



Research paper

# Yoga use, physical and mental health, and quality of life in adults with irritable bowel syndrome: A mixed-methods study

Lucy Doyle, Tina Cartwright\*

Postal address: School of Social Sciences, University of Westminster, 115 New Cavendish Street, W1W 6UW



## ARTICLE INFO

## Keywords:

Irritable Bowel Syndrome  
IBS  
yoga  
Quality of Life  
COM-B  
mixed methods

## A B S T R A C T

**Introduction:** Intervention studies show yoga has several physical and psychological benefits for Irritable Bowel Syndrome (IBS), however few studies have explored yoga use in everyday life amongst people with IBS. This study explored yoga use as a predictor of IBS-related quality of life (QoL) in relation to other physical and psychological factors. It also utilized the Capability, Opportunity, Motivation-Behaviour (COM-B) model to investigate predictors of yoga practice, with a qualitative exploration of perceived IBS-related benefits and barriers to yoga.

**Methods:** A cross-sectional, mixed-methods survey was used. A total of 219 adults with IBS (86.3% female, 32% yoga practitioners, mean age 46.42 years) completed a questionnaire battery to assess symptom severity, psychological symptoms, general health, QoL, COM-B constructs in relation to yoga, and perceived effectiveness of yoga for IBS. Open-ended responses assessing perceptions of yoga in relation to IBS were analysed using thematic analysis.

**Results:** In hierarchical linear regression, education, yoga use, symptom severity, anxiety, depression, and general health explained 64.6% of variance in QoL ( $p < .001$ ). Yoga use explained 6.1% after controlling for education. In hierarchical logistic regression, COM-B constructs explained 37.5% of the variance in yoga use ( $p < .001$ ). In the final model, only Opportunity ( $p < .05$ ) and Motivation ( $p < .001$ ) significantly predicted yoga practice. Qualitative analysis identified three themes reflecting perceived benefits of yoga (*IBS Relief, A Valuable Self-Management Tool, Holistic Wellbeing*), and three reflecting perceived barriers/limitations (*Lack of Physical Capability, Need for a Tailored Approach, Limited Motivation*).

**Conclusion:** This study identified significant relationships between yoga use in everyday life, physical and mental health, and IBS-related QoL, and identified the COM-B model as a useful framework for understanding yoga practice amongst people with IBS. The findings demonstrate that practicing yoga as part of daily life may positively impact both physical and mental health of IBS patients. Furthermore, the findings can be used to inform more targeted yoga interventions and increase accessibility of yoga for this group.

## 1. Introduction

Irritable Bowel Syndrome (IBS) is a long-term functional gastrointestinal condition affecting around 3.2 million people in the UK [1]. It is characterised by abnormal bowel movements, abdominal pain, and abdominal distention [2]. Although its exact causes remain unknown, dysfunction of the brain-gut axis may play a role in the development and maintenance of symptoms through increasing sensitivity to visceral sensations within the bowel [3–5]. Several triggers for IBS have also

been identified, including bacterial and viral infections of the gut [6,7], psychological stress [8,9] and consumption of certain foods, commonly including dairy products, carbohydrates, and foods high in fat [10–12].

In addition to its physical presentation, IBS is associated with increased anxiety and depression [13,14], poorer health-related quality of life [15–17], and disruptions to work and social life [18,19], whilst estimated annual costs to UK healthcare systems for its treatment are as high as £200 million [20,21]. Although medications can be used to manage some symptoms, these often have undesirable side-effects and

**Abbreviations:** IBS, Irritable Bowel Syndrome; QoL, Quality of life; COM-B, Capability, Opportunity, Motivation-Behaviour; RCT, Randomized Controlled Trial; IBS-SSS, Irritable Bowel Syndrome Severity Scoring System; HADS, Hospital Anxiety and Depression Scale; IBS-QoL, Irritable Bowel Syndrome Quality of Life questionnaire; TA, Thematic Analysis.

\* Corresponding author.

E-mail addresses: [w1841522@my.westminster.ac.uk](mailto:w1841522@my.westminster.ac.uk) (L. Doyle), [T.Cartwright@westminster.ac.uk](mailto:T.Cartwright@westminster.ac.uk) (T. Cartwright).

<https://doi.org/10.1016/j.eujim.2023.102270>

Received 7 December 2022; Received in revised form 9 June 2023; Accepted 19 June 2023

Available online 20 June 2023

1876-3820/© 2023 The Author(s).

Published by Elsevier GmbH. This is an open access article under the CC BY license

(<http://creativecommons.org/licenses/by/4.0/>).

limited efficacy in improving overall wellbeing [22], and there is currently no standard pharmacological treatment for IBS [7,23]. Subsequently, The National Institute for Health and Care Excellence states clinicians should encourage self-management of the condition through lifestyle changes including dietary alterations, physical activity, and stress management [24].

Yoga is a mind-body practice which typically combines physical postures, controlled breathing techniques, and meditation [25]. Randomized controlled trials (RCTs) delivering yoga-based interventions to adolescents and adults with IBS have reported both physical and psychological improvements, including significant reductions in pain, fewer self-reported bowel symptoms, and reduced anxiety and depression [26–32]. Schumann et al. (2018) reported comparable improvements in symptom severity between participants in a 12-week Hatha yoga intervention and those following a low-FODMAP diet for the same period [33]. Furthermore, those in the yoga group experienced greater and longer-lasting reductions in anxiety. Importantly, yoga was also concluded to be both safe and effective for people with IBS in a systematic review of six RCTs [25]. The mechanisms by which yoga promotes symptom improvements are thought to include stress reduction [31–35], and regulation of the sympathetic nervous system, which is often overactive in IBS patients [5].

Several studies also report significant improvements in more holistic outcomes following yoga-based interventions for IBS, particularly quality of life (QoL) [28,33]. This is unsurprising given yoga's positive impacts on both physical and mental health-related factors such as symptom severity, anxiety, and depression, all of which are independently associated with QoL in IBS patients [36,37]. QoL is a particularly important outcome given it is consistently lower in IBS patients compared with both the general population and other health conditions [17,38,39].

To date, there has been limited research into yoga use in people with IBS outside of interventions. This is surprising given that many people with IBS already practice yoga in their everyday lives and studies indicate it is perceived as an acceptable alternative therapy, with 77% of participants in one survey reporting that they would consider yoga, compared with less than 60% considering treatments including acupuncture and suppositories [40]. Indeed, over 12% of existing UK-based yoga practitioners in a recent national survey reported having IBS, and 69.3% perceived yoga as helpful for managing it [41]. Whilst structured, short-term yoga interventions designed for IBS have demonstrated improvements in key IBS health outcomes, it is unclear whether yoga practice in everyday life has potential for similar benefits, warranting further research.

To comprehensively understand the practice of health behaviours, such as yoga, studies should be informed by theoretical models of behaviour [42]. Synthesising constructs from over 30 existing behavioural theories, the Capability, Opportunity, Motivation – Behaviour model (COM-B) [43] proposes that the likelihood of undertaking a behaviour is influenced by three core constructs. As an integrated model, it has additional predictive ability compared with single theories, particularly for behaviours related to physical activity [44,45]. Capability refers to the level of physical ability a person has to engage in a behaviour (physical capability) and also the extent to which they have the necessary skills and knowledge (psychological capability). Opportunity relates to having the necessary social support (social opportunity) and physical resources (physical opportunity). Motivation is the 'need to' perform the behaviour, which can arise from both conscious, reflective processes such as experiencing benefits of the behaviour (reflective motivation), and more automatic processes like habit formation (automatic motivation). Evidence suggests self-directed yoga practice is influenced by these constructs. For example, lack of motivation, limited physical opportunity (e.g., time and facilities), and limited physical capability (e.g., poor flexibility) have been cited as reasons for not practicing yoga in both clinical samples and general populations [46,47]. IBS patients may have additional considerations

related to these factors where yoga practice is concerned. For example, Kuttner et al. (2006) reported limitations to physical capability whilst experiencing abdominal pain which presented a barrier to adherence to the four-week home-based yoga practice [31], whilst Kavuri et al. (2015) suggested motivation derived from practicing with other IBS patients may encourage participation and reduce drop-out from yoga classes [28]. However, no studies have directly utilised the COM-B model to explore yoga practice amongst people with IBS. Doing so would be valuable in designing more targeted and evidence-based interventions to help increase accessibility and participation, particularly given some studies report relatively low rates of continuation of independent yoga practice following interventions in people with IBS despite its overall benefits [27].

