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A dietitian led low FODMAP diet webinar: A pre-post study evaluating the impact on symptoms of Irritable Bowel Syndrome.

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Authors' contributions

MW and IEW designed the study. AC, KD, MW, IEW and LS devised the patient surveys. AC and KD processed the outcome data, performed the analysis, designed the figures, and wrote the manuscript. Critical feedback and contribution to the final version of the manuscript was given by MH, TA, IEW, MW, LS and OR. All authors have approved the final version of the paper submitted for publication.

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Iona Elborough-Whitehouse was a dietitian at Leeds Community Healthcare NHS Trust with interests in digital tools and clinical outcome measures.

Ethical approval was granted by Leeds Beckett University and Somerset NHS Foundation Trust to carry out this research.

conflict of interest

No, there is no conflict of interest.

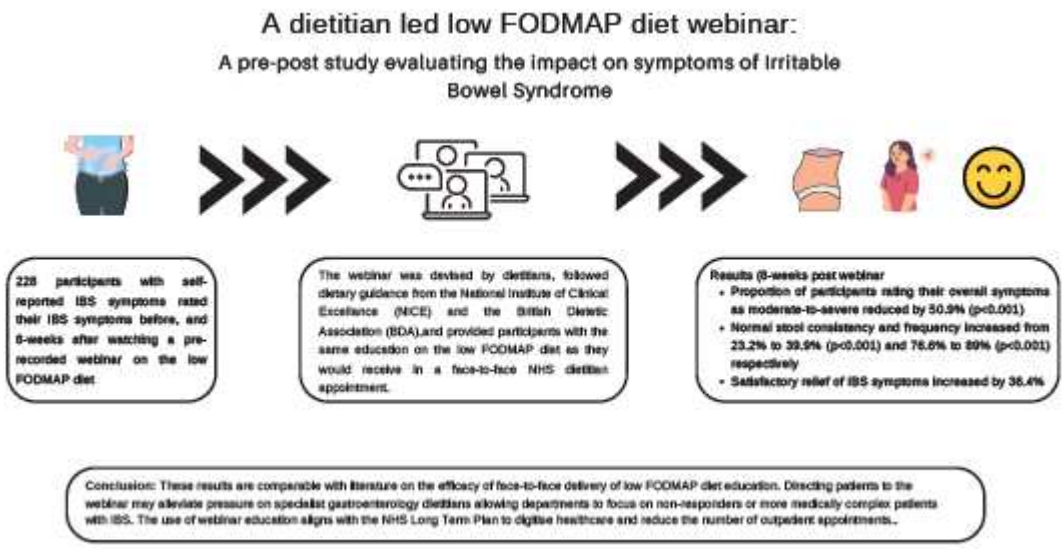
A dietitian led low FODMAP diet webinar: A pre-post study evaluating the impact on symptoms of Irritable Bowel Syndrome.

Abstract

Evidence suggests that the low FODMAP diet (Fermentable Oligo-, Di-, Mono-saccharides, And Polyols) improves Irritable Bowel Syndrome (IBS) symptoms when delivered by a dietitian. However, demand for dietetic appointments exceeds supply. Pre-recorded webinars are acceptable and cost-effective for delivering first-line IBS dietary advice. This study, using a pre-post design, aimed to evaluate the effectiveness of a low FODMAP diet restriction phase webinar at improving IBS symptoms. Participants with self-reported IBS symptoms were asked to report their IBS symptoms, stool frequency, stool consistency, and IBS medication use, before and 8-weeks post-webinar via an online questionnaire. The presence and severity of participants' symptoms and bowel habits were captured using validated tools and a global symptom question. In total 228 participants responded to both pre and post surveys. A statistically significant improvement in all symptoms was observed 8-weeks post-webinar ($p<0.05$). The proportion of participants rating their overall symptoms as moderate-to-severe reduced from 85.5% at baseline to 34.6% post webinar (50.9% reduction, ($p<0.001$)). The proportion of participants reporting normal stool consistency and frequency significantly increased post webinar (23.2% to 39.9%, ($p<0.001$) and 76.3% to 89% ($p<0.001$) respectively)). Satisfactory relief of symptoms increased from 16.7% to 53.1%, ($p<0.001$) 8-weeks post-webinar. These results are comparable with literature on the efficacy of face-to-face delivery of low FODMAP diet education. Dietitians should consider directing triaged patients with IBS, who have tried first-line dietary advice, to this webinar as an alternative or alongside current practice.

Graphical abstract

Participants' IBS symptoms improved 8-weeks after watching a pre-recorded low FODMAP diet advice webinar, with many achieving satisfactory relief. Directing patients to the webinar may alleviate pressure on specialist gastroenterology dietitians allowing departments to focus on non-responders or more medically complex patients with IBS.



Key points

- The low FODMAP diet has been shown to be effective in alleviating symptoms of Irritable Bowel Syndrome (IBS) when administered by a dietitian. However, demand for dietetic appointments currently exceeds capacity.
- Pre-recorded webinars have been shown to be a cost-effective and acceptable method for delivering first-line IBS dietary advice in previous research.
- This study aimed to evaluate the effectiveness of a dietitian developed low FODMAP diet webinar in improving IBS symptoms. Participants with self-reported IBS symptoms (n=228) completed online questionnaires before and 8-weeks after viewing the webinar.
- There was a statistically significant improvement across all IBS symptoms ($p<0.05$) 8-weeks post webinar.
- The proportion of participants rating their overall symptoms as moderate-to-severe reduced from 85.5% at baseline to 34.6% post webinar (50.9% reduction, ($p<0.001$)).
- The proportion of participants reporting normal stool consistency and frequency significantly increased post webinar (23.2% to 39.9%, ($p<0.001$) and 76.3% to 89% ($p<0.001$).
- Satisfactory relief of symptoms increased from 16.7% to 53.1%, ($p<0.001$) 8-weeks post-webinar.
- These findings align with previous research on the efficacy of face-to-face dietitian delivery of low FODMAP diet education and the use of pre-recorded

webinars supports the objectives of the NHS Long-term Plan to digitise healthcare and reduce the number of outpatient appointments.

