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Yoga for teens with irritable bowel syndrome: Results from a mixed-methods pilot study

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Abstract

Objectives: Irritable bowel syndrome (IBS) is a common condition associated with recurrent abdominal pain and altered bowel habits. IBS is particularly pernicious to youth, who may withdraw from life tasks due to pain, diarrhea, and/or fear of symptoms. Emotional stress exacerbates IBS symptoms, and mind-body interventions may be beneficial.

Methods: In this mixed-methods study of 18 teens aged 14–17 years undertaking a 6-week Iyengar yoga intervention, we aimed to identify treatment responders and to explore differences between responders and non-responders on a range of quantitative outcomes and qualitative themes related to yoga impact, goodness of fit, and barriers to treatment.

Results: Half of the teens responded successfully to yoga, defined as a clinically meaningful reduction in abdominal pain. Responders differed to non-responders on post-intervention quantitative outcomes, including improved abdominal pain, sleep, and visceral sensitivity. Qualitative outcomes revealed that responders reported generalized benefits early in treatment, and that their parents were supportive and committed to the intervention. Responders and non-responders alike noted the importance of home practice to achieve maximal, sustained benefits.

Conclusions: This study reveals the need for developmentally-sensitive yoga programs that increase accessibility of yoga for all patients.

Keywords

irritable bowel syndrome; qualitative research; Iyengar yoga; adolescents

Introduction

Irritable bowel syndrome (IBS) is a disorder involving abdominal pain and altered bowel habits that substantially impacts quality of life [1], especially during adolescence [2–4]. Adolescent patients may be particularly debilitated by gastrointestinal and related

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symptoms, with fear of pain, bloating, and/or diarrhea severely limiting their engagement in school and social life functions.

There is agreement that dysregulation in the neuroenteric (brain-gut) signaling system and central brain connectivity plays a role in IBS [5, 6], with evidence that stress and distress are implicated in symptoms [7]. Mind-body techniques that promote relaxation and resumption of activity are beneficial. Evidence supports the roles of physical exercise and psychological treatments such as cognitive behavioral therapy in reducing IBS symptoms [8]. We contend that yoga, with its focus on physical alignment, meditation, and breathing practices, provide a range of mind-body health benefits that target likely mechanisms of the disorder, including emotional dysregulation, heightened visceral pain sensitivity, and physiological stress reactivity [9]. As such, yoga is a unique and potentially robust means to treat young patients' physical and mental functioning.

Yoga is practiced amongst the general population to alleviate stress and pain [10]. Our body of yoga research has demonstrated the feasibility and preliminary efficacy of yoga to treat a number of pain conditions, including depression, rheumatoid arthritis and IBS [11–14]. Despite being attractive to IBS patients [15], yoga's efficacy remains unclear in this population, especially in pediatric populations. A small number of pilot studies have examined yoga for IBS, suggesting a reduction in IBS symptoms [16] [17], similar to pharmacological treatment [18]. However, the small study samples [18] and in one study, the use of an exclusively male sample, despite IBS disproportionately affecting females [17], limit conclusions.

Our recently published randomized clinical trial of an Iyengar yoga intervention in teens and young adults (YA) with IBS, from which the sample for this study originates [12], found different outcomes for teens compared to the YA group. Young adults undertaking yoga reported significantly improved IBS symptoms, psychological distress, disability, sleep, and fatigue compared to waitlist controls. However, the teens in the yoga group reported only significantly improved physical functioning compared to wait-list controls. Of interest, almost half of the YA and teens reported clinically meaningful reductions in pain after yoga. These findings suggest that while pain was similarly impacted by yoga across age, there were differing responses between the teens and YA in the program. The rationale for focusing on teens in the current mixed-methods analysis is based on these developmentally-specific quantitative results and the intention to further understand the factors behind the narrow benefits for teens.