The aims of the current mixed methods study were therefore to: 1) Explore predictors of IBS-related QoL, with a focus on yoga use, symptom severity, and psychological factors; 2) Investigate the ability of COM-B constructs to predict yoga use in a sample of adults with IBS; 3) Explore perceptions and experiences of yoga in relation to IBS to gain a richer understanding of perceived benefits, barriers, and limitations to its use for this condition.

## 2. Methods

### 2.1. Design

A cross-sectional, mixed methods online survey was used. Utilising qualitative methods to complement quantitative techniques provides richer insight into perceptions and experiences [48] in line with the aim to capture perceived benefits and barriers of yoga in more depth.

### 2.2. Participants

Participants were 219 UK-based adults with IBS recruited via social media, online IBS support forums, survey exchanges, and newsletters of the IBS Network and yoga organizations. Recruitment took place between April and July 2022. Inclusion criteria was as follows: UK resident, over the age of 18, has a medical diagnosis of IBS, able to comprehend written English. To minimize risk of harm, anyone seeking or receiving treatment for a severe mental health condition at the time of the study was not eligible.

### 2.3. Measures

#### 2.3.1. Demographic and yoga variables

Participants provided their gender, age, ethnicity, education level, smoking status, and exercise level (number of days brisk physical activity per week) and indicated whether or not they currently practiced yoga or had done so in the past 12 months (those who answered 'yes' to this question were classed as 'practitioners', those who answered 'no' were classed as 'non-practitioners'). Yoga variables (practitioners only) included motivations for practicing, main style, length of time practicing, frequency, and average length of practice (items adapted from Cartwright et al., 2020 [41]). An open-ended question asked practitioners to 'Please write about anything you find particularly helpful or unhelpful about yoga in relation to your IBS'. All participants were asked to rate agreement with a statement measuring perceptions of yoga as a strategy for managing IBS ('Practicing yoga would be an effective way of managing my IBS Symptoms'). Agreement was ranked on a seven-point Likert scale (Strongly Disagree (0) to Strongly Agree (6)). They were then asked to outline reasons for their answer (open-ended).

#### 2.3.2. Self-management strategies

Participants indicated whether they used either of the following to manage their IBS: 1) prescribed or over-the-counter medication; 2) non-medical strategies (checklist based on Harris & Roberts, 2008 [40]).

### 2.3.3. COM-B constructs

Perceived Capability, Opportunity, and Motivation for yoga were measured using Keyworth et al.'s (2020) six-item scale [49]. This includes two items measuring Capability (physical and psychological), two measuring Opportunity (physical and social), and two measuring Motivation (reflective and automatic). Each item was presented as a statement with a description of the construct it measured and rated from Strongly Disagree (0) to Strongly Agree (10). This scale has good reliability and validity and was recommended as sufficiently generic for application to a wide range of behaviours [49], hence it was deemed appropriate for use in the current study, which is the first to test it in relation to yoga.

### 2.3.4. Symptom severity

The *Irritable Bowel Syndrome Severity Scoring System* (IBS-SSS) [50] is a 5-item questionnaire about the presence and severity of abdominal pain, distention, dissatisfaction with bowel habits, and interference with life in the past 10 days. Each question was rated from 0 (symptom not present) to 100 (maximal severity of symptom), with a total score of 500, with higher scores indicating more severe symptoms (<175 indicates mild symptoms, 175-299 moderate symptoms,  $\geq 300$  severe symptoms; [50]).

### 2.3.5. Depression and anxiety

The *Hospital Anxiety and Depression Scale* (HADS) [51] consists of 14 items, half measuring depression, and half anxiety. Scores range from 0 to 21 for each sub-scale, with higher scores indicating greater anxiety and depression symptoms respectively. Scores of  $\leq 7$  on a given sub-scale can be interpreted as within normal range, 8-10 indicating mild symptoms, 11-14 moderate symptoms, and 15-21 severe symptoms [51,52].

### 2.3.6. General health

Self-rated health was assessed with a single item, rating health as excellent, very good, good, fair, or poor [53].

### 2.3.7. Quality of Life (QoL)

The *Irritable Bowel Syndrome – Quality of Life questionnaire* (IBS-QoL) [54] is a 34-item scale measuring the extent to which IBS symptoms interfere with daily functioning. Each statement is rated on a scale of 1 (does not apply) to 5 (applies a great deal). Scores range from 0-100 with higher scores indicating better IBS-related QoL.

## 2.4. Procedure

Ethical approval was obtained from the Liberal Arts and Sciences Research Ethics Committee at the University of Westminster (ETH2122-1661) prior to distribution of the survey, which was then administered via Qualtrics. Participants were presented with study information, consent form and inclusion criteria. Those who consented and met inclusion criteria completed the survey, after which they received written debrief explaining the study aims and providing details of support organizations.

## 2.5. Data analysis

Quantitative analyses were conducted in SPSS v28. A significance level of .05 or below was accepted. 'Other' responses for gender and education were removed during analyses due to few participants in these categories. Missing data points were estimated using the mean of completed items on a given scale, providing there were at least two completed items. Remaining missing data was excluded using listwise deletion. Chi-square tests of association and independent t-tests were used to explore differences between yoga practitioners and non-practitioners on demographic and lifestyle variables, health-related factors, and QoL. Hedges' estimates of effect size [55] were used for t tests (Hedges' g of .20, .50, and .80 equate to small, medium, and large

effect sizes respectively). Pearson's correlations between yoga variables and health outcomes were also examined. Hierarchical multiple linear regression was conducted to examine predictors of QoL. Hierarchical binary logistic regression was conducted to examine predictors of yoga use. To limit the number of predictors, correlations between variables of interest and respective outcome variables were examined and included only if their correlation with the outcome variable was .2 or greater (inter-correlations between all variables are presented in Table A.1 – see Appendix). Assumptions for parametric testing were checked prior to analysis. One outlier was removed from the multiple linear regression and one from the binary logistic regression. To avoid issues of multicollinearity, scores for the sub-constructs comprising each of the COM-B constructs were added together to create three final scores for Capability, Opportunity, and Motivation respectively. A priori power analysis in G\*Power 3.1 indicated a minimum sample of 133 participants was required to achieve a statistical power level of 0.8 (based on a regression model including a maximum of 10 predictors).

Open-ended answers were analysed using inductive Thematic Analysis (TA), where codes and sub-themes are determined by the researcher from the data [56]. Responses from both open-ended questions were analysed together and themes reflect responses across both questions. Responses were first exported to Excel and read several times by the primary author, who then developed initial codes and broader themes. These were later reviewed by the second author, who read through the data to compare codes and develop themes further. Both authors then discussed each theme and agreed on their final presentation. Final themes were then written up, grouped into 'benefits', and 'barriers and limitations' to yoga.

## 3. Results

247 participants accessed the survey, 28 were removed due to not meeting inclusion criteria or not providing information about yoga use, leaving a final sample of 219 participants, of which 86.3% were female and 93.2% were white. 70 participants (32%) practiced yoga at the time of the survey or had done so in the 12 months prior. Sample characteristics are presented in Table 1. 76.3% of participants experienced moderate or severe IBS. Depression scores were most commonly within normal range (69.7%), whilst half experienced mild or moderate anxiety symptoms (50.8%). On average, QoL was low-middling though this was better for practitioners than non-practitioners (Table 1). Of those who reported using non-medical strategies to manage their IBS, dietary changes were most commonly used (see Fig. A.1 in Appendix).

There was a significant association between yoga use and the following variables: gender ( $\chi^2(1, 215) = 10.56, p = .001$ ), exercise ( $\chi^2(1, 201) = 20.42, p < .001$ ), use of medication ( $\chi^2(1, 204) = 9.81, p = .002$ ), and use of non-medical self-management strategies ( $\chi^2(1, 204) = 12.58, p < .001$ ). Males, those who did less than three days brisk exercise per week, those who used medication for their IBS, and those who did not use any non-medical strategies comprised a significantly lower proportion of practitioners than expected by chance. Practitioners had significantly lower depression ( $t(183) = 2.96, p = .003$ ,  $\text{hedges' } g = .46$ ) and symptom severity ( $t(184) = 2.42, p = .017$ ,  $\text{hedges' } g = .37$ ), and significantly higher QoL ( $t(179) = -3.76, p < .001$ ,  $\text{hedges' } g = -.58$ ) when compared with non-practitioners.