- Dietitians should consider signposting triaged patients with IBS to the low FODMAP diet webinar as an alternative or to supplement current practice.
- Long-term follow up of this cohort will be explored in future research to determine how long participants experienced satisfactory relief from symptoms.

Keywords:
Dietetics < Clinical practice, Gastroenterology < Cellular and physiological function, Nutrition education < Clinical practice, Carbohydrate < Nutrients, Communication < Communication and education, Dietary Advice < Food intake, Fibre < Nutrients, Primary care < Care setting

Introduction

Irritable bowel syndrome (IBS) is a chronic and relapsing functional bowel condition. The prevalence of IBS is high globally, with 11% of the western population thought to be affected [(1)]. Symptoms include abdominal pain, bloating, and altered bowel habits including constipation and diarrhoea. Symptoms can be distressing, negatively impacting patients' quality of life and can result in significant healthcare utilisation, at a considerable cost to the National Health Service (NHS) in the United Kingdom (UK) [(2)]. The pathophysiology of IBS is unclear; however, it is thought to be related to factors including altered gut microbiota, increased visceral sensitivity, changes to gastrointestinal motility, and slight inflammation [(3)]. Gut brain interactions are also thought to play a role in the pathophysiology of IBS and cognitive behavioural therapy and gut-directed hypnotherapy may be effective at reducing global IBS symptoms [(4)].

Timely diagnosis and symptom management are essential to lessen the burden of IBS. Treatment usually comprises of dietary, psychological, and pharmacological methods [(5)]). Patients often recognise dietary triggers and approximately 60% of patients with IBS claim certain foods aggravate their symptoms [(3)]. The UK National Institute of Clinical Excellence (NICE) guidelines identify dietary intervention as an effective first-line approach for IBS [(2)]. This includes modifying fibre, fluid, and following a general healthy diet and lifestyle.

Fermentable Oligo-,Di- and Monosaccharides And Polyols (FODMAPs) are short-chain carbohydrates which may trigger IBS symptoms [(6)]. Clinical guidelines acknowledge the importance of the low FODMAP diet in IBS management [(2, 7)]. The low FODMAP diet generally involves three phases: FODMAP restriction; reintroduction; and personalisation, therefore it is a complex process [(8)]. Restriction is

recommended for 4-8 weeks [9]. The main dietary components excluded include wheat, lactose, pulses, legumes and a variety of fruit and vegetables. Short chain carbohydrates are poorly absorbed in the small intestine, causing increased production of gas, and increased intestinal osmolarity. Research shows approximately 70% of patients with IBS experience symptom improvement following a low FODMAP diet [9]. The staged reintroduction of FODMAPs is important to allow patients with IBS to identify foods they can consume without exacerbating their IBS symptoms and to prevent any negative effects on nutritional status or gastrointestinal microbiota [8].

Dietary advice should be given by a healthcare professional with dietary expertise [2]. The symptoms associated with IBS can be similar to those seen in other conditions such as coeliac disease, gluten sensitivity and food allergy. These conditions all require different diets, highlighting that specialist dietetic intervention is key to enabling patients to manage their conditions. However, the demand is exceeding capacity and dietetic departments are struggling to cope with a high number of referrals [10].

Alternative approaches to dietetic appointments have been implemented to reduce pressure on dietetic services, as one-to-one appointments can be time consuming. Group education can be useful when demand is higher than supply [11]. However, the demand is still beyond capacity, and the burden usually lies with primary and secondary care services [10]. The low FODMAP diet is becoming more popular and healthcare professionals with little dietary training are advising on the diet more frequently or suggesting patients get their information online, which may lead to patients with IBS acquiring very basic or inaccurate information [12, 13]. This highlights the need for more accessible dietetic, evidence-based advice.

Technology has the potential to transform dietetic practice, to make more effective use of finite time and resources and improve patient experience. The NHS long-term plan recognises digital transformation as a way to reduce patient waiting lists [14]. It is estimated that up to 75% of UK adults seek health information online [15]. There is a lot of dietary information available online, but many sources are not evidence-based or accurate [13]. Recently, several studies investigating the use of mobile applications to deliver or support low FODMAP diet education have demonstrated improvements in participants' IBS symptoms and quality of life [16-18], demonstrating that technology can play a role in supporting patients with IBS.

The digital format of a webinar allows patients to listen to expert NHS healthcare professionals. Pre-recorded webinars allow an unlimited number of patients to access online education at a time that suits them. They enable self-care whilst providing reliable specialist advice and potentially reducing pressures across the healthcare system [10]. Anecdotally, some patients feel uncomfortable talking about bowel habits, therefore webinars can be watched in privacy. Research has shown that the first-line dietary advice for IBS webinar was feasible, acceptable, and cost effective [10]. This suggests webinars could provide patients with IBS with evidence-based advice on the low FODMAP diet.

The aim of this study is to assess whether patients with IBS experience an improvement in their symptoms 8-weeks after watching the low FODMAP diet webinar. As literature on the low FODMAP diet indicates that 70% of patients with IBS experience symptom improvements following face-to-face low FODMAP dietary advice from a dietitian, it is hypothesised that patients with IBS accessing the low FODMAP diet webinar will experience similar improvements in symptom presence and severity.

Methods

A single group pre-post study design was used to evaluate the effectiveness of a low FODMAP diet restriction phase webinar. The webinar follows British Dietetic Association (BDA) and NICE guidance and provides patients with IBS with the same education on the low FODMAP diet as they would receive in a face-to-face NHS appointment with a dietitian [2, 7].

Individuals accessing the webinar between October 2020 and March 2022 were invited to complete a pre-webinar survey if they self-reported IBS symptoms. Participants may have been directed to the webinar as part of their local IBS dietetic management pathway, been directed there by other healthcare professionals aware of the resource, or come across the webinar independently. Those who indicated that they were watching for a friend or family member with IBS were directed straight to the webinar and were excluded. The inclusion criteria were individuals with IBS symptoms of any age, gender, and nationality. Individuals with IBS who declined to take part in the survey were still required to answer anonymous demographic questions to access the webinar. This was done to facilitate comparison of participants and individuals with IBS who declined to take part in the study to help identify selection bias. Participants

were contacted 8-weeks later with a post-webinar survey via text and/or email. Participants' pre- and post-webinar responses were matched using the email addresses and/or mobile numbers they provided.

