# Disordered Eating and Eating Competence in Adults with Irritable Bowel Syndrome Based on Symptom Severity

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## Abstract

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**Objectives:** This study seeks to assess the frequency at which disordered eating impacts patients with irritable bowel syndrome (IBS), evaluate the level of Eating Competence (EC) among patients with IBS, and determine whether EC and eating disorder (ED) risk varies according to IBS symptom severity and IBS subtype.

**Methods:** This cross-sectional study is based on an anonymous survey conducted from August to September 2021. Adults with IBS (N=225) were recruited from online and social media IBS support forums. IBS symptom severity was assessed using the validated IBS Severity Scoring System (IBS-SSS), ED risk was assessed using the validated Eating Attitudes Test (EAT-26), and EC was assessed using the validated Satter Eating Competence Inventory (ecSI 2.0™). Multiple linear regression was used to predict EAT-26 total score from IBS-SSS score and age. The regression model was repeated with IBS subtype added as a covariate. Two-way ANOVAs

were used to examine the relationships between IBS severity level, IBS subtype, and ecSI 2.0™ total score.

**Results:** EC among the sample was 17% while 27% was classified as likely or very likely disordered eating. IBS severity was positively associated with ED risk ($p$=0.011), and EC was significantly lower in the severe IBS group compared to the moderate IBS group ($p$=0.016). No relationship was detected between IBS subtype and ED risk or EC.

**Conclusions:** IBS severity was positively associated with ED risk and negatively associated with EC. This sheds light on the importance of assessing EC and screening for disordered eating and EDs prior to selecting therapies for patients with IBS, particularly when symptom severity is high. This study also calls to attention the relatively low rates of EC in patients with IBS, especially among those with severe IBS.

## Introduction

Irritable bowel syndrome (IBS) is one of the most common disorders of gut-brain interaction (DGBI) (previously referred to as functional gastrointestinal disorders (FGID)), affecting an estimated 11% of the global population. It is a chronic condition characterized by abdominal pain and altered bowel habits that is associated with significant reductions in quality of life.[1] Existing evidence suggests that an increased risk of eating disorders (ED) and disordered eating practices exists among patients with DGBIs, particularly IBS. ED risk in patients with DGBIs and IBS has been measured in cross-sectional research using a variety of validated tools including the 26 Item Eating Attitudes Test (EAT-26), the 40 Item Eating Attitudes Test (EAT-40), the Eating Disorder Inventory (EDI), the Eating Disorders Examination Questionnaire (EDE-Q), the Nine Item ARFID Screen (NIAS), and the SCOFF questionnaire. Due to the heterogeneity of assessment methods, the estimated prevalence of ED in this population varies. Studies utilizing SCOFF in patients with IBS found that 23-25% are at risk for ED[2,3], and a recent study that assessed EAT-26 in patients with IBS found that 27% were classified as "likely disordered eating" and 21% were classified as "very likely disordered eating".[4] Studies examining the broader population of patients with DGBIs found that approximately 20% met the criteria for Avoidant Restrictive Food Intake Disorder (ARFID)[5,6] and 28% had EDE-Q scores suggestive of an underlying eating disorder.[6]

A handful of studies have measured ED risk in IBS patients in comparison to controls. One found that patients with IBS scored significantly higher on the EAT-40 in comparison to patients with inflammatory bowel disease (IBD) and healthy controls, indicating a higher level of concern about dieting and body weight and problematic eating behaviors among the IBS group.[7] A

second study that utilized EAT-40 found significantly higher scores among patients with IBS compared to patients with IBD and patients with peptic ulceration.[8] In two other studies, Reed-Knight et al. and Tang et al. found no significant differences in EDE-Q and EDI scores, respectively, between patients with IBS and healthy controls.[9,10] Nonetheless, the adolescents with IBS included in Reed-Knight et al.'s study reported using disordered eating behaviors such as skipping meals and vomiting after eating as a means of controlling symptoms at a significantly higher rate than controls.[9] In Tang et al.'s study, physical pain and discomfort were positively associated with the Perfectionism and Ineffectiveness EDI subscales and symptoms of nausea and vomiting were positively associated with the Bulimia EDI subscale, indicating that patients who experienced nausea and vomiting as IBS symptoms were more likely to have thoughts of vomiting as a means of weight control.[10] Most recently, Kayar et al. found that EAT-26 score was significantly higher among patients with IBS compared to controls, and that IBS severity was positively associated with EAT-26 scores.[4] Overall, the existing evidence suggests that in comparison to patients with organic GI disorders and healthy controls, patients with IBS tend to exhibit more warning signs for disordered eating and higher ED risk.