Descriptive statistics for COM-B and yoga variables are presented in Table 2. Amongst practitioners, Hatha yoga was used most frequently and improving psychological wellbeing was the most common primary motivation for yoga practice (see Fig. A.2 in Appendix). Practitioners reported greater perceived Capability, Opportunity, and Motivation for yoga, and perceived yoga to be more effective for managing their IBS compared with non-practitioners.

Pearson's correlations between yoga variables and health variables are presented in Table 3. Years practicing was significantly negatively correlated with anxiety ( $r = -.41, p < .001$ ) and depression ( $r = -.28, p < .05$ ), and significantly positively correlated with QoL ( $r = .51$ ,

**Table 1**  
Sample characteristics.

	All participants		Practitioners		Non-practitioners	
	N <sup>a</sup> (%) <sup>b</sup>	Mean (SD)	n (%)	Mean (SD)	n (%)	Mean (SD)
<b>DEMOGRAPHICS AND LIFESTYLE</b>						
<b>Age</b>	<b>201</b>	46.42 (16.64)	<b>64</b>	48.87 (16.72)	<b>137</b>	45.28 (16.54)
<b>Gender</b>	<b>219</b>	-	<b>70</b>	-	<b>149</b>	-
number and % female	189 (86.3%)	-	67 (95.7%)	-	122 (81.9%)	-
<b>Ethnicity</b>	<b>219</b>	-	<b>70</b>	-	<b>149</b>	-
White	204 (93.2%)	-	65 (92.9%)	-	139 (93.3%)	-
Asian/Asian British	7 (3.2%)	-	3 (4.3%)	-	4 (2.7%)	-
Black – African, Caribbean, Black British	1 (.5%)	-	0	-	1 (.7%)	-
Mixed/Multiple	7 (3.2%)	-	2 (2.9%)	-	5 (3.4%)	-
<b>Education (highest level)</b>	<b>216</b>	-	<b>69</b>	-	<b>147</b>	-
Secondary	35 (16.2%)	-	9 (13%)	-	26 (17.7%)	-
College/A-Level	56 (25.9%)	-	16 (23%)	-	40 (27.2%)	-
Undergraduate	59 (27.3%)	-	18 (26.1%)	-	41 (27.9%)	-
Postgraduate	57 (26.4%)	-	23 (33.3%)	-	34 (23.1%)	-
Other	9 (4.2%)	-	3 (4.3%)	-	6 (4.1%)	-
<b>Smoking status</b>	<b>218</b>	-	<b>69</b>	-	<b>149</b>	-
Number and % yes	15 (6.9%)	-	5 (7.2%)	-	10 (6.7%)	-
<b>Exercise (days per week)</b>	<b>201</b>	3.58 (2.15)	<b>66</b>	4.62 (1.83)	<b>135</b>	3.07 (2.11)
<b>HEALTH</b>						
<b>Use of medication for IBS</b>	<b>204</b>	-	<b>64</b>	-	<b>140</b>	-
Number and % using	142 (69.6%)	-	35 (54.7%)	-	107 (76.4%)	-
<b>Use of non-medical strategies for IBS</b>	<b>204</b>	-	<b>64</b>	-	<b>140</b>	-
Number and % using	106 (52%)	-	45 (70.3%)	-	61 (43.6%)	-
<b>General health</b>	<b>187</b>	-	<b>63</b>	-	<b>124</b>	-
Poor	13 (7%)	-	3 (4.8%)	-	10 (8.1%)	-
Fair	67 (35.8%)	-	19 (30.2%)	-	48 (38.7%)	-
Good	66 (35.3%)	-	25 (39.7%)	-	41 (33.1%)	-
Very Good	36 (19.3%)	-	13 (20.6%)	-	23 (18.5%)	-
Excellent	5 (2.7%)	-	3 (4.8%)	-	2 (1.6%)	-
<b>Symptom severity</b>	<b>186</b>	255.86 (110.31)	<b>63</b>	228.89 (112.18)	<b>123</b>	269.67 (107.18)
<b>Anxiety</b>	<b>185</b>	9.29 (4.46)	<b>63</b>	8.71 (4.79)	<b>122</b>	9.59 (4.28)
<b>Depression</b>	<b>185</b>	5.93 (3.77)	<b>63</b>	4.81 (3.41)	<b>122</b>	6.51 (3.84)
<b>Quality of Life</b>	<b>181</b>	52.13 (22.37)	<b>63</b>	60.39 (22.03)	<b>118</b>	47.72 (21.37)

Note:

<sup>a</sup> N for each variable in bold.<sup>b</sup> Valid percent. SD = Standard Deviation.

$p < .001$ ). Duration of average practice was significantly positively correlated with general health ( $r = .42, p < .001$ ). Hours per week was significantly negatively correlated with anxiety ( $r = -.27, p < .05$ ) and significantly positively correlated with QoL ( $r = .36, p < .01$ ).

### 3.1. Predictors of QoL

The overall model was significant ( $F(6, 164) = 52.65, p < .001$ ), accounting for 64.6% of the variance in QoL. In block 1, education accounted for 10.8% of variance. In block 2, yoga use accounted for an additional 6.1%. In block 3, symptom severity, anxiety, depression, and general health accounted for a further 48.5%. In this final model, increased symptom severity, anxiety, and depression were associated with decreasing QoL, whilst 'good', 'very good' or 'excellent' general health were associated with increasing QoL, as was holding a university degree. Symptom severity was the strongest overall predictor. Regression coefficients are presented in Table 4.

### 3.2. Predictors of yoga use

The block 1 model consisting of gender, medication, non-medical self-management strategies, and exercise was significant ( $\chi^2(4, 166) = 46.54, p < .001$ ) and explained 33.9% of variance in yoga use (Nagelkerke  $R^2 = .339$ ). The addition of depression in block 2 significantly improved this first model ( $\chi^2(5, 166) = 51.46, p < .001$ ), with depression accounting for a further 3% of variance (Nagelkerke  $R^2 =$

.369). The addition of perception of yoga's effectiveness for IBS in block 3 further improved predictive ability ( $\chi^2(6, 166) = 72.81, p < .001$ ) and this accounted for a further 12.3% of variance (Nagelkerke  $R^2 = .492$ ). Finally, the addition of the COM-B constructs significantly improved the previous model ( $\chi^2(9, 166) = 163.18, p < .001$ ), together accounting for a further 37.5% of variance in yoga use. The overall model accounted for 86.7% of variance (Nagelkerke  $R^2 = .867$ ). In this final model, Opportunity and Motivation were the only significant predictors. Regression coefficients are presented in Table 5.

### 3.3. Thematic Analysis

155 participants (54 practitioners) provided data for qualitative analysis. Six themes were identified, three reflecting perceived benefits of yoga, and three reflecting perceived barriers and limitations. An overview of all themes, sub-themes and example quotes are presented in Table A.2 in Appendix. 'F' and 'M' denote female and male respectively in the following section.

#### 3.3.1. Benefits

##### Theme 1: IBS Relief

**3.3.1.1. Reduction in symptoms.** When considering benefits of yoga in relation to IBS, many practitioners discussed reductions in specific symptoms, commonly including pain, bloating, and constipation. One practitioner emphasised the direct relief she experienced, describing her



**Table 2**  
Descriptive statistics – COM-B constructs and yoga variables.

	All participants		Practitioners		Non-practitioners	
	N <sup>a</sup>	Mean (SD.)	n	Mean (SD)	n	Mean (SD)
<b>COM-B</b>						
<b>Capability</b>	<b>185</b>	14.34 (4.85)	<b>62</b>	16.77 (3.27)	<b>123</b>	13.10 (5.06)
Physical	185	6.82 (3.05)	62	8.08 (1.99)	123	6.18 (3.28)
Psychological	185	7.52 (2.41)	62	8.69 (1.73)	123	6.93 (2.48)
<b>Opportunity</b>	<b>185</b>	12.52 (5.48)	<b>62</b>	16.11 (4.21)	<b>123</b>	10.71 (5.15)
Physical	184	6.67 (2.78)	62	8.35 (1.93)	123	5.82 (2.76)
Social	184	5.85 (3.22)	62	7.76 (2.67)	123	4.89 (3.05)
<b>Motivation</b>	<b>184</b>	8.48 (6.37)	<b>61</b>	15.72 (4.08)	<b>123</b>	4.89 (3.66)
Reflective	184	5.11 (3.29)	61	8.31 (1.98)	123	3.52 (2.58)
Automatic	185	3.35 (3.45)	62	7.29 (2.60)	123	1.37 (1.80)
<b>YOGA</b>						
<b>Perception of yoga's effectiveness for IBS</b>	<b>205</b>	3.28 (1.47)	<b>64</b>	4.14 (1.59)	<b>141</b>	2.89 (1.22)
<b>Years practicing</b>	-	-	<b>67</b>	13.36 (12.09)	-	-
<b>Hours per week</b>	-	-	<b>63</b>	3.53 (2.36)	-	-
<b>Times per week</b>	-	-	<b>62</b>	4.05 (2.65)	-	-
<b>Duration of average practice (minutes)</b>	-	-	<b>64</b>	49.20 (24.20)	-	-

Note:  
<sup>a</sup> N for each variable in bold. SD = Standard Deviation.

symptoms as “quiet” when practicing (F, 61). Experiencing symptom improvements was a motivation for continued practice - “If I stop practicing for a while, I notice the symptoms start to remerge.” (F, 24). Similarly, there was a general perception that frequent and consistent practice was necessary for noticeable relief, as experienced by one practitioner who wrote, “it does have a positive impact especially if you use it more on a regular basis” (F, 24).