Ethical approval for the study was granted by Leeds Beckett University and Somerset NHS Foundation Trust.

Developing the webinar

A PowerPoint presentation on the low FODMAP diet restriction phase was developed by three specialist gastroenterology community dietitians working in the Somerset NHS Foundation Trust. They used this to record a webinar which was edited and uploaded to www.patientwebinars.co.uk. The webinar was not branded, was free to access, and could be accessed outside of the UK. The webinar advised restricting FODMAPs for 4-8 weeks before reintroduction and signposted viewers to a separate reintroduction phase webinar available on the same website.

Data Collection

The pre- and post-webinar surveys were created using QUESTBACK (Questback, Bridgeport, CT, USA) software and contained validated tools to capture the presence and severity of participants' symptoms. The validated Gastrointestinal Symptoms Rating Scale (GSRS) was used to identify severity of symptoms based on the frequency and extent to which they affected social activities [(19)]. The GSRS has a four-point scale (0=no symptom, 1=mild, 2=moderate, 3=severe). The symptoms participants were asked to rate were abdominal pain, bloating, flatulence, burping, borborygmi, urgency to defecate, incomplete evacuation of bowels, nausea, heartburn, acid regurgitation and tiredness [(20)]. Symptom response was assessed by changes in the proportion of participants reporting the presence of a score of 2-3 (moderate to severe symptoms) on the GSRS.

Participants were asked how often they passed a stool and its consistency based on the Bristol Stool Form Scale (BSFS). This seven-point scale describes different stool types ranging from separate, hard lumps (types 1-2), normal (types 3-5) to watery with no solid pieces (types 6-7) [(21)]. Stool consistency was also recoded to normal (types 3-4 and 4-5) and abnormal (types 1-2. 2-3, 5-6, 6-7) and variable across all types. When the surveys went 'live' participants were mistakenly allowed to select multiple responses

to the BSFS. This error affected 37 (16%) pre-survey responses and 24 (11%) post-survey responses. It was decided that if participants had selected 'variable' as one of their responses, then they would be recorded as having a 'variable' stool type. If they had not selected 'variable', but had selected multiple other stool types, then their stool type would be recorded as their most extreme selection from normal (type 3-4). For example, if participants selected type 5-6 and type 6-7, they would be recorded as type 6-7.

Stool frequency was reported on a seven-point Likert scale which has been previously used with patients with IBS [11]. This seven-point scale ranged from 1=once a week, to 4=once a day, to 7=over 7 times per day. Stool frequency responses were recoded into normal (between once every 3 days and up to 3 times a day) and abnormal (less than every 3 days or more than 3 times a day).

The validated global symptom question "do you currently have adequate relief of your gut symptoms?" was included as it is a straightforward outcome to measure and analyse and simply requires a 'yes' or 'no' answer [22].

To assess adherence to FODMAP restriction participants were asked "how strictly" and "how long" they followed the low FODMAP diet. Strictness was rated on a 6-point Likert scale ranging from 1=all of the time, to 5=hardly at all, to 6=I decided not to follow the diet. Duration was also rated on a 6-point Likert scale (1=less than two weeks, 2=two to four weeks, 3=four to six weeks, 4=six to eight weeks, 5=more than eight weeks, 6=I decided not to follow the low FODMAP diet).

Data was collected on participants' use of prescribed medication for IBS and whether they had been officially diagnosed with IBS by a healthcare professional. Participants without an official diagnosis were still included in the study. These questions allowed for only one answer per question.

Participants were asked to indicate the factors that were important to them when choosing to watch the low FODMAP diet webinar and what they would have done had the webinar not been available. These questions allowed for multiple answers.

To assess the patient acceptability of the webinar participants were asked to rate how likely they would be to recommend the low FODMAP diet webinar to a friend or family member on a 5-point Likert scale ranging from 1=very likely, to 5=very unlikely.

The pre- and post-survey questions are provided in the supporting information.

Sample size

The UK has a population of 67.1 million people [23]. Irritable Bowel Syndrome is estimated to have a prevalence of 11% in the UK [1]. For the purposes of calculating sample size, the population from which the sample was drawn was estimated to be 7,381,000. Assuming a population of 7,381,000 a confidence interval of 5% and a confidence level of 95%, a sample size of 384 was indicated [24].

The slow rate of participant responses meant a much longer data collection period would be needed to achieve the target sample size of 384. Resource limitations meant an early analysis of the data was considered appropriate acknowledging a confidence interval of 6%.

Statistical analysis

Statistical analysis was performed using IBM SPSS (version 26). Demographics of participants and non-participants were analysed descriptively and presented as frequencies and percentages.

A Wilcoxon ranked test was applied to determine whether there were any statistically significant changes in the severity of the cohort's individual and overall symptoms.

McNemar's test was used to determine if there was a statistically significant change in the proportion of participants reporting normal stool frequency, normal stool consistency, current use of prescribed medications, and satisfactory relief of their IBS symptoms.

The demographic characteristics of participants and non-participants were compared and analysed using Mann-Whitney test for ordinal categorical data, and Chi-squared test for nominal categorical data.

$P<0.05$ was considered statistically significant.

Results

Figure 1 shows the recruitment for the study, showing a 36% take up rate for the survey and a large attrition rate of 58%, resulting in only 15% of those eligible completing the

pre and post surveys. Participants completed the post-survey an average of 9-weeks post-webinar (range of 8-14 weeks).