The evidence summarized above is indicative of a relationship between eating disorders and gastrointestinal disorders which may be bidirectional in nature. On the one hand, disordered eating practices such as self-induced vomiting, binge eating, laxative abuse, and caloric restriction can lead to physiological changes including esophageal acid damage, changes in hormone secretion, damage to pelvic floor muscles, delayed gastric emptying, and abnormal colonic function that result in gastrointestinal (GI) symptoms.[11] In one study, history of ED based on DSM-IV criteria was noted in 15.9% of patients with DGBIs[12], and in another, 87% of

patients with ED and IBS reported developing their ED prior to IBS, indicating that in some cases ED precedes DGBI diagnosis.[13] On the other hand, avoidance of certain foods is reported in up to 98% of patients with IBS[9] and restrictive dietary changes are commonly prescribed as a therapy for IBS. This results in altered eating behaviors that may progress to a maladaptive focus on food intake and ultimately disordered eating, as proposed in a review by Satherley et al.[14] Two studies have observed a positive association between GI problems in childhood and early adolescence and later disordered eating, suggesting that in some cases DGBIs may in fact precede EDs.[15,16]

In contrast to the tools described above for characterizing disordered eating and eating disorder risk, higher scores on the Satter Eating Competence Inventory (ecSI 2.0™) are inversely related to eating disorder symptoms.[17–19] ecSI 2.0™ is a validated 16-item questionnaire that addresses eating attitudes and behaviors within the framework of the Satter eating competence model (ecSatter), a comprehensive model with a focus on enjoyment, variety, hunger and satiety cues, and regularity.[20] Individuals scoring 32 or above on ecSI 2.0™ are classified as eating competent, meaning they have a "flexible, positive approach to feeding themselves nutritious and enjoyable food".[19] ecSI 2.0™ has four subscales or domains: eating attitudes, internal regulation, food acceptance, and contextual skills.[20] There is no existing research that assesses ecSI 2.0™ in patients with IBS. Given that eating competence (EC) is associated with a higher Healthy Eating Index, improved metabolic health markers, lower stress, and lower body dissatisfaction[21–23], if low rates of EC are found in patients with IBS, its principles may prove a valuable tool in enhancing overall health and wellbeing and reducing ED risk in this population.

This study seeks to add new knowledge pertaining to the frequency at which disordered eating impacts patients with IBS, evaluate the level of EC among patients with IBS, and determine whether EC and ED risk varies according to IBS symptom severity and IBS subtype. We predict an inverse relationship between IBS severity and EC, and a positive relationship between IBS severity and ED risk.

## Methods

### *Study design & procedures*

This cross-sectional study is based on an anonymous online survey conducted from August to September 2021. Individuals ages 18 and older who were able to read and understand English, had not taken the survey before, and self-reported being diagnosed with IBS by a physician were eligible to participate. After being pilot tested for functionality and face validity, the survey link was posted to the following online and social media forums: "IBS Support (Official)" on Facebook.com, Reddit.com/r/ibs, Ibsgroup.org, and Ibspatient.org. The survey took approximately 10 minutes to complete and was accessed on Research Electronic Data Capture (REDCap), a secure web-based platform hosted through the University of Washington Institute of Translational Health Sciences.[24,25] Exempt status was granted by the University of Washington Human Subjects Division.

### *Measures*

#### *Demographic and health information*

The first part of the survey collected information about participants' age, height, weight, gender, sex assigned at birth, sexual orientation, race, country of residence, IBS subtype, years since IBS

diagnosis, eating disorder history, and comorbidities. Participants were also asked to indicate where they obtained the survey link. IBS diagnosis status was assessed with the following question: *"Have you ever been told by a physician that you have irritable bowel syndrome (IBS)?"* Body mass index (BMI) was calculated using participant's self-reported height and weight.

*IBS severity*

The validated IBS Severity Scoring System (IBS-SSS) was used to assess IBS symptom severity.[26] The IBS-SSS contains five questions that pertain to abdominal pain, abdominal distention, dissatisfaction with bowel functioning, and interference of IBS symptoms with life in general (example: *"How severe was your abdominal (stomach) pain in the past 10 days? Please indicate a number from 0 to 100, with 0 meaning no pain and 100 meaning very severe pain"*). Response options are provided in increments of 10. Scores of 75 to 174 correspond to "mild IBS", scores of 175 to 299 correspond to "moderate IBS", and scores greater than or equal to 300 correspond to "severe IBS". Individuals who self-reported a diagnosis of IBS but scored less than 75 were included in the mild group.