Many practitioners also discussed mechanisms through which they felt yoga helped their IBS. Relaxation was the most prominent, with several answers discussing relaxation of the gut and in turn reduced digestive symptoms. One practitioner wrote, “Because yoga relaxes me, it means that it calms my stomach as well” (F, 69).

Several practitioners described specific components of yoga which they found useful. Elements which directly affected digestion and relieved abdominal tension were found to be particularly helpful, such

**Table 3**  
Correlations between yoga variables, health-related variables, and COM-B constructs (practitioners only).

	Symptom severity	Anxiety	Depression	General health <sup>a</sup>	QoL	Years practicing	HPW	TWP	Avg. duration
<b>Years practicing</b>	-.22	-.41***	-.28*	.22	.51***				
<b>HPW</b>	-.07	-.27*	-.19	.23	.36**	.33**			
<b>TPW</b>	-.02	-.15	-.15	.19	.16	.33**	.73***		
<b>Avg. duration</b>	-.20	-.01	-.05	.42***	.16	.06	.32*	.02	

\* p<.05.  
\*\* p<.01.  
\*\*\* p<.001 (two-tailed).

Note: Pairwise deletion of missing cases was used, n ranged from 61 – 64 cases per correlation. HPW=average hours of yoga practice per week. TPW=average number of yoga sessions per week. Avg. duration = length of time of an average yoga practice (minutes).

<sup>a</sup>Coded as poor/fair (1), good/very good/excellent (2).

as digestion-focused sequences and supported bridge poses.

3.3.1.2. *Helps manage stress-related triggers.* This was a strong sub-theme, with both practitioners and non-practitioners showing awareness of relationships between stress, digestion, and gut-related symptoms, and yoga was largely perceived as an effective stress-relieving activity:

“I’ve never practiced yoga...However, since yoga is known to be good at reducing stress, it could have a positive effect on IBS, which is stress-related” (M, 31)

Many participants discussed how stress is a primary IBS trigger and noticed a direct association between the stress-relieving properties of yoga and symptom relief, as illustrated by one practitioner: “yoga helps me manage stress and in return, prevents stress induced IBS attacks from happening.” (F, 20).

Despite the stress-relieving properties of yoga being acknowledged as beneficial for digestion, a common perception was that yoga’s ability to help manage stress-related flare-ups was contrasted with more limited effect on food-related triggers, though a small number of participants did experience benefits in this area, with one practitioner reflecting: “I also find I can ‘cheat’ more with my food a bit if I am practicing regularly, like some of my trigger foods digest better if I’ve been practicing yoga that day” (F, 42).

**Theme 2: ‘Extremely empowering’: A valuable self-management tool**

3.3.1.3. *Confidence in coping.* Yoga gave many practitioners an increased sense of control over their IBS and several mentioned feeling

**Table 4**  
Standardized regression coefficients from hierarchical linear regression predicting QoL (N=171).

Block	Variable(s) entered	Block 1	Block 2	Block 3
1	Education <sup>a</sup>	.34***	.32***	.14**
2	Yoga use <sup>b</sup>		.25***	.09
3	Symptom Severity			-.36***
	Depression			-.35***
	Anxiety			-.19***
	General health <sup>c</sup>			.11*
<b>R<sup>2</sup></b>		.113	.174	.658
<b>Adjusted R<sup>2</sup></b>		.108	.164	.646
<b>R<sup>2</sup> change</b>		.113	.061	.485
<b>Model F</b>		21.55***	17.65***	52.65***

\* p<.05.  
\*\* p<.01.  
\*\*\* p<.001 (two tailed).

Note: A one-unit change in dichotomous variables (Education, Yoga use, General health) represents the full range of scores for the variable.

<sup>a</sup> Coded as no university degree (1), holds university degree (2).

<sup>b</sup> Coded as non-practitioner (0), practitioner (1).

<sup>c</sup> Coded as poor/fair (1), good/very good/excellent (2).

**Table 5**

Standardized regression coefficients from hierarchical binary logistic regression predicting yoga use (N=166).

Block	Variable(s) entered	Block 1	Block 2	Block 3	Block 4
1	<b>Gender<sup>a</sup></b>	2.64*	2.72*	2.29*	1.39
	<b>Medication<sup>b</sup></b>	-.89*	-.92*	-.84	.00
	<b>Non-medical strategies<sup>b</sup></b>	.91*	.89*	.20	1.07
	<b>Exercise<sup>c</sup></b>	2.22***	2.16***	2.09***	1.81
2	<b>Depression</b>		-.12*	-.09	.04
3	<b>Perception of yoga effectiveness<sup>d</sup></b>			2.00***	.91
4	<b>Capability</b>				-.22
	<b>Opportunity</b>				.23*
	<b>Motivation</b>				.71***

\*  $p < .05$ .

\*\*\*  $p < .001$  (two tailed).

Note: A one unit change in dichotomous predictors (Gender, Medication, Non-medical strategies, Exercise, and Perception of yoga eff.) represents the full range of scores for the variable.

<sup>a</sup> Coded as male (1), female (2).

<sup>b</sup> Coded as does not use (1), uses (2).

<sup>c</sup> Coded as less than 3 days per week (1), 3 days + per week (2).

<sup>d</sup> Coded as negative/neutral (1), positive (2).

more “confident” in managing it. For some, this was derived from learning techniques in yoga that could be used independently to help manage symptoms:

*“I was provided with a short practice I could carry out for myself if I wished. I found this extremely empowering”* (F, 59)

Importantly, this benefit also extended beyond direct symptom management. Several practitioners did not notice symptom improvements, but still felt yoga had benefits in increasing their ability to cope with the challenges of living with IBS:

*“I feel that yoga does not actually improve my IBS symptoms but helps my mindset in that I am able to deal with them with less anxiety & in a more relaxed manner.”* (F, 34)

Similarly, a particularly strong perception was that yoga is not a single ‘cure’ for IBS, but rather one potentially valuable tool which could be utilised as part of a wider approach, as captured by one practitioner - *“I agree but for me it’s also about my diet. So, yoga is only one way of managing symptoms.”* (F, 59).

**3.3.1.4. A positive distraction.** Yoga also had more immediate benefits for managing negative mental and physical states more generally. It was largely viewed as a positive activity which, for some, helped shift focus from negative thoughts and feelings, keeping practitioners in touch with their bodies and selves in a more positive way:

*“Yoga helps you to calm your mind and helps you to focus on the sensations in your body. It helps me to be focused rather than thinking about my IBS.”* (F, 70)

These perceptions of yoga as a positive distraction were also held by a few non-practitioners, with one describing yoga as, *“diverting from anxiety a bit like meditation”* (F, 63).

### Theme 3: Holistic wellbeing

Participants also recognised benefits unrelated to IBS, with one practitioner describing how yoga helped her body *“feel stronger”* (F, 35), whilst another noted that *“psychologically I feel better for doing ‘self-care’ by moving and stretching my body”* (F, 35). For a few practitioners, improving their general fitness and flexibility was their primary motivation for yoga practice, with several recognising benefits for IBS, but emphasising other primary reasons for practicing such as, *“to improve/maintain flexibility as I get older”* (F, 47).

Benefits for mental wellbeing were also experienced, with several practitioners describing feelings of *“calm”* and *“relaxation”* following

practice. One woman described feeling *“super light...more relaxed and less aggressive”* (F, 26). These were experienced both as reductions in negative mental states like anxiety, and promotion of positive feelings including improved mood, peacefulness, and self-acceptance.