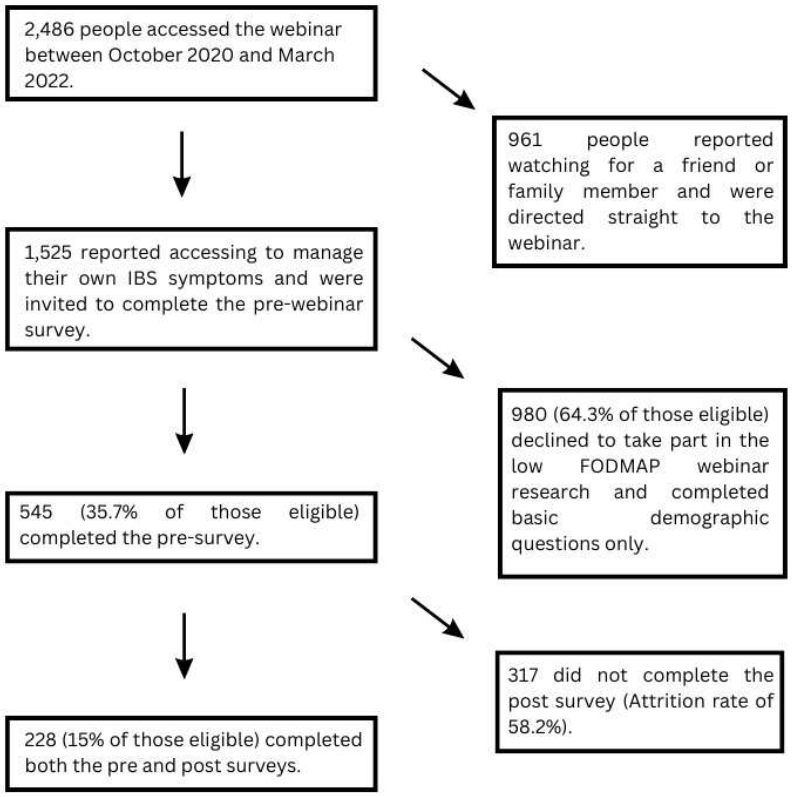


Figure 1: Flow diagram of participants accessing the dietitian led low FODMAP diet webinar.

Basic demographics of participants and non-participants

Of the 228 participants in this study, 170 (74.6%) reported a formal diagnosis of IBS by a healthcare professional. Most participants were female (80%), aged between 55-64 years (31%), had suffered symptoms between 1-5 years (41%), lived in the southwest of England (33%), and had watched the IBS first-line dietary advice webinar (66%) (Table 1). Participants and non-participants differed in terms of gender, age (younger), years of IBS symptoms, and location (Table 1). This indicates that participants did not wholly represent the IBS patient population.

The proportion of participants taking prescribed medications for their IBS reduced from 85 (37.3%) at baseline to 75 (32.9%) participants at 8-week follow-up, although this decrease was not statistically significant (p=0.18).

Table 1: Demographics of participants and non-participants.

Demographic		Participants N (%)	Non-participants N (%)	P value
Gender	Female	182 (79.8)	735 (75)	0.005*
	Male	44 (19.3)	181 (18.5)	
	Other	1 (0.4)	3 (0.3)	
	Prefer not to say	1 (0.4)	61 (6.2)	
Age (years)	Under 17	3 (1.3)	9 (0.9)	<0.001*
	18-24	11 (4.8)	121 (12.3)	
	25-34	27 (11.8)	179 (18.3)	
	35-44	36 (15.8)	189 (19.3)	
	45-54	36 (15.8)	133 (13.6)	
	55-64	71 (31.1)	179 (18.3)	
	65-74	35 (15.4)	139 (14.2)	
	Over 75	9 (3.9)	31 (3.2)	
Years of symptoms	Less than 1 year	26 (11.5)	166 (17.1)	0.013*
	1-5 years	93 (41)	377 (38.9)	
	6-10 years	17 (7.5)	142 (14.7)	
	11-15 years	30 (13.2)	94 (9.7)	
	Over 15 years	61 (26.9)	190 (19.6)	
Location	Yorkshire and the Humber	6 (2.6)	52 (5.3)	0.001*
	East Midlands	5 (2.2)	47 (4.8)	
	East of England	12 (5.3)	35 (3.6)	
	London	9 (3.9)	93 (9.5)	
	Northeast England	21 (9.2)	47 (4.8)	
	Northwest England	16 (7)	71 (7.2)	
	Outside UK or Ireland	6 (2.6)	51 (5.2)	
	Scotland	15 (6.6)	64 (6.5)	

	South East England	51 (22.4)	175 (17.9)	
	South West England	74 (32.5)	268 (27.3)	
	Wales	5 (2.2)	9 (0.9)	
	West Midlands	8 (3.5)	50 (5.1)	
	Republic of Ireland	0 (0)	8 (0.8)	
	Northern Ireland	0 (0)	10 (1)	
Previously watched first-line dietary advice webinar	Yes	149 (65.6)	600 (61.2)	0.007*
	No	76 (33.5)	317 (32.3)	
	Don't know	2 (0.9)	57 (5.8)	

*P values calculated using Mann-Whitney test for ordinal categorical data and chi-squared test for nominal categorical data.

Participants' gastrointestinal symptoms

Table 2 shows the symptoms and stool output reported by participants at baseline and 8 weeks post webinar. All reported symptoms reduced after the webinar. At baseline, the most common symptoms were abdominal pain, bloating, increased wind, and tiredness. Over 60% of participants rated these symptoms as moderate-to-severe. The least common symptoms at baseline were acid regurgitation and heartburn. The proportion of participants rating their overall symptoms as moderate-to-severe reduced by 50.9%. Those reporting satisfactory relief of their IBS symptoms increased 36.4% 8-weeks post-webinar (Table 2).

Table 2: Symptoms and stool output reported by participants, at baseline and 8-weeks post-webinar.