*Eating competence*

The validated Satter Eating Competence Inventory (ecSI 2.0™), a 16-item questionnaire that addresses eating attitudes and behaviors with a focus on enjoyment, variety, hunger and satiety cues, and regularity, was used to assess EC.[20] All items are scored on a 5-point Likert scale with the following choices and point values: "Always" (3 points), "Often" (2 points), "Sometimes" (1 point), "Rarely" (0 points), and "Never" (0 points). Examples of items include *"I am relaxed*

*about eating*", *"I eat until I feel satisfied"*, and *"I have regular meals".* All items are summed to determine overall ecSI 2.0™ score. Individuals who score 32 and above are defined as eating competent. Scores for each of the four subscales (eating attitudes, contextual skills, food acceptance, and internal regulation) do not have assigned cutoffs but can be used to draw general impressions.

*Eating disorder risk*

The validated Eating Attitudes Test (EAT-26), a 26-item questionnaire that is useful in identifying eating disturbances and problematic eating behaviors, was used to assess eating disorder risk.[27,28] The EAT-26 has three subscales: dieting, bulimia and food preoccupation, and oral control. Items 1-24 and 26 are scored on a 6-point Likert scale with the following choices and point values: "Always" (3 points), "Usually" (2 points), "Often" (1 point), "Sometimes" (0 points), "Rarely" (0 points), and "Never" (0 points). Item 25 was reverse scored. Examples of items include *"I feel extremely guilty after eating*", *"I feel that food controls my life"*, and *"I avoid eating when I am hungry"*. All items are summed to determine overall EAT-26 score. Scores of 0 to 10 correspond to "Normal; modest to low anxiety," scores of 11 to 20 correspond to "Moderate or 'normative' disturbance," scores of 21 to 30 correspond to "Significant disturbance, likely disordered eating," and scores of 31 and above correspond to "Extreme disturbance, very likely disordered eating." Scores for each of the three subscales do not have assigned cutoffs. The dieting subscale is significantly related to body image and highly associated with total EAT-26 score, the bulimia and food preoccupation subscale is positively related to bulimia and heavier body weight, and the oral control subscale is associated with lower body weight and the absence of bulimia.[27]

*Additional information*

At the end of the survey, participants had the option to provide additional information by submitting a response to the open-ended question, *"Is there anything else you would like to share with the research team?"*.

***Statistical analysis***

Five separate two-way ANOVAs were used to examine the relationships between IBS subtype, IBS severity level, and ecSI 2.0™ total score and subscale scores. The first grouping variable was IBS severity with three levels: mild (n=34), moderate (n=82), and severe (n=90). The second grouping variable was IBS subtype with three levels: IBS with constipation (IBS-C) (n=31), IBS with diarrhea (IBS-D) (n=74), and IBS with alternating or unclearly reported bowel habits (Unknown) (n=101). Participants who selected no subtypes, multiple subtypes, or IBS alternating were classified as "Unknown". Exploratory analyses determined that gender and age were not significantly related to ecSI 2.0™ total score or subscale scores and thus gender and age were not included in the two-way ANOVAs described above. Bonferroni post hoc tests were used for multiple comparisons. In all instances where ANOVA assumptions were not fully met, the non-parametric Kruskal-Wallis H test was used to verify results. No discrepancies between parametric and non-parametric results were noted, so parametric results are reported.

Preliminary analyses were conducted to determine relevant covariates in the models. One-way ANOVA and *t*-tests revealed that age was significantly negatively associated with EAT-26 total score and subscale scores. Additional one-way ANOVAs found that gender was significantly related to EAT-26 oral control subscale score but was not significantly related to EAT-26 total score, EAT-26 dieting subscale score, or EAT-26 bulimia and food preoccupation subscale

score. Thus, age was incorporated into all EAT-26 models, while gender was incorporated into the EAT-26 oral control subscale model only. Multiple linear regression was used to predict EAT-26 score and each of the subscale scores from gender (if applicable), IBS-SSS score, and age. Each of the four regression models were then repeated with IBS subtype added as an additional covariate. SPSS version 28.0 was used for all statistical analyses.[29] The significance level was set at 0.05.

## Results

### *Sample characteristics*

260 individuals followed the survey link, 225 of whom met the eligibility criteria and indicated their informed consent by proceeding to the questionnaires. The mean age (± standard deviation) of participants was 38.3 ± 15.6, and 84.4% were female. 29.1% of participants self-reported having a history of eating disorder by answering yes to the question, *"Do you now see or have you ever seen yourself as having an eating disorder?"* and 57.3% indicated that they had been told by a physician that they have a mental health condition. Table 1 displays a summary of participant demographics and relevant health information.