The aim of the current paper is to explore, using in-depth qualitative data from teens and their parents, the full range of teens' experiences with the yoga program. Given the high number of teens reporting clinically relevant reductions in pain, we intended to: 1) identify teen treatment responders using established methods of pain reduction, and 2) to explore, using mixed-methods data, key differences between responder and non-responder teens on the quantitative outcomes of IBS symptoms, fatigue/sleep, psychological distress, and visceral sensitivity, and qualitative themes related to yoga impact, goodness of fit, and barriers to treatment.

Method

As detailed in our primary study [12], we tested a randomized, controlled clinical trial of a 6 week twice/week yoga intervention against a usual care waitlist control condition to assess yoga's safety, feasibility and preliminary efficacy in teens and young adults (aged 14–26 years) with documented IBS. Participants were recruited through advertising in various locations, including community bulletin boards, support groups, online sources (eg, Craigslist, the [Clinical Trials.gov](https://www.clinicaltrials.gov) Web site), gastroenterology offices, and physician referrals. A small gas reimbursement (\$10) was offered to participants who lived greater than 25 miles away from the yoga studio. The institutional review board of the University of California, Los Angeles granted full approval for this study.

Inclusion Criteria:

Inclusion criteria consisted of: aged 14–26 years, diagnosis of recurrent abdominal pain (RAP), or IBS using ROME III adult criteria for 18–26 year-olds and ROME III pediatric criteria for 14–17 year-olds, ability to speak and understand English and provide written informed assent or consent. Exclusion criteria consisted of: being pregnant; practice of yoga within the last 3 months, possessing any disease, injury, or physical or laboratory finding that could potentially impact results or render the individual at risk by participating in yoga; being unable to comply with study procedures; or planning new treatment within 2 weeks of the intervention.

Selection of sub-group:

At study entry, participants were randomized and entered into either the immediate yoga or the usual-care control group in a 1:1 ratio (Table 1). Participants in the waitlist control condition continued with usual-care under their gastroenterologist or primary physician. After their waitlist ended they were offered the yoga intervention. Fifty-one adolescents and young adults completed the study (control = 22; yoga = 29). The yoga group comprised of 18 adolescents (14–17 years) and 11 young adults (18–26 years). The present study is focused on the 18 adolescents (16 females and 2 males; mean age = 16.4 years) aged 14–17 years randomized to the yoga intervention. Baseline attrition was 24%, and adolescents attended an average of 10/12 yoga classes.

Iyengar Yoga (IY):

This tradition of yoga is potentially suited to meeting the rehabilitation needs of people with medical conditions [19]. Poses were carefully selected by an experienced IY teacher to be beneficial for IBS, and were taught with props. The intervention involved 6 weeks of 1.5 hour classes held twice/week (total duration was 18 hours). A maximum of 6 students attended to ensure sufficient instructor: student ratio. Classes were led by an experienced IY teacher, assisted by a junior level teacher. The senior teacher served as an advisor to the study, and developed the working list of poses to standardize delivery. Classes were held in the UCLA Pediatric Pain Program Yoga Studio. One make-up class was available.

Poses taught to students included standing, reclining and seated poses, forward bends, back bends and supported inversions. As students developed skills, more challenging poses were

introduced in a sequenced manner. Classes were held during mid-week (evening) and on weekends (afternoon) to ensure that employed participants and full-time students had access. Homework was not mandatory, but was suggested. Participants had the option to take props home during the intervention.

Study personnel reviewed the yoga teachers' adherence to the pose and sequence protocol. There were no deviations from the manualized yoga protocol. Any changes were allowed within predetermined guidelines to account for individual differences in comorbidities or injuries.

Quantitative Measures

Yoga responders versus non-responders.

Teens in the yoga group were divided into responders versus non-responders according to their responses on the abdominal pain numeric rating scale (NRS) described below: Consistent with standards for minimally clinically significant differences in pain [20], responders were defined as those with a raw change of -1 point on the NRS at the post-intervention assessment compared to baseline.

Abdominal Pain Intensity. At baseline and during post-intervention assessments, participants were asked to rate their abdominal pain intensity in the last week, on a scale of 0 (no pain) to 10 (most pain possible). Raw changes of 1 point are considered clinically meaningful [20].