Outcome	Participants (n=228)		
	Baseline N (%)	8-weeks post-webinar N (%)	P-value
Abdominal pain/discomfort[a]	154 (67.5)	65 (28.5)	<0.001
Abdominal bloating/distension[a]	153 (67.1)	64 (28.1)	<0.001
Increased wind/ flatulence[a]	138 (60.5)	60 (26.3)	<0.001

Belching/burping[a]	54 (23.7)	37 (16.2)	0.022
Borborygmi[a]	104 (45.6)	43 (18.9)	<0.001
Urgency to open bowels[a]	114 (50)	61 (26.8)	<0.001
Incomplete evacuation[a]	120 (52.6)	62 (27.2)	<0.001
Nausea[a]	57 (25)	31 (13.6)	<0.001
Heartburn[a]	43 (18.9)	23 (10.1)	0.001
Acid regurgitation[a]	33 (14.5)	15 (6.6)	<0.001
Tiredness[a]	144 (63.2)	88 (38.6)	<0.001
Overall symptoms[a]	195 (85.5)	79 (34.6)	<0.001
Stool frequency[b]	174 (76.3)	203 (89)	<0.001
Stool consistency[b]	53 (23.2)	91 (39.9)	<0.001
Satisfactory relief of IBS symptoms[c]	38 (16.7)	121 (53.1)	<0.001

a Proportion of respondents reporting moderate-to-severe symptoms

b Proportion of respondents reporting normal stool frequency and consistency

c Proportion of respondents reporting a positive answer to the question "Do you currently have satisfactory relief of your IBS symptoms?"

The proportion of participants reporting normal stool frequency (between once every 3 days and 3 times per day) increased post webinar (Table 2). Figure 2 shows stool types at baseline and 8-weeks post webinar. At baseline, the most reported stool consistencies were variable, and type 5-6. Type 2-3 was the least reported stool consistency at baseline. Post-webinar, the most reported stool types were type 4-5 and type 3-4, which were considered a normal stool consistency. Loose stools (type 6-7) were the least commonly reported stool type post-webinar.

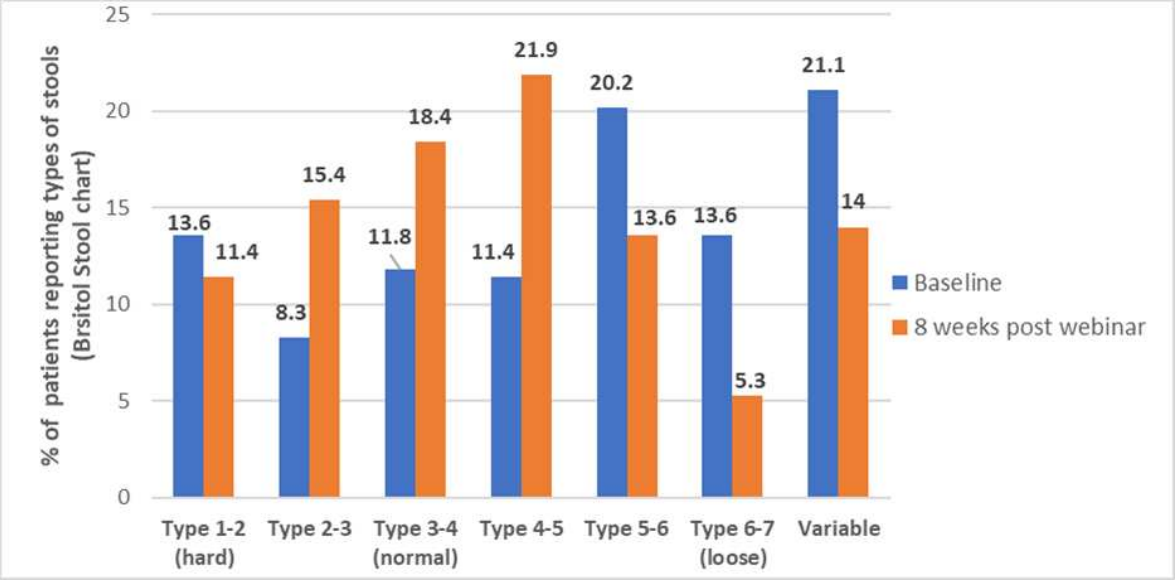


Figure 2: Participant stool types at baseline and 8-weeks post low FODMAP diet webinar.

Duration and strictness of the low FODMAP restriction phase

Figures 3 and 4 show the reported duration of adherence to the low FODMAP diet and strictness of adherence. Most participants followed the diet for between 4-8 weeks, as recommended in the webinar. Some participants reported that they decided not to follow the low FODMAP diet, or that they followed the diet for more than 8 weeks. Over three quarters of participants indicated that they followed the low FODMAP diet 'all of the time' or 'most of the time'.

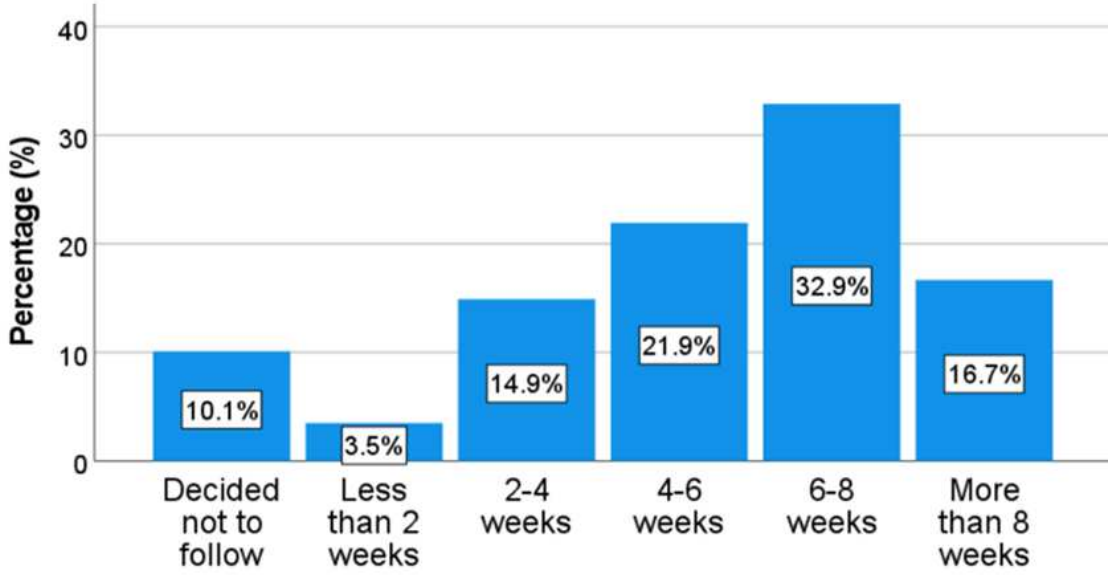


Figure 3: Participants' reported duration of low FODMAP diet adherence.