### *Prevalence of eating competence and disordered eating risk*

Mean IBS-SSS score (± standard deviation) was 280.0 ± 102.2, with the majority of participants classified as having moderate IBS (41.1%) or severe IBS (43.0%). Only 17.1% of the sample was classified as eating competent, and 27% of the sample was categorized as likely or very likely disordered eating based on EAT-26 score. Table 2 displays a summary of participant IBS-SSS, ecSI 2.0™, and EAT-26 scores and categorizations.

***Eating competence according to IBS symptom severity and subtype***

There was no interaction between IBS severity level and IBS subtype in relation to ecSI 2.0™ total score ($p$=0.596). There was a statistically significant main effect of IBS severity level on ecSI 2.0™ score, $F$(2, 197)=3.872, $p$=0.022, $\eta 2$=0.038, while there was no relationship between IBS subtype and ecSI 2.0™ score, $F$(2,197)=0.064 $p$=0.938, $\eta 2$=0.001. The mean (± standard deviation) ecSI 2.0™ score for the severe group (21.1 ± 9.3) was significantly lower than the moderate group (24.9 ± 9.1)($p$=0.016) but not significantly different from the mild group (24.1 ± 9.2). Mean ecSI 2.0™ score by IBS severity level and IBS subtype is shown in Figure 1.

There was no interaction between IBS severity level and IBS subtype in relation to each of the ecSI 2.0™ subscales, all $p$>0.05. For the eating attitudes subscale score, there was a statistically significant main effect of IBS severity level, $F$(2, 201)=5.826, $p$=0.003, $\eta 2$=0.055, but there was not a statistically significant main effect of IBS subtype, $F$(2,201)=0.513 $p$=0.599, $\eta 2$=0.005. For the food acceptance, internal regulation, and contextual skills subscale scores, the interaction effect between IBS severity level and IBS subtype was not statistically significant nor were either of the main effects ($p$>0.05).

***Disordered eating according to IBS symptom severity and subtype***

The models showed that age and IBS-SSS were associated with EAT-26 total score [$F$(2,181) = 13.088, $p$<0.001, adj. $R^2$ = 0.12], EAT-26 dieting subscale score [$F$(2,188) = 8.547, $p$<0.001, adj $R^2$ = 0.07], and EAT-26 bulimia and food preoccupation subscale score [$F$(2,194)=9.259, $p$<0.001, adj $R^2$= 0.08]. IBS-SSS was positively associated with EAT-26 total score ($p$=0.011), EAT-26 dieting subscale score ($p$=0.001), and EAT-26 bulimia and food preoccupation subscale

score ($p$=0.002). Age was negatively associated with EAT-26 total score ($p$<0.001), EAT-26 dieting subscale score($p$=0.038), and EAT-26 bulimia and food preoccupation subscale score ($p$=0.009). The model for EAT-26 oral control showed that age, IBS-SSS, and gender were associated with EAT-26 oral control subscale score [$F(3,193) = 3.030$, $p$=0.31, adj $R^2$= 0.045], but that the individual variables were not statistically significantly related to the subscale. When the models were repeated with IBS subtype as an additional covariate, it was found that IBS subtype was not significantly related to EAT-26 total score or any EAT-26 subscales (all $p$>0.05). All regression coefficients and standard errors can be found in Table 3.

**Table 1.** Participant characteristics, based on the results of a cross-sectional online survey of 225[a] patients with IBS

| | |
|---|---|
| *mean ± SD* | |
| Age, years (n=222) | 38.3 ± 15.6 |
| BMI (n=220) | 26.0 ± 7.5 |
| Years since diagnosis (n=224) | 8.6 ± 9.3 |
| *n (%)* | |
| Sex (n=224) | |
| Female | 189 (84.4) |
| Male | 35 (15.6) |
| Gender (n=223) | |
| Woman | 182 (81.6) |
| Man | 33 (14.8) |
| Other | 8 (3.6) |
| Sexual orientation (n=223) | |
| Heterosexual | 175 (78.8) |
| Other | 47 (21.2) |
| Race/Origin (n=224) | |
| White or Caucasian | 190 (84.8) |
| Asian | 13 (5.8) |
| Hispanic, Latinx, or Spanish origin | 9 (4.0) |
| African American or Black | 4 (1.8) |
| More than one race or origin | 6 (2.7) |
| Other | 2 (0.9) |
| Country of residence (n=223)[b] | |
| United States | 143 (64.1) |
| United Kingdom | 32 (14.3) |
| Canada | 15 (6.7) |
| Sweden | 5 (2.2) |
| Italy | 4 (1.8) |
| Australia | 3 (1.3) |
| France | 3 (1.3) |
| Ireland | 3 (1.3) |
| Other | 15 (6.7) |
| IBS subtype (n=225) | |
| IBS-D[c] | 81 (36.0) |
| IBS-C[d] | 32 (14.2) |
| Unknown[e] | 112 (49.8) |
| Eating disorder history (n=225) | |
| Yes | 65 (29.1) |
| No | 158 (70.9) |
| Comorbidities (n=401) | |
| Mental health condition | 129 (57.3) |
| Other GI disorder | 56 (24.9) |
| Skin disorder | 44 (19.6) |
| Other pain syndrome | 34 (15.1) |
| Endocrine disorder | 32 (14.2) |
| Chronic respiratory disease | 28 (12.4) |
| Musculoskeletal disease | 24 (10.7) |
| Cardiovascular disease | 21 (9.3) |

