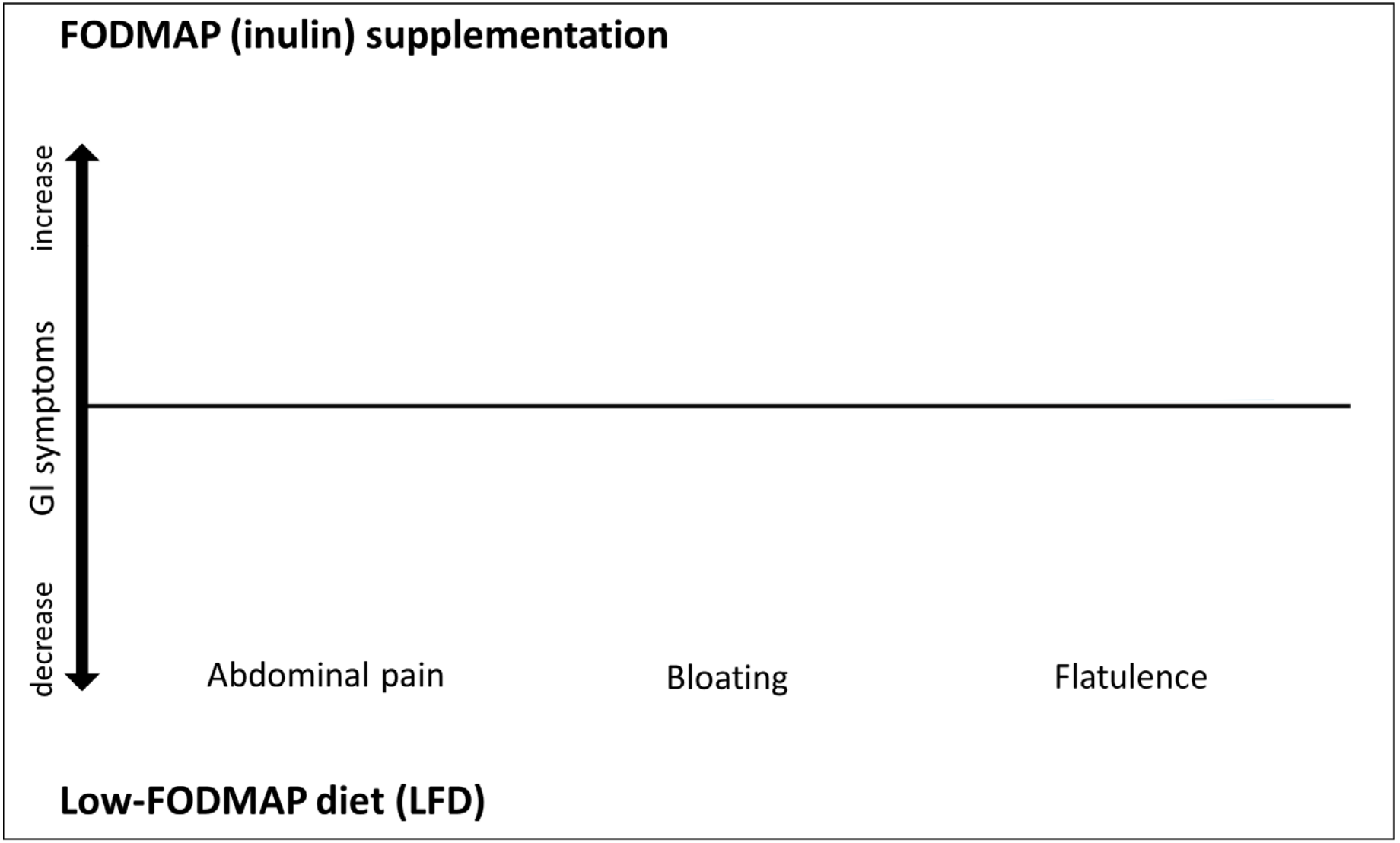
Absolute Faecal bifidobacteria abundance

Low-FODMAP diet (LFD) | **FODMAP (inulin) supplementation**

Relative faecal bifidobacteria abundance

Staudacher *et al.* (2012) found LFD to sig. ↓ relative bifidobacteria abundance compared with control (0.5, 0.2-0.9 vs. 3.2, 1.8-5.8, CI 95%; P<0.001). Halmos *et al.* (2015) reported a non-sig. ↓

GI symptoms *(objective 2)*



Bifidobacteria and GI symptoms

(objective 3)

- No association was found between faecal bifidobacteria abundance and GI symptoms, though only one study (Halmos *et al.,* 2015) investigated this.

Is a low-FODMAP diet
both <u>safe</u> and <u>effective</u>
for IBS symptom control

Conclusions

1

A LFD reduces absolute bifidobacteria abundance

- +ve association between inulin supplementation and absolute bifidobacteria abundance
- Effects of lactose, fructose, polyols and oligos. other than inulin have not been established.

2

A LFD is effective in managing common IBS-related symptoms of abdominal pain and bloating.

This agrees with robust existing evidence (Marsh *et al*., 2015; Rao *et al*., 2015)

3

An association between bifidobacteria abundance and GI symptoms could not be determined.

4

It could not be established whether bifidobacteria levels return to baseline in IBS populations on recommencement of habitual diet.

Recommendations

Research

- Effect of ↑ / ↓ lactose, fructose, polyols and oligosaccharides other than inulin on bifidobacteria abundance in IBS, including (1) whether bifidobacteria abundance correlates with GI symptoms; (2) whether bifidobacteria levels return to baseline on recommencement of habitual diet.
- Other dietary / supplementary means of ↑ bifidobacteria abundance.
  ? resistant starch, **?** polyphenols, **?** probiotics – and their impact on IBS symptoms.
- Review of the wider impact of FODMAP manipulation on (1) the microbiome – microbiota, SCFA production, faecal pH; (2) metabolic and immune system health.

Clinical practice

- Dietetic emphasis *not only* on FODMAP reintroduction to individual tolerance during stage 2 of second-line IBS dietary management, but also on an overall ↑ in dietary diversity during stage 3, to minimise the detrimental impact of long-term FODMAP restriction on bifidobacteria abundance.

  ? Longer period of dietetic input
  ? Probiotic supplementation

Thank you for listening

Any questions

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