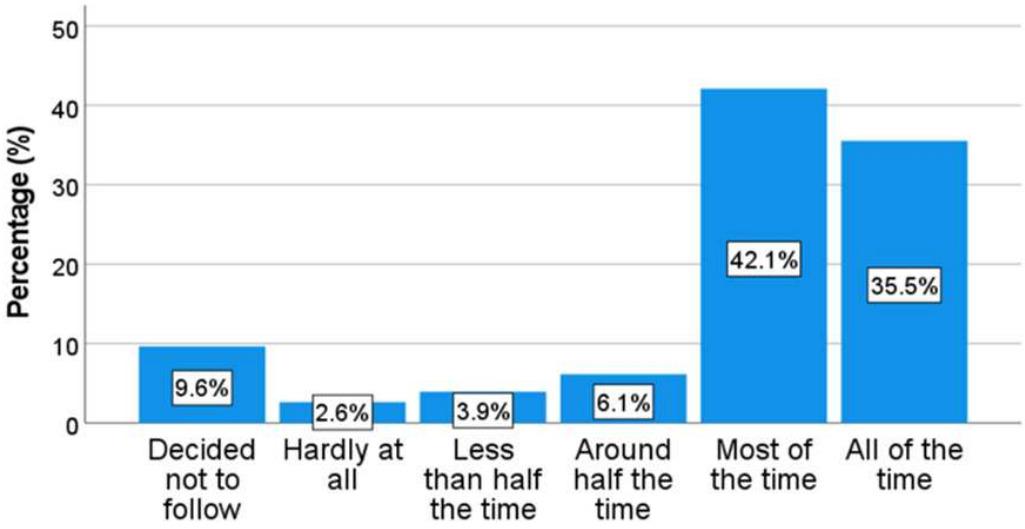


Figure 4: Participants' reported strictness of low FODMAP diet adherence.

Participant feedback on the webinar

Participants were asked about the factors that were important to them when choosing to access the webinar (Figure 5). The most influential factors were 'access to accurate and reliable information', 'being able to rewatch the webinar', 'instant access to specialist information', and 'no wait for a specialist appointment'.

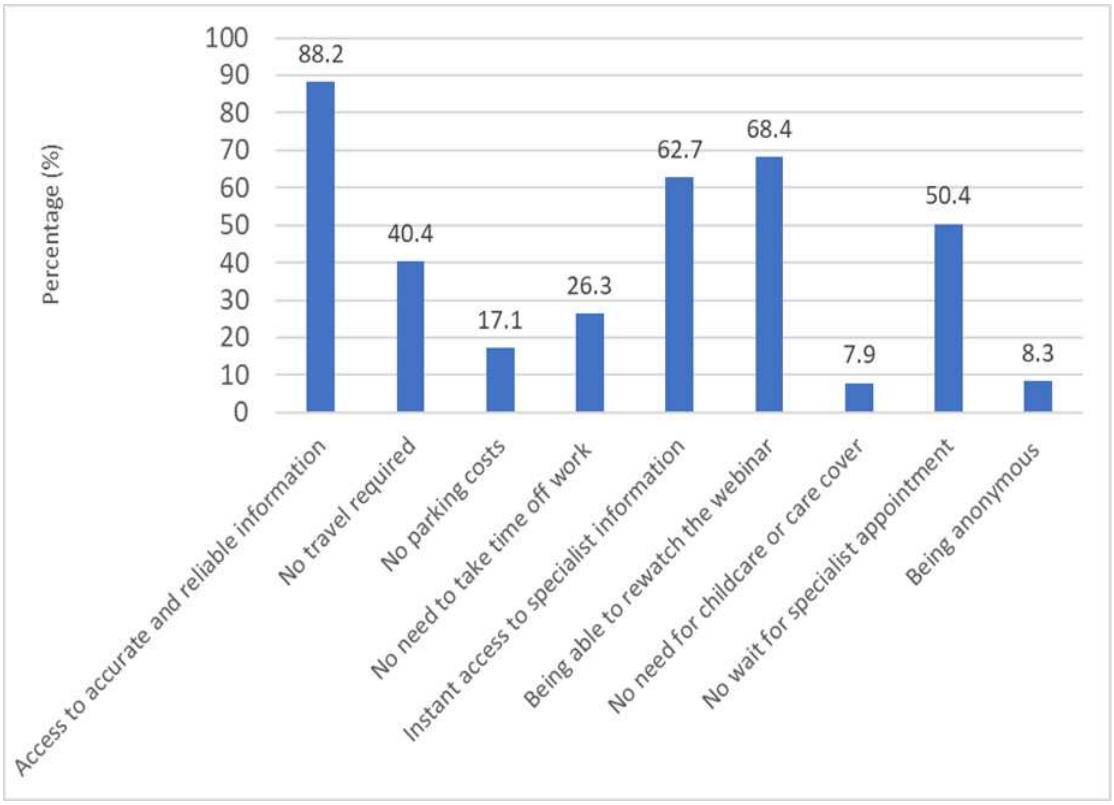


Figure 5: Participant feedback on factors important to them when deciding to access the low FODMAP diet webinar.

Participants were asked about what action they would have taken if the low FODMAP diet webinar was not available. Most participants indicated they would have looked up information about the low FODMAP diet on the internet or would have requested an appointment with a specialist dietitian (Figure 6). Some participants indicated they would make an appointment with their General Practitioner (GP) or a consultant (Figure 6).