IBS Symptoms were measured using the abdominal symptoms subscale of the Children's Somatization Inventory (CSI), [21–23]. Participants are asked to rate the presence of symptoms, including nausea, diarrhea, and abdominal pain, for the last 2 weeks using a 5-point scale (*not at all* to *a whole lot*) [21].

Psychological Distress was determined with the Brief Symptom Inventory-18 (BSI-18) [24], where participants rate how often they have experienced anxiety, somatization, and depressive symptoms within the last 7 days on a 5-point scale. The BSI-18 has adequate to good internal consistency ([alpha] range = 0.74–0.89) and validity [24].

The Pittsburgh Sleep Quality Index (PSQI) assesses sleep quality during the previous month [25]. The subjective sleep quality component was used, with lower scores indicating less sleep problems.

Fatigue was evaluated with the Functional Assessment of Chronic Illness Therapy Fatigue Subscale (FACIT-Fatigue) [26, 27]. The subscale includes 13 items to assess physical and functional consequences of fatigue on a reverse 4-point Likert scale. Scores range from 0 to 52 with higher scores demonstrating less fatigue.

Visceral sensitivity was assessed with the *Visceral Sensitivity Index (VSI)*, which includes 15 items to measure fear, anxiety and hypervigilance associated with perceptions of bodily sensations. Anxiety related to gastrointestinal sensations is rated on a 6-point scale from *strongly agree* to *strongly disagree*, with higher scores denoting greater GI-specific anxiety. The VSI is a reliable, valid measure of gastrointestinal symptom-specific anxiety [28].

Qualitative methods

At the end of the intervention semi-structured interviews were conducted with participants. Topics included perceptions of whether and how yoga changed functioning, including any changes in pain, symptoms, or mood. Barriers to treatment were also explored, including what was/was not helpful, and whether the intervention was a good match for IBS. Teens and their primary caregiver (who generally drove teens to each yoga session) were interviewed separately.

Data Analysis

We used a mixed-methods approach, in which the depth of qualitative interview data have the potential to shed light on the quantitative findings. Such an approach is recommended when exploring new treatment regimens.

Once yoga response had been determined, we used ANOVAs to examine post-intervention group differences between yoga responders and non-responders on the quantitative measures described above. Baseline scores were entered as covariates, to account for potential baseline differences between the groups. Significance tests were set at 0.05, although trends at 0.10 were also noted.

Next qualitative responses were analyzed by responder status. Ethnographic content analysis was used to integrate these data with the quantitative data. Interview transcripts were read, and codes were assigned to relevant text. After the interviews had been read in detail twice by two different researchers, main themes were identified and coded according to variables that were consistent with the quantitative data. Corresponding quotes were entered into Microsoft Excel to create tables identifying the main themes. The process is iterative and code categories were revised, expanded, and created. Data were used to clarify the data from one method with the data of another (complementarity), cross-validate the qualitative and quantitative data (triangulation), and broaden the depth of the data (expansion) [29].

Results

Nine teens were identified as yoga responders (mean post-intervention pain NRS = 4.11), and 9 as non-responders (mean post-intervention pain NRS = 6.22) using the definition described above. Chi-square and t-tests revealed the groups did not differ on demographics (sex, race, and IBS duration), number of classes attended, amount of yoga homework practiced or baseline GI symptoms/pain.

Quantitative results

Table 2 shows post-intervention differences (including trends) between responders and non-responders. Estimated marginal means, calculated with ANOVAs controlling for baseline scores are displayed in bold. Of note, there were trends in responders having lower levels of post-intervention gastrointestinal symptoms, disability, visceral sensitivity, sleep problems, and fatigue compared to non-responders, mirroring the domains of improvement in the YA yoga group that were reported in our primary paper. The results support the validity of our

responder status categories, with teen responders' post-yoga improvement spanning multiple domains.