| | |
|---|---|
| Cancer | 8 (3.6) |
| Neurological disorder | 4 (1.8) |
| Chronic kidney disease | 3 (1.3) |
| Other[f] | 18 (8.0) |
| Source (n=223) | |
| Facebook.com | 124 (55.6) |
| Reddit.com | 93 (41.7) |
| Ibsgroup.com & Ibspatient.com | 6 (2.6) |

[a] 260 individuals followed the survey link, 225 of whom met the eligibility criteria and indicated their informed consent by proceeding to the questionnaires. "n" is included in the case of missing values

[b] This list includes countries of residence for which there were at least 3 respondents. "Other" includes the following countries: Austria, Bulgaria, Croatia, Germany, India, Malaysia, New Zealand, Portugal, Saudi Arabia, Singapore.

[c] IBS-D = IBS with predominant diarrhea

[d] IBS-C = IBS with predominant constipation

[e] Unknown = IBS with alternating or unclearly reported bowel habits

[f] "Other" includes various write-in responses that did not fit into any of the predefined categories, e.g. endometriosis, Ehlers-Danos, pelvic floor dysfunction, Asperger syndrome, and pernicious anemia.

**Table 2**. Participant IBS-SSS, ecSI2.0™, and EAT-26 scores[a]

| | |
|---|---|
| *mean ± SD* | |
| IBS-SSS score[b] (n=214) | 280.0 ± 102.2 |
| ecSI 2.0™ score[c] (n=210) | 23.1 ± 8.2 |
| EAT-26 score[d] (n=189) | 14.9 ± 11.1 |
| *n (%)* | |
| IBS-SSS groups (n=214) | |
| Mild | 34 (15.9) |
| Moderate | 88 (41.1) |
| Severe | 92 (43.0) |
| ecSI 2.0™ groups (n=210) | |
| Eating competent | 36 (17.1) |
| Not eating competent | 174 (82.9) |
| EAT-26 groups (n=189) | |
| Normal; modest to low anxiety | 82 (43.4) |
| Moderate or "normative" disturbance | 56 (29.6) |
| Significant disturbance, likely disordered eating | 34 (18.0) |
| Extreme disturbance, very likely disordered eating | 17 (9.0) |

[a] "n" varies due to differences in completion rate for each questionnaire.

[b] Total score on the IBS Severity Scoring System (IBS-SSS) ranges 0 to 500, with higher scores indicating higher levels of IBS symptom severity, continuous variable; 75-175 considered mild IBS, 175-300 considered moderate IBS, >300 considered severe IBS. Individuals who self-reported a diagnosis of IBS but scored less than 75 were included in the mild group.

[c] Total score on the 16-item Satter Eating Competence Inventory (ecSI 2.0™) ranges 0 to 48, with higher scores indicating higher levels of Eating Competence, continuous variable; ≥32 considered Eating Competent (EC), < 32 considered Not EC.

[d] Total score on 26 Item Eating Attitudes Test (EAT-26) ranges 0 to 78, with higher levels indicating higher eating disorder risk, continuous variable; 0-10 considered "Normal; modest to low anxiety," 11-20 considered "Moderate or 'normative' disturbance," 21-30 considered "Significant disturbance, likely disordered eating," >30 considered "Extreme disturbance, very likely disordered eating"