### 3.3.2. Barriers and limitations

#### Theme 4: Lack of physical capability

**3.3.2.5. IBS hinders participation.** Whilst symptoms were commonly relieved through yoga, several practitioners simultaneously discussed feeling restricted in the extent to which they could practice whilst experiencing symptoms:

*“Most of my IBS pain is in my upper abdomen. I found that positions where I have to bend over (downward dog etc.) could aggravate this.”* (F, 34)

Similarly, several non-practitioners cited the severity of their IBS as a prominent reason why they felt yoga would not be effective or even possible for them to participate in. This often reflected limitations to physical activity more generally, with one non-practitioner describing how she is *“usually in pain and not feeling well enough to do exercise”* (F, 66).

**3.3.2.6. Perceptions of an incompatible body.** Non-practitioners also discussed physical barriers unrelated to their IBS. These were often related to joint issues, which participants felt would limit their ability to perform core elements of yoga like bending and stretching, as experienced by one participant who wrote, *“I suffer from joint problems and have great difficulty with bending knees/kneeling.”* (F, 59).

This barrier was also reflected in perceptions that certain physical characteristics were incompatible with practicing yoga. These included lacking flexibility, weight-related barriers, and older age - *“I’d love to do yoga but I’m too overweight to practice”* (F, 36). In contrast, practitioners’ comments often conveyed a sense of confidence derived from yoga practice, describing physical benefits such as increased flexibility and bodily awareness which acted as facilitators to further practice.

#### Theme 5: Limitations in managing a complex condition: Need for a tailored approach

A strong perception was that yoga was too often viewed as a ‘cure’ for IBS and indiscriminately recommended as a beneficial approach for all. Several participants suggested the need for a more nuanced approach which considers aspects of IBS which may limit effectiveness or suitability of yoga in some cases. One practitioner captured this in her reflection:

*“Yoga can give us a different understanding of ourselves and our bodies but what is helpful for one person may not be so for another. I think it’s a mistake to be too general in statements about yoga being helpful for IBS”* (F, 59)

This was demonstrated by a common experience amongst practitioners that yoga’s suitability was often dependent on their IBS symptoms at the time of practice, which made its effectiveness unpredictable and sometimes inconsistent, with one practitioner reflecting, *“if I do the wrong poses when I’m in a diarrhea phase it will make things worse.”* (F, 47)

Due to these nuances, it was recognised that, when not targeted specifically to IBS, yoga may be off-putting to people with the condition:

*“I found a standard yoga class would often involve certain moves and rotations that could inflame the gas, pain and constipation...yoga is good, but it needs to be specific instruction to IBS needs and low impact or it can produce more symptoms which can put people off.”* (F, 50),

#### Theme 6: Limited motivation

Most non-practitioners did not associate yoga with IBS, citing a lack of “knowledge”, or stating that they *“have not heard of”* yoga being beneficial for the condition. Several explicitly stated that they felt yoga

would not benefit their symptoms and conveyed a sense of limited motivation to try it for this reason - *"I do not feel that yoga would positively impact this diagnosis in any way. It may make me more flexible but very little else."* (F, 51).

In contrast, a smaller number of non-practitioners discussed being more open to the possibility of trying yoga for their IBS. These participants often displayed greater knowledge of yoga's benefits, particularly in relation to links between its stress-reducing properties and the potential impacts of this on bowel symptoms - *"I am open to the possibility not least because I know that it can help manage stress and this is a clear trigger for my IBS"* (F, 40).

For a few non-practitioners, their limited motivation was not related to a perception of yoga in relation to IBS, but rather reflected a lack of appeal of yoga as an activity more generally. This was demonstrated by one participant who wrote, *"I have seen some research on it but I don't think I would enjoy it"* (F, 22).

#### 4. Discussion

This study highlights several significant relationships between yoga use, physical and mental health, and IBS-related QoL. Additionally, it is the first to test the utility of the COM-B model [43] in predicting yoga use amongst people with IBS. Furthermore, qualitative elements to this study provide new insight into perceptions towards yoga as a complementary therapy for IBS, revealing several condition-specific benefits and barriers to its use which will be valuable in informing more targeted yoga instruction for this condition.

##### 4.1. Yoga use, health-related factors, and QoL

Yoga practitioners reported significantly higher QoL and significantly lower depression and symptom severity than non-practitioners. Furthermore, yoga use accounted for additional variance in QoL when controlling for education, and was positively associated with QoL. This is in line with observations of improved QoL following short-term yoga interventions designed for IBS [28,33] and suggests practicing yoga as part of an everyday lifestyle may be similarly beneficial for IBS-related QoL. Yoga's statistical significance as a predictor of QoL was attenuated when considering health-related factors including symptom severity, anxiety, and depression. This is somewhat unsurprising given the strength of impact of such factors on day-to-day functioning with IBS [57,58], and yoga's established positive impacts on them, for example its impact on gut symptoms via regulation of the nervous system and its stress-reducing properties [59,60], which were also reflected in qualitative findings in the current study. It is therefore likely that improvements in these factors explain the relationship between yoga use and IBS-related QoL to some extent. The direction of relationships between health-related factors and QoL observed in the current study are comparable to those of previous studies [36,61]. Interestingly however, the emergence of symptom severity as the strongest predictor contrasts with findings from Weerts et al. (2019), who found improvements in gastrointestinal symptoms were not paralleled by improvements in QoL in a 4-year longitudinal study, instead observing stronger associations between psychological factors and QoL [62]. This difference may however be partially attributable to different measures of QoL. Whilst the IBS-QoL focuses on the impact of bowel symptoms on functioning, Weerts et al. (2019) utilised the SF-36 [63], a broader measure which is not IBS-specific.

Correlational analyses in the current study found that practicing yoga for a greater number of years was associated with decreased depression and anxiety symptoms and increased QoL, whilst practicing for a greater number of hours per week was also associated with decreased anxiety and increased QoL. This is the first study to explore these associations in yoga practitioners with IBS, though they align with those of existing studies in other populations which suggest higher dosages of yoga are associated with greater benefits for psychological

health [64,65]. Though these results from the current study should be interpreted with caution due to the correlational nature of analyses, they provide a valuable starting point for further research into optimal yoga dosage for IBS.

##### 4.2. Capability, Opportunity, and Motivation

This study is the first to have utilised the COM-B model [43] to further understanding of yoga practice amongst people with IBS. The emergence of Opportunity as a significant predictor of yoga practice fits with findings from D'Silva et al. (2021), who identified specific opportunities to practice (e.g., low-cost yoga classes) as facilitators in adults with IBS [66], whilst the identification of Motivation as the strongest predictor also reflects findings from other populations which indicate strong relationships between motivational factors (e.g., behavioural intentions) and yoga practice [67]. Qualitative findings complemented this, giving unique insight into potential IBS-specific influences on Motivation for yoga practice. For example, having little knowledge of potential benefits in relation to bowel symptoms appeared to be a reason why many non-practitioners lacked motivation to try yoga to support the management of their condition, whilst practitioners displayed greater knowledge of such benefits, which often motivated further practice. This suggests it would be useful to publicise more widely the potential IBS-specific benefits of yoga in materials for patients.

Though not a statistical predictor of yoga use, Capability was also identified as a key influence on yoga practice in qualitative findings. Physical Capability was often limited due to symptoms such as abdominal pain, which influenced both perceived ability to participate in yoga and the extent to which practitioners felt able to carry out all components. This fits with a need for a more nuanced approach to yoga for IBS, which was acknowledged by both practitioners and non-practitioners, for example the need to consider other factors such as symptoms at the time of practice when deciding which components may be most appropriate.

##### 4.3. Strengths and Limitations

Strengths of this study include the diverse age range and educational attainment level of participants, and its mixed-methods design. Furthermore, by asking specifically about perceptions of yoga in relation to IBS, this study extended previous work which has focused primarily on more general benefits and barriers, such as holistic benefits for health, and time- and cost-related barriers [66].