Qualitative results

Next, interview data were comparatively analyzed by responder versus non-responder status. Key themes emerged from the parent and adolescent interviews, presented in Table 3 with supporting quotes. Three themes emerged that clearly distinguished the groups, including: 1) nature of benefits; 2) timeline of benefits; and 3) extent of parent commitment to their child's involvement in the program. Responders tended to report multiple benefits across outcomes that appeared after the first few sessions, whereas non-responders noted late in the intervention that they were only just beginning to notice changes. Non-responders also expressed that benefits didn't transfer outside of yoga class time and that symptoms returned by the next day. Perhaps the clearest group difference, however, was between parents in their levels of commitment and support. Many families had to drive an hour or more each way to class. For parents of responders, this was not an apparent problem, but parents of non-responders expressed frustration at time spent in traffic even when they lived a short distance away. Parents of non-responders were also much less likely to know about or recall evidence of their child's home practice materials, had less knowledge about the classes and were more likely to encourage poor coping strategies such as staying home from class during pain episodes.

Two other themes emerged that, rather than distinguishing the groups, were shared by responders and non-responders alike: 1) a sense that the yoga poses were a good fit for IBS, and 2) the need for prescribed, supported homework. All but one teen (a non-responder) said IY was a good fit for IBS and wanted classes to continue. Participants consistently reported that abdomen opening poses, such as supported setu bandha (see Figure 1), and inversions were particularly helpful, and they liked how the approach was gentle, individualized, and used a balance of active and relaxing poses. Many teens said they would have liked more meditation exercises as this would “*help to calm my wandering mind*” and provide a method of relief outside class. Teens were eager for skills they could use in other settings, particularly in school during stressful or painful episodes.

Despite largely failing to use yoga at home, responder and non-responder teens alike noted that homework would have augmented the benefits they experienced. Participants were not formally instructed to practice at home, but were provided with an information sheet and props. This informal homework model resulted in low compliance (across responder status) and almost no one was still engaging in yoga at the 2-month follow-up. Many teens, however, identified a link between home practice and relief. For example, one non-responder teen reported that she would have felt better with daily home practice, but that she needed more prodding:

“I only do things that are assigned to me and it comes with being in school...but I felt like if that was demanded of me (homework) I would have done it.”

In addition to a lack of prescription and support, other barriers to home practice included lack of space, time, and confidence. For example, one non-responder noted it “*felt weird not to have any help*.” Another noted she didn't have any quiet, private space at home in which

to practice. Such comments elucidate the need for researchers to invest heavily in the homework component of yoga interventions for teens if continued self-management is a goal of treatment.

Discussion

Our quantitative data revealed that half of the teens completing yoga were responders, demonstrating clinically meaningful reductions in abdominal pain following yoga treatment, and half were non-responders, failing to display clinically meaningful reductions in pain. Treatment responders had lower post-intervention IBS symptoms, fatigue, sleep problems, and visceral sensitivity at levels of significance or trend compared to non-responder teens. Responder teens' relative improvements are consistent with the changes noted in young adults following yoga within our primary study. Overall, our findings suggest that yoga may positively impact gastrointestinal discomfort and associated symptoms in a sub-set of individuals with IBS.

The qualitative data provide insight into the factors underlying treatment response in teens. Interviews revealed that responders felt relief in multiple domains of functioning early in treatment, and that their parents were supportive and committed to the intervention. Conversely, non-responders reported that they experienced relief while they were in yoga class, but that the benefits did not generalize outside of classes. They also reported impact on symptoms later in the intervention compared to responders, and their parents were generally unaware of what the classes involved, and noted barriers to supporting the teen's participation.