**Table 3**: Multiple regression analyses of EAT-26 total score and subscale scores

| Model | *B* | Std. Error | *t* | *p* |
|---|---|---|---|---|
| *Total scores* | | | | |
| EAT-26[a] | | | | |
| (Constant) | 16.771 | 3.187 | 5.262 | <.001 |
| Age | -0.199 | 0.05 | -3.97 | <.001 |
| IBS-SSS[b] | 0.02 | 0.008 | 2.591 | 0.011 |
| | | | | |
| EAT-26 | | | | |
| (Constant) | 16.806 | 3.222 | 5.217 | <.001 |
| Age | -0.199 | 0.05 | -3.944 | <.001 |
| IBS-SSS | 0.02 | 0.008 | 2.582 | 0.011 |
| IBS subtype | -0.072 | 0.845 | -0.085 | 0.932 |
| *Subscale scores* | | | | |
| EAT-26 Dieting[c] | | | | |
| (Constant) | 8.674 | 1.988 | 4.363 | <.001 |
| Age | -0.104 | 0.032 | -3.268 | 0.001 |
| IBS-SSS | 0.01 | 0.005 | 2.092 | 0.038 |
| | | | | |
| EAT-26 Dieting | | | | |
| (Constant) | 8.944 | 2.013 | 4.443 | <.001 |
| Age | -0.102 | 0.032 | -3.186 | 0.002 |
| IBS-SSS | 0.011 | 0.005 | 2.128 | 0.035 |
| IBS subtype | -0.471 | 0.537 | -0.877 | 0.381 |
| | | | | |
| EAT-26 Bulimia & food preoccupation[d] | | | | |
| (Constant) | 2.958 | 0.97 | 3.048 | 0.003 |
| Age | -0.048 | 0.015 | -3.107 | 0.002 |
| IBS-SSS | 0.006 | 0.002 | 2.632 | 0.009 |
| | | | | |
| EAT-26 Bulimia & food preoccupation | | | | |
| (Constant) | 2.711 | 0.978 | 2.773 | 0.006 |
| Age | -0.05 | 0.015 | -3.232 | 0.001 |
| IBS-SSS | 0.006 | 0.002 | 2.55 | 0.012 |
| IBS subtype | 0.436 | 0.265 | 1.644 | 0.102 |
| | | | | |
| EAT-26 Oral control[e] | | | | |
| (Constant) | 5.827 | 1.728 | 3.373 | <.001 |
| Age | -0.027 | 0.019 | -1.437 | 0.152 |
| IBS-SSS | 0.005 | 0.003 | 1.764 | 0.079 |
| Gender | -1.12 | 0.718 | -1.56 | 0.12 |
| | | | | |
| EAT-26 Oral control | | | | |
| (Constant) | 5.828 | 1.732 | 3.364 | <.001 |
| Age | -0.027 | 0.019 | -1.428 | 0.115 |
| IBS-SSS | 0.005 | 0.003 | 1.757 | 0.081 |
| Gender | -1.117 | 0.723 | -1.546 | 0.124 |
| IBS subtype | -0.012 | 0.326 | -0.036 | 0.971 |

[a] Total score on 26 Item Eating Attitudes Test (EAT-26) ranges 0 to 78, with higher levels indicating higher eating disorder risk, continuous variable; 0-10 considered "Normal; modest to low anxiety," 11-20 considered "Moderate or 'normative' disturbance," 21-30 considered "Significant disturbance, likely disordered eating," >30 considered "Extreme disturbance, very likely disordered eating"

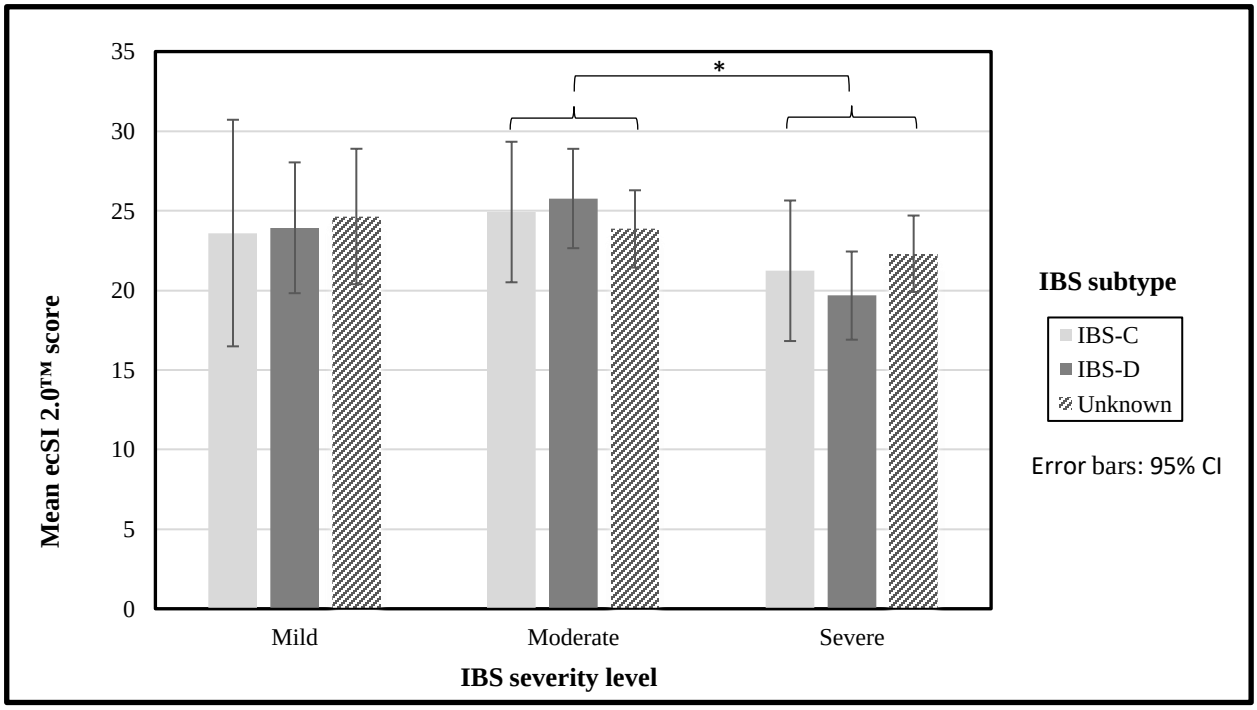
[b] Total score on the IBS Severity Scoring System (IBS-SSS) ranges 0 to 500, with higher scores indicating higher levels of IBS symptom severity, continuous variable; 75-175 considered mild IBS, 175-300 considered moderate IBS, >300 considered severe IBS. Individuals who self-reported a diagnosis of IBS but scored less than 75 were included in the mild group.