However, it also has some limitations. Firstly, there was limited diversity in the sample in terms of ethnicity and gender, with participants being mostly white and female which may have impacted results. For example, although IBS is diagnosed more commonly in females [68], males were still disproportionately under-represented in the current study. There may be male-specific barriers to yoga practice which were not sufficiently captured, especially given common perceptions of yoga as a 'feminine' activity amongst men more generally [69] and greater prevalence of diarrhoea-related IBS symptoms in males [70], which may present a more significant practical barrier to physical activity when compared with constipation-predominant symptoms seen more often in females [70]. Secondly, whilst many practitioners in this study were recruited from yoga groups, the majority of non-practitioners came from online support groups and may therefore represent a sub-group who are affected more severely by their IBS [71]. This may have impacted on the differences between practitioners and non-practitioners in symptom severity and QoL observed in the current study. Thirdly, due to the cross-sectional design, causal relationships between variables cannot be inferred. Finally, whilst utilising Keyworth et al.'s (2020) existing measure of the COM-B constructs carried some strengths in terms of validity [49], some limitations to its applicability in relation to yoga were identified in this study. Specifically, the statements measuring Motivation were of limited relevance to non-practitioners when

compared with those measuring Capability and Opportunity, which may therefore have resulted in an over-estimation of its predictive ability relative to the other variables. For example, the automatic motivation statement (“*Planning yoga into my day/week is something that I do automatically*”) implies a participant already practices yoga. This may reflect a wider limitation of this relatively new scale in its ability to meaningfully measure motivation for less common behaviours.

#### 4.4. Practical implications and future directions

Notwithstanding its limitations, this study has several practical implications. Quantitative findings suggest yoga practiced as part of everyday life may have valuable benefits for improving IBS-related QoL, though they emphasise the sustained importance of considering both physical and psychological symptoms in all interventions to improve QoL. Secondly, yoga interventions should be designed to optimise Capability, Opportunity, and Motivation. Given the key influence of COM-B factors demonstrated by this study, targeting these could help not only reduce attrition rates from yoga interventions for IBS, which typically range from 5-20% [59], but also help identify ways of widening yoga participation more broadly in people with this condition, for example increasing availability of yoga instruction tailored to people with IBS (e.g., focusing on components which target common digestive symptoms).

Further research is needed to explore why some IBS patients may experience less benefit from yoga than others, as evidenced in the qualitative component of the current study by participants who reported finding yoga ineffective for their IBS. Although these differing effects may in part be attributed to differences in IBS triggers (e.g., lower effectiveness for food-induced IBS flare-ups), it may also be influenced by other factors like IBS sub-type, which was not considered in this study. For example, whilst constipation relief was commonly cited as a significant benefit of yoga in the current study, this is a less prominent symptom in those with diarrhoea-predominant IBS (IBS-D).

## 5. Conclusion

The results of this study suggest practicing yoga in day-to-day life can have important physical and mental benefits for IBS patients, whilst perceived Capability, Opportunity, and Motivation are key influences on the choice to practice yoga amongst this group. In light of this, health care providers may consider emphasising the potential benefits of yoga as part of an IBS management regimen when advising patients. However, the current study also highlights the importance of tailoring yoga to IBS symptoms, suggesting the development of more IBS-specific yoga classes may be particularly useful. It is hoped these findings will be valuable in informing future interventions and identifying ways of maximising yoga’s benefits for IBS.

### Financial support

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

### CRediT authorship contribution statement

**Lucy Doyle:** Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Writing – original draft. **Tina Cartwright:** Conceptualization, Formal analysis, Methodology, Supervision, Writing – review & editing.

### Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## Data availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

## Acknowledgements

Support from the following organisations in the recruitment process is acknowledged with thanks: *IBS Network, British Wheel of Yoga, Association for Yoga Studies, Iyengar Yoga (UK)*.

## Supplementary materials

Supplementary material associated with this article can be found, in the online version, at [doi:10.1016/j.eujim.2023.102270](https://doi.org/10.1016/j.eujim.2023.102270).

## References

- [1] Guts UK, IBS awareness month 2021. <https://gutscharity.org.uk/2021/03/ibs-awareness-month-2021/>, 2021 (accessed 25 Feb 2022).
- [2] F. Mearin, C. Ciriza, M. Mínguez, E. Rey, J.J. Mascort, E. Peña, P. Cañones, J. Júdez, Clinical practice guideline: Irritable bowel syndrome with constipation and functional constipation in the adult, *Rev. Esp. Enferm. Dig.* 108 (2016) 332–363, <https://doi.org/10.17235/reed.2016.4389/2016>.
- [3] M. Camilleri, C. Di Lorenzo, Brain-gut axis: From basic understanding to treatment of IBS and related disorders, *J. Pediatr. Gastroenterol. Nutr.* 54 (2012) 446–453, <https://doi.org/10.1097/MPG.0b013e31823d34c3>.
- [4] J. Wu, I. Masuy, J.R. Biesiekierski, H.E. Fitzke, C. Parikh, L. Schofield, H. Shaikh, A. Bhagwanani, Q. Aziz, S.A. Taylor, J. Tack, L.V. Oudenhove, Gut-brain axis dysfunction underlies fodmap-induced symptom generation in irritable bowel syndrome, *Alim. Pharmacol. Ther.* 55 (2022) 670–682, <https://doi.org/10.1111/apt.16812>.
- [5] V. Kavuri, N. Raghuram, A. Malamud, S.R. Selvan, Irritable bowel syndrome: Yoga as a remedial therapy, *Evid.-based Complement. Altern. Med.* 398156 (2015), <https://doi.org/10.1155/2015/398156>.
- [6] I.A. Downs, O.C. Aroniadis, L. Kelly, L.J. Brandt, Post infection irritable bowel syndrome: The links between gastroenteritis, inflammation, the microbiome, and functional disease, *J. Clin. Gastroenterol.* 51 (2017) 869–877, <https://doi.org/10.1097/MCG.0000000000000924>.
- [7] T. Bokic, M. Storr, R. Schicho, Potential causes and present pharmacotherapy of irritable bowel syndrome: An overview, *Pharmacology* 96 (2015) 76–85, <https://doi.org/10.1159/000435816>.
- [8] H. Qin, C. Cheng, X. Tang, Z. Bian, Impact of psychological stress on irritable bowel syndrome, *World J. Gastroenterol.* 20 (2014) 14126–14131, <https://doi.org/10.3748/wjg.v20.i39.14126>.
- [9] K.N. Lee, O.Y. Lee, The role of mast cells in irritable bowel syndrome, *Gastroenterol. Res. Pract.* 2031480 (2016), <https://doi.org/10.1155/2016/2031480>.
- [10] P.A. Hayes, M.H. Fraher, E.M.M. Quigley, Irritable bowel syndrome: The role of food in pathogenesis and management, *Gastroenterol. Hepatol. (N Y)* 10 (2014) 164–174.
- [11] G.L. Austin, C.B. Dalton, Y. Hu, C.B. Morris, J. Hankins, S.R. Weinland, E. C. Westman, W.S. Yancy Jr., D.A. Drossman, A very low-carbohydrate diet improves symptoms and quality of life in diarrhea-predominant irritable bowel syndrome, *Clin. Gastroenterol. Hepatol.* 7 (2009) 706–708, <https://doi.org/10.1016/j.cgh.2009.02.023>.
- [12] L. Böhn, S. Störsrud, T. Liljebo, L. Collin, P. Lindfors, H. Törnblom, M. Simrén, Diet low in fodmaps reduces symptoms of irritable bowel syndrome as well as traditional dietary advice: A randomized controlled trial, *Gastroenterology* 149 (2015) 1399–1407, <https://doi.org/10.1053/j.gastro.2015.07.054>.
- [13] A. Banerjee, S. Sarkhel, R. Sarkar, G.K. Dhali, Anxiety and depression in irritable bowel syndrome, *Indian J. Psychol. Med.* 39 (2017) 741–745, [https://doi.org/10.4103/IJPSYM.IJPSYM\\_46\\_17](https://doi.org/10.4103/IJPSYM.IJPSYM_46_17).
- [14] W.E. Whitehead, O. Palsson, K.R. Jones, Systematic review of the comorbidity of irritable bowel syndrome with other disorders: What are the causes and implications? *Gastroenterology* 122 (2002) 1140–1156, <https://doi.org/10.1053/gast.2002.32392>.
- [15] P. Singh, K. Staller, K. Barshop, E. Dai, J. Newman, S. Yoon, S. Castel, B. Kuo, Patients with irritable bowel syndrome-diarrhea have lower disease-specific quality of life than irritable bowel syndrome-constipation, *World J. Gastroenterol.* 21 (2015) 8103–8109, <https://doi.org/10.3748/wjg.v21.i26.8103>.
- [16] H.B. El-Serag, K. Olden, D. Bjorkmann, Health-related quality of life among persons with irritable bowel syndrome: A systematic review, *Aliment. Pharmacol. Ther.* 16 (2002) 1171–1185, <https://doi.org/10.1046/j.1365-2036.2002.01290.x>.
- [17] L. Frank, L. Kleinman, A. Rentz, G. Ciesla, J.J. Kim, C. Zacker, Health-related quality of life associated with irritable bowel syndrome: Comparison with other chronic diseases, *Clin. Ther.* 24 (2002) 675–689, [https://doi.org/10.1016/s0149-2918\(02\)85143-8](https://doi.org/10.1016/s0149-2918(02)85143-8).