Gaining the buy-in of parents may be a critical component of successful delivery of such an intervention. Parents are known to play a role in children's IBS symptoms and treatment, supporting the need to increase parental motivation and commitment to the child's treatment. Parent characteristics such as over-involvement and rejection have been implicated in IBS symptoms [30, 31], as have behaviors like solicitousness [32]. Parents of children with chronic pain are also significantly more likely than parents of controls to experience IBS, pain, anxiety, and depression themselves [33]. Parents are not only implicated in the etiology of pediatric IBS; they also have power as treatment aids. Adding parents to treatment is beneficial on at least two levels. First, parents can directly impact the child's therapy by adjusting their responses to the child's pain and supporting the child's motivation, attendance, and home practice. Second, involving parents presents an opportunity for parents to learn skills to regulate their own mental and physical health. This indirect pathway is likely to lead to adaptive stress modeling, reduced parental pain, healthier parent-child relationships, and an upward spiral of parent and child well-being. Including parents in treatment aimed at children's pain management may be critical for the success of pediatric interventions [34].

Qualitative data also revealed that teens almost unanimously felt that IY was an appropriate form of therapy, but that prescribed and supported homework was necessary for maximal benefit. Self-directed home practice may be an essential aspect of yoga therapy and a pathway to continued self-management in teens. A recent survey of yoga practitioners

showed that home practice was a stronger indicator of health outcomes than class attendance, correlating with well-being, healthy eating, and sleep indices [35]. We recommend actively prescribing and supporting yoga home practice in future interventions. Support measures particularly relevant to teens include daily reminders sent via text or email, descriptions and photographs of yoga poses and audio recordings of guided meditation available for download on tablets and phones, discussion of home practice at each yoga class, and e-support with a yoga teacher to build patient confidence. Supporting home practice may ultimately enhance the ecological validity of yoga, enabling patients to manage their condition after study completion.

This study is the first we are aware of that examines the impact of yoga by responder status. Previous results in young people have demonstrated support for the use of yoga to improve IBS symptoms and function by examining mean improvement scores. For example, improvement in pain and quality of life was noted in a recent single-arm pilot study of yoga for 20 children aged 8–18 years with IBS or functional abdominal pain (FAP) [16]. However, similar to the developmentally disparate results in our original study, children aged 8–11 years had longer-lasting effects than teens. Overall, adolescents may be a particularly difficult group to treat. A study using predominantly home-practice yoga with 25 adolescents aged 11–18 years with IBS demonstrated significantly less disability, anxiety and problem-based coping in the yoga group compared to waitlist controls, but no post-intervention gastrointestinal differences. Our study adds to the literature, by documenting the barriers and challenges faced by teens who do not readily respond to yoga.

The results of our primary study support the benefits of yoga in reducing abdominal pain and other symptoms in young adults with IBS. The present study builds upon these findings, by detailing teen responses and shedding light on the developmental differences noted in the original study. Teens in the original study displayed a more limited response compared to the broad range of improvements found in the young adults [12]. By examining responder versus non-responder teens on quantitative and qualitative data, the present study demonstrates some of the factors behind non-response to yoga in adolescence, and points to potential valuable additions for future intervention studies.

Overall, this qualitative data provides guidance for future studies examining teen yoga, including:- the importance of prescribed and supported daily homework; the need for an intervention longer than 6 weeks for all patients to have ample time to respond (with multiple assessments for dose testing); inclusion of portable skills by adding guided meditation/breathing exercises to yoga interventions; and incorporating parents in treatment, by providing training in optimizing responses to the teen's treatment and parent yoga/meditation to ameliorate parental pain and stress. Our findings suggest that a sub-group of teens may require a different yoga intervention plan. Future research should further explore moderators of treatment response, to enable predictions about the likelihood of response so that teens at risk of non-response can be provided with an effective yoga intervention. Measuring pain scores mid-intervention might identify non-responders early in treatment, with provision of additional instruction, coaching or support, to increase the chance of all teens experiencing relief.

Ultimately, it is likely that interventions require developmental sophistication, where programs meet the age and developmental needs of participants in elegant and novel ways. As yet, there has been little attention in the yoga literature to the developmental tailoring of interventions, even though physical, cognitive and emotional changes occur across the lifespan. Yoga may be most optimally presented when the selection of postures, meditation exercises, modifications and pacing are tailored to populations. Just as issues of dosing, benefit, and side effects vary as a function of patient age and maturation in pharmacological treatment, developmental considerations should also be considered in behavioral interventions.