[c] Total score on the EAT-26 Dieting subscale ranges from 0 to 39, continuous variable; no assigned cutoff.

[d] Total score on the EAT-26 Bulimia & food preoccupation subscale ranges from 0 to 18, continuous variable; no assigned cutoffs.

[e] Total score on the EAT-26 Oral control subscale ranges from 0 to 21, continuous variable; no assigned cutoff.

**Figure 1:** Mean ecSI 2.0™ score by IBS severity level and IBS subtype




IBS-D = IBS with predominant diarrhea
IBS-C = IBS with predominant constipation
Unknown includes participants who selected no subtypes, multiple subtypes, or IBS-A.
*Statistically significant difference between moderate group and severe group, analyzed using two-way ANOVA followed by Bonferroni post-test (p=.016).

## Discussion

This study aimed to determine whether EC as assessed by ecSI 2.0™ and ED risk as assessed by EAT-26 varies according to IBS symptom severity and IBS subtype. The findings revealed that IBS severity was positively associated with ED risk and that EC was significantly lower in the severe IBS group compared to the moderate IBS group. No relationship was detected between IBS subtype and ED risk or EC. Of note, only 17.1% of the sample was classified as eating competent, 27.0% was classified as likely or very likely disordered eating, and 29.1% self-reported having a past or present eating disorder.

The predominance of females in the sample aligns with existing research, which indicates that rates of IBS in women are approximately 1.5- to 3-times the rate of IBS in men.[30] It is also possible that sex differences in willingness to seek support on social media are further contributing to the predominance of females. A higher-than-expected proportion of the sample (84%) was classified as having moderate or severe IBS based on IBS-SSS. This may be indicative of a relationship between IBS severity and likelihood of joining and/or viewing an online support forum.

This study adds to the body of research exploring the relationship between IBS severity and ED risk. The inverse relationship between EAT-26 score and age and the positive relationship between EAT-26 score and IBS severity aligns with work done by Kayar et al., even though a different tool was used to assess severity.[4] Other studies have provided conflicting evidence. Mari et al. found no association between SCOFF score and IBS-SSS[2], and a study conducted by Tang et al. found that Daily Gastrointestinal Symptom Diary Score was not associated with

overall EDI score, though it was associated with the Perfectionism and Ineffectiveness EDI subscales.[10] These differing findings may be due to heterogeneity of assessment tools. More research is needed to develop a clear understanding of the role IBS symptom severity plays in eating disorder risk.

The rate of EC observed in this sample (17.1%) is notably lower than rates of EC in other populations. For comparison, the rate of EC was 45% in a sample of low-income females[21], 47.4% in a sample of college students in an introductory nutrition class[19], 41.3% in a sample of hypercholesterolemic adults[22], and 53% in a sample of predominantly non-Hispanic white parents of 4$^{th}$ graders.[31] This indicates that a greater proportion of patients with IBS struggle to maintain a flexible and positive approach to eating than would be expected in a more general population.