- [18] S. Bertram, M. Kurland, M. Lydick, E. Locke, R. Locke III, B.P. Yawn, The patient's perspective of irritable bowel syndrome, *J. Fam. Pract.* 50 (2001) 521–525.
- [19] O. Skrastins, P.C. Fletcher, One flare at a time: Adaptive and maladaptive behaviors of women coping with inflammatory bowel disease and irritable bowel syndrome, *Clin. Nurse Spec.* 30 (2016) E1–E11, <https://doi.org/10.1097/NUR.0000000000000229>.
- [20] C. Canavan, J. West, T. Card, The economic impact of the irritable bowel syndrome, *Aliment. Pharmacol. Ther.* 40 (2014) 1023–1034, <https://doi.org/10.1111/apt.12938>.
- [21] M. Williams, Y. Barclay, L. Harper, C. Marchant, L. Seamark, M. Hickson, Feasibility, acceptability and cost efficiency of using webinars to deliver first-line patient education for people with irritable bowel syndrome as part of a dietetic-led gastroenterology service in primary care, *J. Hum. Nutr. Diet.* 33 (2020) 758–766, <https://doi.org/10.1111/jhn.12799>.
- [22] P. Katiraei, G. Bultron, Need for a comprehensive medical approach to the neuro-immune-gastroenterology of irritable bowel syndrome, *World J. Gastroenterol.* 17 (2011) 2791–2800, <https://doi.org/10.3748/wjg.v17.i23.2791>.
- [23] NHS, Diet, lifestyle and medicines: Irritable bowel syndrome (IBS). <https://www.nhs.uk/conditions/irritable-bowel-syndrome-ibs/diet-lifestyle-and-medicines/2021> (accessed 23 Feb 2022).
- [24] NICE, Irritable bowel syndrome in adults: Diagnosis and management, Clinical guideline [CG61], 2017. <https://www.nice.org.uk/guidance/cg61> (accessed 23 Feb 2022).
- [25] D. Schumann, D. Anheyer, R. Lauche, G. Dobos, J. Langhorst, H. Cramer, Effect of yoga in the therapy of irritable bowel syndrome: A systematic review, *Clin. Gastroenterol. Hepatol.* 14 (2016) 1720–1731, <https://doi.org/10.1016/j.cgh.2016.04.026>.
- [26] T. Tavakoli, N. Davoodi, T.S.J. Tabatabaee, Z. Rostami, H. Mollaei, F. Salmani, S. Avati, S. Tabrizi, Comparison of laughter yoga and anti-anxiety medication on anxiety and gastrointestinal symptoms of patients with irritable bowel syndrome, *Middle East J. Dig. Dis.* 11 (2019) 211–217, <https://doi.org/10.15171/mejdd.2019.151>.
- [27] L. Shahabi, B.D. Naliboff, D. Shapiro, Self-regulation evaluation of therapeutic yoga and walking for patients with irritable bowel syndrome: A pilot study, *Psychol. Health. Med.* 21 (2016) 176–188, <https://doi.org/10.1080/13548506.2015.1051557>.
- [28] V. Kavuri, P. Selvan, A. Malamud, N. Raghuram, S.R. Selvan, Remedial yoga module remarkably improves symptoms in irritable bowel syndrome patients: A 12-week randomized controlled trial, *Eur. J. Integr. Med.* 7 (2015) 595–608, <https://doi.org/10.1016/j.eujim.2015.11.001>.
- [29] S. Evans, K.C. Lung, L.C. Seidman, B. Sternlieb, L.K. Zeltzer, J.C.I. Tsao, Iyengar yoga for adolescents and young adults with irritable bowel syndrome, *J. Pediatr. Gastroenterol. Nutr.* 59 (2014) 244–253, <https://doi.org/10.1097/MPG.0000000000000366>.
- [30] I. Taneja, K.K. Deepak, G. Poojary, I.N. Acharya, R.M. Pandey, M.P. Sharma, Yogic versus conventional treatment in diarrhea-predominant irritable bowel syndrome: A randomized control study, *Appl. Psychophysiol. Biofeedback.* 29 (2004) 19–33, <https://doi.org/10.1023/b:apbi.0000017861.60439.95>.
- [31] L. Kuttner, C.T. Chambers, J. Hardial, D.M. Israel, K. Jacobson, K. Evans, A randomized trial of yoga for adolescents with irritable bowel syndrome, *Pain Res. Man.* 11 (2006) 217–224, <https://doi.org/10.1155/2006/731628>.
- [32] A. D'Silva, D. Marshall, Y. Rajagopalan, J. Nasser, J. Valance, M. Raman, Meditation and yoga for irritable bowel syndrome (my-ibs): A randomized controlled trial, *J. Can. Assoc. Gastroenterol.* 5 (2022) 139–141, <https://doi.org/10.1093/jcag/gwab049.246>.
- [33] D. Schumann, J. Langhorst, G. Dobos, H. Cramer, Randomised clinical trial: Yoga vs a low fodmap diet in patients with irritable bowel syndrome, *Aliment. Pharmacol. Ther.* 47 (2018) 203–211, <https://doi.org/10.1111/apt.14400>.
- [34] M. Javnbakht, R.H. Kenari, M. Ghasemi, Effects of yoga on depression and anxiety in women, *Complement. Ther. Clin. Pract.* 15 (2009) 102–104, <https://doi.org/10.1016/j.ctcp.2009.01.003>.
- [35] S. Prathikanti, R. Rivera, A. Cochran, J.G. Tungol, N. Fayazmanesh, E. Weinman, Treating major depression with yoga: A prospective, randomized, controlled pilot trial, *PLoS One* 12 (2017), e0173869, <https://doi.org/10.1371/journal.pone.0173869>.
- [36] L. Zhu, D. Huang, L. Shi, L. Liang, T. Xu, M. Chang, W. Chen, D. Wu, F. Zhang, X. Fang, Intestinal symptoms and psychological factors jointly affect quality of life in patients with irritable bowel syndrome with diarrhea, *Health. Qual. Life Outcomes.* 13 (2015) 49, <https://doi.org/10.1186/s12955-015-0243-3>.
- [37] S. Pletkosić Tončić, M. Tkalčić, G. Hauser, Brain-gut miscommunication: Biopsychosocial predictors of quality of life in irritable bowel syndrome, *Psihol. Teme.* 27 (2018) 91–114, <https://doi.org/10.31820/pt.27.1.6>.
- [38] R.L. Akehurst, J.E. Brazier, N. Mathers, C. O'Keefe, E. Kaltenhaler, A. Morgan, M. Platts, S.J. Walters, Health-related quality of life and cost impact of irritable bowel syndrome in a UK primary care setting, *Pharmacoconomics* 20 (2002) 455–462, <https://doi.org/10.2165/00019053-200220070-00003>.
- [39] M. Kopczyńska, L. Mokros, T. Pietras, E. Malecka-Panas, Quality of life and depression in patients with irritable bowel syndrome, *Prz. Gastroenterol.* 13 (2018) 102–108, <https://doi.org/10.5114/pg.2018.75819>.
- [40] L.R. Harris, L. Roberts, Treatments for irritable bowel syndrome: Patients' attitudes and acceptability, *BMC Complement. Altern. Med.* 8 (2008) 65, <https://doi.org/10.1186/1472-6882-8-65>.
- [41] T. Cartwright, H. Mason, A. Porter, K. Pilkington, Yoga practice in the UK: A cross sectional survey of motivation, health benefits and behaviours, *BMJ Open* 10 (2020), e031848, <https://doi.org/10.1136/bmjopen-2019-031848>.
- [42] J. Cane, D. O'Connor, S. Michie, Validation of the theoretical domains framework for use in behaviour change and implementation research, *Implement. Sci.* 7 (2012) 37, <https://doi.org/10.1186/1748-5908-7-37>.
- [43] S. Michie, M.M. van Stralen, R. West, The behaviour change wheel: A new method for characterising and designing behaviour change interventions, *Implement. Sci.* 6 (2011) 42, <https://doi.org/10.1186/1748-5908-6-42>.
- [44] N. Howlett, J. Schulz, D. Trivedi, N. Troop, A. Chater, Determinants of weekly sitting time: Construct validation of an initial com-b model and comparison of its predictive ability with the theory of planned behaviour, *Psychol. Health.* 36 (2021) 96–114, <https://doi.org/10.1080/08870446.2020.1763994>.
- [45] N. Howlett, J. Schulz, D. Trivedi, N. Troop, A. Chater, A prospective study exploring the construct and predictive validity of the com-b model for physical activity, *J. Health Psychol.* 24 (2019) 1378–1391, <https://doi.org/10.1177/1359105317739098>.
- [46] J.E. Keosaian, C.M. Lemaster, D. Dresner, M.E. Godersky, R. Paris, K.J. Sherman, R. B. Saper, We're all in this together: A qualitative study of predominantly low income minority participants in a yoga trial for chronic low back pain, *Complement. Ther. Med.* 24 (2016) 34–39, <https://doi.org/10.1016/j.ctim.2015.11.007>.
- [47] N.L. Atkinson, R. Permeth-Levine, Benefits, barriers, and cues to action of yoga practice: A focus group approach, *Am. J. Health. Behav.* 33 (2009) 3–14, <https://doi.org/10.5993/ajhb.33.1.1>.
- [48] V. Braun, V. Clarke, What can "thematic analysis" offer health and wellbeing researchers? *Int. J. Qual. Stud. Health Well-being* 9 (2014) 26152, <https://doi.org/10.3402/qhw.v9.26152>.
- [49] C. Keyworth, T. Epton, J. Goldthorpe, R. Calam, C.J. Armitage, Acceptability, reliability, and validity of a brief measure of capabilities, opportunities, and motivations ("COM-B"), *Br. J. Health Psychol.* 25 (2020) 474–501, <https://doi.org/10.1111/bjhp.12417>.
- [50] C.Y. Francis, J. Morris, P.J. Whorwell, The irritable bowel severity scoring system: A simple method of monitoring irritable bowel syndrome and its progress, *Aliment. Pharmacol. Ther.* 11 (1997) 395–402, <https://doi.org/10.1046/j.13652036.1997.142318000.x>.
- [51] A.S. Zigmond, R.P. Snaith, The hospital anxiety and depression scale, *Acta Psychiatr. Scand.* 67 (1983) 361–370, <https://doi.org/10.1111/j.1600-0447.1983.tb09716.x>.
- [52] A.F. Stern, The hospital anxiety and depression scale, *Occup. Med.* 4 (2014) 393–394, <https://doi.org/10.1093/occmed/kqu024>.
- [53] O. Lundberg, K. Manderbacka, Assessing reliability of a measure of self-rated health, *Scand. J. Public Health* 24 (1996) 218–224, <https://doi.org/10.1177/140349489602400314>.
- [54] D.L. Patrick, D.A. Drossman, I.O. Frederick, J. DiCesare, K.L. Puder, Quality of life in persons with irritable bowel syndrome: Development and validation of a new measure, *Dig. Dis. Sci.* 43 (1998) 400–411, <https://doi.org/10.1023/a:1018831127942>.
- [55] L.V. Hedges, Distribution theory for glass's estimator of effect size and related estimators, *J. Educ. Stat.* 6 (1981) 107–128, <https://doi.org/10.2307/1164588>.
- [56] V. Braun, V. Clarke, Using thematic analysis in psychology, *Qual. Res. Psychol.* 3 (2006) 77–101, <https://doi.org/10.1191/1478088706qp0630a>.
- [57] Y. Ringel, R.E. Williams, L. Kalilani, S.F. Cook, Prevalence, characteristics, and impact of bloating symptoms in patients with irritable bowel syndrome, *Clin. Gastroenterol. Hepatol.* 7 (2009) 68–72, <https://doi.org/10.1016/j.cgh.2008.07.008>.
- [58] S. Ballou, L. Keefer, The impact of irritable bowel syndrome on daily functioning: Characterizing and understanding daily consequences of IBS, *Neurogastroenterol. Motil.* 29 (2017) 12982, <https://doi.org/10.1111/nmo.12982>.
- [59] A. D'Silva, G. MacQueen, Y. Nasser, L.M. Taylor, M. Raman, Yoga as a therapy for irritable bowel syndrome, *Dig. Dis. Sci.* 65 (2020) 2503–2514, <https://doi.org/10.1007/s10620-019-05989-6>.
- [60] O. Grundmann, S.L. Yoon, Mind-body therapies for functional bowel disorders – A review of recent clinical trials, *Eur. J. Integr. Med.* 5 (2013) 296–307, <https://doi.org/10.1016/j.eujim.2013.03.007>.
- [61] H.S. Cho, J.M. Park, C.H. Lim, Y.K. Cho, I.S. Lee, S.W. Kim, M. Choi, I. Chung, Y. K. Chung, Anxiety, depression and quality of life in patients with irritable bowel syndrome, *Gut Liver* 5 (2011) 29–36, <https://doi.org/10.5009/gnl.2011.5.1.29>.
- [62] Z.Z.R.M. Weerts, L. Vork, Z. Mujagic, D. Keszthelyi, M.A.M. Hesselink, J. Kruiemel, C. Leue, J.W.M. Muris, D.M.A.E. Jonkers, A.A.M. Masclee, Reduction in IBS symptom severity is not paralleled by improvement in quality of life in patients with irritable bowel syndrome, *Neurogastroenterol. Motil.* 31 (2019) 1–10, <https://doi.org/10.1111/nmo.13629>.
- [63] C.A. McHorney, J.E. Ware Jr., A.E. Raczek, The MOS 36-item short-form health survey (SF-36): II. Psychometric and clinical tests of validity in measuring physical and mental health constructs, *Med. Care.* 31 (1993) 247–263, <https://doi.org/10.1097/00005650-199303000-00006>.
- [64] C.C. Streeter, P.L. Gerbarg, T.H. Whitfield, L. Owen, J. Johnston, M.M. Silveri, M. Gensler, C.L. Faulker, C. Mann, M. Wixted, A.M. Hernon, M.B. Nyer, E.R. P. Brown, J.E. Jensen, Treatment of major depressive disorder with iyengar yoga and coherent breathing: A randomized controlled dosing study, *J. Altern. Complement. Med.* 23 (2017) 201–207, <https://doi.org/10.1089/acm.2016.0140>.
- [65] N.K. Bukar, L.M. Eberhardt, J. Davidson, East meets west in psychiatry: Yoga as an adjunct therapy for management of anxiety, *Arch. Psychiatr. Nurs.* 33 (2019) 371–376, <https://doi.org/10.1016/j.apnu.2019.04.007>.
- [66] A. D'Silva, Y. Nasser, J. Vallance, D. Marshall, M. Raman, Using theory of planned behaviour to understand factors influencing irritable bowel syndrome patients' intention to practice yoga, *Am. J. Gastroenterol.* 116 (2021) S231–S232, <https://doi.org/10.14309/01.ajg.0000774532.11919.22>.