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Table 1.

Descriptive characteristics of teens undertaking yoga

Participant	Sex	Age (yrs)	Ethnicity/Race	IBS duration (yrs)
1	F	17.67	Non-Hispanic/Non-Latino White	1.67
2	F	17.25	African-American	2.25
3	F	17.58	Non-Hispanic/Non-Latino White	3.58
4	F	17.42	Hispanic-Latino	0.92
5	M	17.67	Non-Hispanic/Non-Latino White	0.67
6	F	16.00	Asian	1.00
7	F	14.17	Hispanic/Latino multi-racial	9.17
8	F	16.67	Non-Hispanic/Non-Latino White	3.67
9	F	16.83	Non-Hispanic/Non-Latino White	0.83
10	F	14.25	Multi-racial	1.25
11	F	14.92	Non-Hispanic/Non-Latino White	1.92
12	F	17.00	Hispanic/Latino Multi-racial	1.00
13	F	15.17	Non-Hispanic/Non-Latino White	1.17
14	F	15.75	Non-Hispanic/Non-Latino White	3.75
15	F	16.92	Non-Hispanic/Non-Latino White	2.92
16	M	16.00	Multi-racial	3.00
17	F	16.83	Non-Hispanic/Non-Latino White	4.00
18	F	17.83	Hispanic/Latino Multi-racial	0.83

Table 2.

Quantitative post-intervention differences between yoga responders and non-responders

Post-intervention outcomes	Responders (n= 9) Mean (sd)	Non-responders (n=9) Mean (sd)	t (df)	p value
CSI: Gastrointestinal Symptoms	9.44 (4.77)	13.89 (5.58)	-1.82 (16)	.08
Functional Disability Index	11.22 (9.34)	21.89 (13.64)	-1.94 (16)	.07
FACIT Fatigue *	34.4 (11.93)	25.33 (10.94)	1.69 (16)	.10
SF-36 Physical Functioning *	77.78 (17.87)	73.89 (18.83)	.45 (16)	.65
PSQI: Sleep Duration	.11 (.33)	1.22 (1.09)	-2.92 (16)	.01
BSI-18: Psychological Distress	13.89 (11.46)	21 (14.68)	-1.12 (15)	.28
Visceral Sensitivity Index	28.89 (14.99)	47.33 (17.4)	-2.41 (16)	.03

* Higher = better functioning

CSI: Children's Somatization Inventory; PSQI: Pittsburgh Sleep Quality Index; BSI-18: Brief Symptom Inventory – 18-Item Version.

Table 3.

Textual themes distinguishing responder from non-responder teens

Themes	Yoga responders	Non-responders
<i>Benefits of yoga</i>	Consistent, multiple benefits reported. One teen mentioned yoga was “ <i>better than taking medicine</i> ” for pain relief. Another teen noted she “ <i>started class 8/10 for pain and ended 2/10.</i> ”	Most reported benefits were specific to class and effects wore off quickly: “ <i>The pain was completely eliminated while doing the yoga. I think for me, like, I couldn’t apply it everywhere where I needed it.</i> ”
<i>Timeline of benefits</i>	Almost immediately: “ <i>I noticed it after the first two sessions.</i> ”	As noted by this parent, effects were beginning to manifest: “ <i>I think she’s feeling like she’s just starting to, you know, get some benefit, real benefit.</i> ”
<i>Parent commitment and response</i>	6/7 parents knew about homework sheets sent home to adolescents. Parents shared in the experience with their child, used words such as ‘ <i>grateful</i> ’ and ‘ <i>excited</i> .’ One mother, driving her daughter an hour each way, said she ‘ <i>would do anything to help her.</i> ’ Encouraged teens to attend, despite flare-ups.	6/7 parents <i>did not</i> know about or recall the homework sheets. Parents had low enthusiasm/commitment: “ <i>It’s a 20 minute commute, sometimes she (mother) wanted to be home and do things. So that kind of got annoying to her.</i> ” Encouraged teens to stay home if not well.