While EC has not previously been assessed in a sample of patients with IBS, the low rate of EC in this sample aligns with existing research on the impacts of IBS on eating behaviors in general. For instance, irregular eating habits such as skipping meals and going long periods of time without eating have been noted in individuals with IBS, particularly females.[32,33] In a cross-sectional study, 42% of adolescents surveyed reported "not eating any food even when hungry" as a means of controlling symptoms.[9] These findings align not only with the contextual skills and internal regulation subscales of ecSI 2.0™, but also with several open-ended survey responses in our study. One participant stated, "I tend to starve myself to avoid triggering my IBS" and another reported that they "only eat one meal per day to keep from living in the bathroom."

These quotes in combination with the research discussed above illustrate the effects IBS can have on eating patterns and attunement to appetite cues, thereby impacting overall EC.

The fact that the severe IBS group had the lowest EC aligns with existing evidence related to dietary triggers and food avoidance in IBS patients. Food intolerances and/or food fears may contribute to lower ecSI 2.0™ food acceptance subscale scores in individuals with severe IBS, driving down overall EC. A recent study found a positive association between IBS severity and the number of food items patients report as triggers for their IBS.[34] Another study found that severe food avoidance and restriction in IBS patients is associated with greater symptom severity as well as lower quality of life and lower energy and nutrient intake.[35] These findings indicate that food acceptance may be lowest among patients with severe IBS and may impact both nutritional status and overall well-being.

Despite the potential negative implications of lower food acceptance, this may be adaptive in some cases if it is the result of appropriately applied medical nutrition therapy that is prescribed to enhance symptom control, such as the low fermentable oligosaccharides, disaccharides, monosaccharides, and polyols (FODMAP) diet. The low FODMAP diet is an elimination diet that is associated with improvements in IBS symptoms and bowel habits.[36] Even when dietary restriction is associated with improvements in symptom control, efforts can be made to mitigate the impacts on food acceptance. In the setting of a low FODMAP diet, guidelines recommend the strategic reintroduction of foods to liberalize the diet and increase the variety of foods consumed.[1] In contrast, if reintroduction of foods is not attempted or food choices are driven by fear or anxiety, dietary restriction may be maladaptive. One study participant indicated in their

open-ended response that they are “terrified of trying new foods”, illustrating the role that fear can play in lower food acceptance.

The final subscale of EC is eating attitudes, which encompasses overall enjoyment of food**.** While previous research has not directly examined attitudes towards and enjoyment of food in a population of individuals with IBS, our study provides evidence of an inverse relationship between IBS symptom severity and the ecSI 2.0™ eating attitudes subscale. Several responses from the open-ended survey question illustrate lower enjoyment of food, including one participant who stated, “The pleasure on my tastebuds is ruined by the fear of what the food will do in my intestines.” The effects of IBS on eating attitudes and enjoyment may impact patients’ quality of life and is an area for further research.

Strengths of this study include the use of validated questionnaires and homogenous recruitment methods. There are several limitations to this study to consider. First, individuals who self-selected to participate in the survey may have different characteristics than individuals who did not, such as access to the internet and an interest in participating in research. The sample is limited to individuals who have personally viewed and/or joined an online IBS support forum. Individuals who view or join these forums may have shared characteristics that differ from the general population of patients with IBS, such as heightened concerns about their health and/or greater symptom severity. This may have contributed to the small number of participants in the mild IBS group. As a result, the mild IBS group may have been underpowered to make accurate comparisons to the moderate IBS and severe IBS groups and the ANOVA design was somewhat

unbalanced. Lastly, because this study is cross-sectional, directionality and causality of relationships cannot be established.

The results of this study highlight the need for a higher level of awareness of ED risk and EC in clinical gastroenterology practice. Given that the low FODMAP diet is contraindicated in patients with an active ED[37], the knowledge that ED risk may be higher with higher IBS symptom severity should be taken into account when selecting therapies for patients with IBS. The presence of likely or very likely disordered eating in over one-fourth of our sample sheds light on the importance of screening for disordered eating and EDs in this population so that the appropriate referrals for ED treatment can be made when necessary, and so that support can be provided to prevent those in high-risk categories from progressing to a clinical ED. This study also calls attention to the relatively low rates of EC in patients with IBS, particularly among those with severe IBS. Intervention studies can help determine if improving EC in patients with IBS improves symptom control. It is possible that focusing on factors such as meal timing and honoring hunger, appetite, and satiety cues may promote digestive regularity and aid in normalizing colonic motility.[32] Promoting relaxed and positive attitudes about food could potentially lower stress and anxiety at mealtimes and thereby modulate the gut-brain axis.[38] Eliminating overly restrictive eating patterns through a focus on EC principles may improve overall nutrition status[21] as well as decrease stress[23] and binge eating behaviors[39], both of which may exacerbate IBS symptoms.[38,40]

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