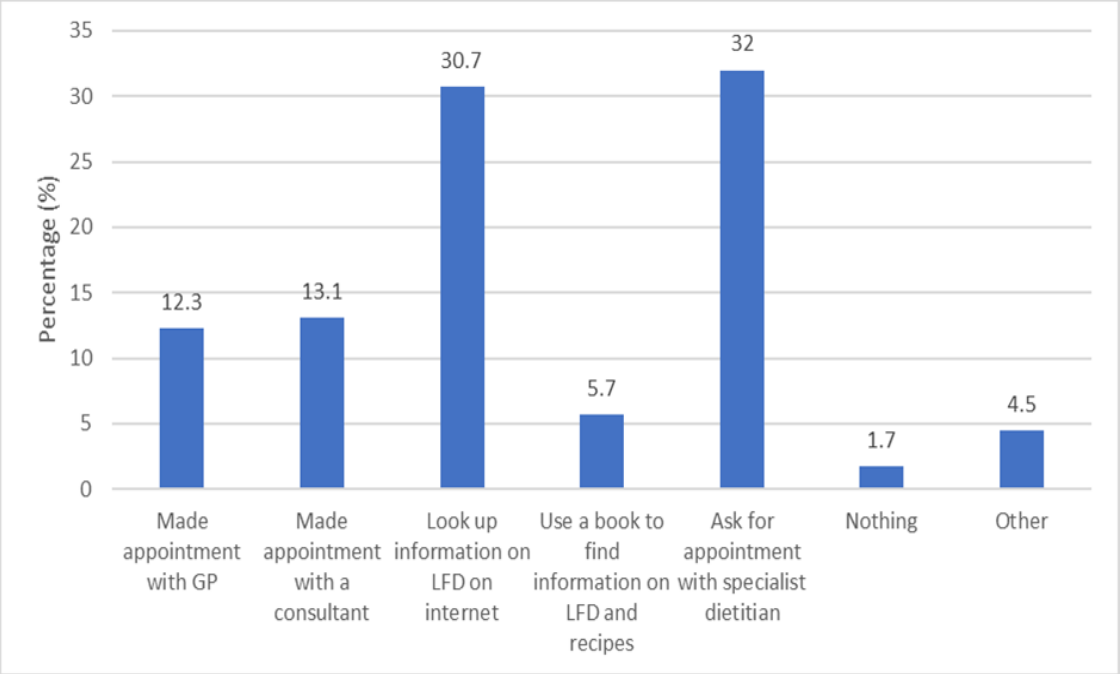


Figure 6: Participant feedback on what action they would have taken had low FODMAP diet webinar not been available.

The acceptability of the webinar was high with 88.6% of participants indicating that they were 'very likely' or 'likely' to recommend the webinar to a friend or family member with IBS.

Discussion

This study showed that participants' IBS symptoms improved 8-weeks after watching a pre-recorded low FODMAP diet advice webinar, with those achieving satisfactory relief increasing by 36.4%.

IBS symptoms

The most common symptoms at baseline were abdominal pain, bloating, increased wind, and tiredness, all of which improved 8-weeks post webinar. This is consistent with data from one-to-one and group low FODMAP diet education delivered face-to-face [11, 25, 26].

A recent study [17] reported significant decreases in the presence of mild-to-severe abdominal pain, bloating, and flatulence (13%, 11%, and 10% respectively) after 2-8 weeks of low FODMAP diet education delivered via a mobile application. One-to-one low FODMAP diet education, followed by mobile application support for 4 weeks, produced a clinically significant response in 57% of participants (as defined by a 50-

point decrease in the IBS Severity Scoring System) [18]. The present study assessed changes in the presence of moderate-to-severe symptoms on the GSRS which makes direct comparisons with results from the above studies challenging [17,18]. However, these studies add to a growing evidence base which supports the use of technology to deliver low FODMAP diet education.

Tiredness was a common symptom pre-webinar, and it was the highest reported symptom post-webinar. Low iron, folate, or vitamin B12 status can result in anaemia, which is a potential cause of fatigue in patients with IBS [27]. A limitation of webinars is that patients' blood results cannot be reviewed by a dietitian, which would typically be done in a face-to-face appointment to confirm or eliminate the possibility of nutritional deficiencies. Nevertheless, factors such as sleep, stress, and other concurrent medical conditions may contribute to tiredness in patients with IBS.

In this study satisfactory relief of gastrointestinal symptoms increased, but to a lesser extent than other reported data. Seamark et al. [25] and Nawawi et al. [26] reported satisfactory relief in 66% of participants with IBS at 9- week and 12-week follow up respectively. The proportion of participants reporting satisfactory relief of gastrointestinal symptoms at baseline was lower (10% versus 16.7%) and medication use was higher in research by Seamark et al. [25]. Taken together, this suggests that viewers of the low FODMAP diet webinar had less severe baseline symptoms than patients with IBS seen elsewhere in clinical practice. This is plausible, considering participants in Seamark et al. [25] had been officially diagnosed by a GP or consultant and referred to the dietetic service where the research took place. Participants in the present study self-reported their IBS symptoms, and a quarter reported being self-diagnosed. A service evaluation of group low FODMAP diet education [11] reported similar levels of satisfactory relief of symptoms at baseline (18%) and 6-week follow-up (54%) as the present study, supporting the idea that the patient cohorts are slightly different in the alternative settings.

Stool consistency

The proportion of participants with loose stools (types 6-7) reduced by over half at 8-week follow up, which is encouraging as many patients with IBS report that bowel issues have the most detrimental impact on their quality of life [25]. It has been reported that diarrhoea predominant IBS may respond better to the low FODMAP diet than

constipation predominant IBS [7]. The low FODMAP diet excludes many sources of fibre and reduces the amount of water in the small intestine, both of which may exacerbate constipation in patients with IBS [28]. Interestingly, Whigham et al. [11] categorised participants according to IBS subtype and found that both those with constipation predominant IBS and diarrhoea predominant IBS reported similar levels of satisfactory relief when adhering to a low FODMAP diet.

Normal stool consistency (defined as types 3-4 and types 4-5 in the present study) increased post-webinar, but not as much as in previous low FODMAP diet education research. In a service evaluation of low FODMAP diet group education [11], the proportion of participants reporting normal stool consistency significantly increased from 57% at baseline, to 72% at follow-up (>6 weeks). The proportion of participants with a normal stool consistency at baseline in Seamark et al. [25] was similar to the present study (23%). This increased to 49% at short-term follow-up in that face-to-face cohort. The differences in results can be explained partly by varying definitions of normal stool consistency in those studies. Whigham et al. [11] defined normal stool consistency as discrete types 3, 4 or 5, while Seamark et al. [25] classified it as types 3 or 4 only. However, the technical error with the BSFS in the online surveys (participants could select more than one option), and coding solution applied, means that the proportion of participants reporting normal stool consistency in the current study may be slightly under-represented. All these studies show consistently that an increased frequency of 'normal' stools is reported by participants following low FODMAP diet education, indicating that dietary changes do result in more normal bowel function in a proportion of patients with IBS.