- [67] A.E. Speed-Andrews, C. Stevinson, L.J. Belanger, J.J. Mirus, K.S. Courneya, Predictors of adherence to an iyengar yoga program in breast cancer survivors, *Int. J. Yoga*. 5 (2012) 3–9, <https://doi.org/10.4103/0973-6131.91693>.
- [68] L.A. Houghton, M. Heitkemper, M. Crowell, A. Emmanuel, A. Halpert, J. A. McRoberts, B. Toner, Age, gender and women's health and the patient, *Gastroenterology* 150 (2016) 1332–1343, <https://doi.org/10.1053/j.gastro.2016.02.017>.
- [69] J.Y. Cagas, S.J.H. Biddle, I. Vergeer, Yoga not a (physical) culture for men? Understanding the barriers for yoga participation among men, *Complement. Ther. Clin. Pract.* 42 (2021), 101262, <https://doi.org/10.1016/j.ctcp.2020.101262>.
- [70] M.A. Adeyemo, B.M.R. Spiegel, L. Chang, Meta-analysis: Do irritable bowel syndromesymptoms vary between men and women? *Aliment. Pharm. Therap.* 32 (2010) 738–775, <https://doi.org/10.1111/j.1365-2036.2010.04409.x>.
- [71] M. Jones, J. Bratten, L. Keefer, Quality of life in patients with inflammatory bowel disease and irritable bowel syndrome differs between subjects recruited from clinic or the internet, *Am. J. Gastroenterol.* 102 (2007) 2232–2237, <https://doi.org/10.1111/j.15720241.2007.01444.x>.