Low FODMAP diet adherence

Around 10% of participants decided not to follow the low FODMAP diet and the main reason provided was the challenge of managing other medical conditions alongside IBS. This suggests medically complex patients would still benefit from one-to-one appointments with a dietitian, where dietary advice could be tailored to account for coexisting medical conditions. Qualitative research suggests patients with IBS can view low FODMAP diet advice as contradicting 'healthy eating' advice and that adapting advice to fit in with their lifestyle and social activities can be burdensome [12]. Most participants in the present study reported following the diet for 4-8 weeks (54%). Three

quarters (77.6%) of participants reported following the diet 'strictly', however this was self-reported on a Likert scale rather than using a validated tool. Likert scales can be subjective and open to responder bias. In one-to-one appointments adherence could be assessed by a dietitian via a detailed diet history. Patients with IBS who follow the low FODMAP diet strictly for 4-8 weeks and see no improvements may benefit from seeing a dietitian face-to-face to further investigate their symptoms, barriers to adherence, and to discuss other treatment options. These include trialling probiotics (should these not have been trialled with first-line IBS advice), dietary fibre supplements like ispaghula or psyllium, or signposting to psychological inventions like cognitive behavioural therapy [2,7].

Participant feedback on the low FODMAP diet webinar

The acceptability of the webinar was high among participants. The most cited reason for accessing the webinar was 'access to accurate and reliable information'. It is important that patients with IBS have access to accurate and reliable information on the low FODMAP diet online, since up to 75% of the UK population already seek health information online [15]. When asked what they would have done had the webinar not been available, a third of participants stated that they would have looked up information about the diet online. There is evidence that the quality and reliability of online nutritional content can be poor, and that dietitian-produced content is underrepresented [13]. A strength of the low FODMAP diet webinar is that it was devised by dietitians and follows NICE and BDA guidance [2, 7]. A quarter of participants stated that if the webinar had not been available that they would have sought help from their GP or secondary care consultant instead. This highlights how the webinar can help reduce the burden not only on dietetic services but also on over stretched primary and secondary care medical services. Participants also appreciated the ability to 'rewatch the webinar' (68.4%), which is an advantage of pre-recorded webinars versus face-to-face or remote dietetic consultations. The accuracy and reliability, and the ability to rewatch the webinar content also ranked highest among viewers choosing to watch the first-line dietary advice webinar in previous research [10].

Strengths and limitations

There were several strengths to this research. Symptom severity was investigated using the validated GSRS tool, which increases the validity and reliability of participant responses, and allows direct comparisons with other studies using the GSRS.

The capturing of non-participants' demographic data allowed for identification of selection bias. Most participants and non-participants were female. Not surprising, as IBS is reported to have a higher prevalence in women [(29)]. Participants and non-participants differed in demographics so the sample may not be wholly representative of patients with IBS willing to use an online webinar. This means some caution is needed in applying the results to all patients with IBS but does show substantially positive results for those that did participate in the survey.

There was a high attrition rate between surveys, which increases the probability of non-response bias. Perhaps participants did not complete the second survey because they did not see an improvement in their IBS symptoms? Equally possible is that because they felt better, they felt no motivation to return to the survey.

Due to the study's observational design, it is not possible to draw clear conclusions on cause and effect. The placebo effect is reported to be significant in IBS research [(30)]. Participants' expectations of the low FODMAP diet may have affected how they recorded their symptoms.

Prescribed medications, stress levels and stress management techniques, other simultaneous dietary changes, and exercise can affect IBS symptoms. These factors were not controlled for in the present study. Additionally, there was no control group which affects internal validity.

A quarter of participants reported self-diagnosing themselves with IBS and there was no way to confirm a diagnosis in those who reported an official diagnosis of IBS. Therefore, it cannot be confirmed that all participants had IBS, and that there were no other reasons for gastrointestinal symptoms such as coeliac disease or inflammatory bowel diseases.

This recording decision applied to the BSFS means that participants reporting a normal stool type may have been slightly underrepresented in both surveys.

The low FODMAP diet includes the reintroduction and personalisation phases as well as the restriction phase. This study did not investigate these. Long term follow-up of

this cohort will be explored in future research to determine how long participants experienced adequate relief from their IBS symptoms.

Recommendations for practice

Directing patients with IBS for whom first-line advice has not been effective, to watch the low FODMAP diet webinar, may eliminate the need for a one-to-one dietetic appointment in many patients. A webinar on the low FODMAP diet reintroduction phase is also available. This aligns with the NHS long-term plan of digitising healthcare to reduce outpatient appointments. This would free up specialist gastroenterology dietitians' time to focus on complex IBS cases, or patients with other gastrointestinal disorders like coeliac and inflammatory bowel diseases. Additionally, as the webinar was devised by dietitians and follows NICE and BDA guidance, its presence on the internet may prevent patients with IBS accessing inaccurate, lower quality low FODMAP diet content online and may help to reduce demand for GP or consultant appointments. Patients with IBS could be triaged by overburdened dietetic services allowing for those with complex medical needs, non-English speakers, or those without digital access to be seen in a one-to-one setting. In Somerset the NHS dietetic team make self-referral forms available for those who do not respond to low FODMAP diet webinar advice or for those who prefer a one-to-one appointment. For non-responders, a one-to-one appointment can then focus on tailoring the advice to the individual and teasing out any points of confusion in dietary adherence or onward referral for an alternative diagnosis.

Conclusion

Most participants experienced some improvements in their IBS symptoms 8-weeks after viewing the low FODMAP diet webinar. Directing patients with IBS to the webinar may alleviate pressure on specialist gastroenterology dietitians allowing departments to focus on non-responders or more medically complex IBS cases. The use of webinar education aligns with the NHS Long Term Plan to digitise healthcare and reduce the number of outpatient appointments.

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