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Prevalence of Disordered Eating in Adults with Gastrointestinal Disorders: A Systematic Review

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ABSTRACT

Background: Patients with gastrointestinal disorders are prone to heightened awareness of dietary intake. When diet-related thoughts or behaviors are excessive they may lead to psychological distress, nutritional compromise, and impair medical treatment. Identification of disordered eating behavior and eating disorders is crucial for effective management, but data on their prevalence within this population remains scarce. We conducted a systematic review of the prevalence of disordered eating behavior and eating disorders in adults with gastrointestinal disorders.

Methods: MEDLINE, PubMed and PsycInfo databases were searched up to June 2021. Studies examining disordered eating in adult patients with a primary gastrointestinal diagnosis were included.

Key Results: 17 studies met the inclusion criteria for the review. The range of gastrointestinal disorders examined included disorders of gut brain interaction (DGBI), coeliac disease and inflammatory bowel disease (IBD). The methods for examining disordered eating were highly variable. The prevalence of disordered eating ranged from 13-55%. The prevalence was higher in patients with disorders of gut brain interaction (DGBI) than in those with organic gastrointestinal disorders. Factors associated with disordered eating included female sex, younger age, gastrointestinal symptom severity, anxiety and depression, and lower quality of life.

Conclusions & Inferences: Disordered eating is highly prevalent in adult patients with gastrointestinal illness, particularly those with DGBI. Understanding whether a patient's primary underlying diagnosis is that of an eating disorder or gastroenterological disorder remains a challenge for clinicians. There is an unmet need to identify at-risk patients so that psychological intervention can be included in the therapeutic strategy.

Keywords: Avoidant/Restrictive Food Intake Disorder; Disordered eating; Disorders of gut-brain interaction; Eating disorder; Gastrointestinal disorder

INTRODUCTION

Gastrointestinal disorders are increasingly managed by dietary modification[1,2], and patients frequently attribute an aggravation of gut symptoms to food intake[3]. As a consequence, a proportion of patients excessively restrict their diet[4], occasionally

resulting in nutritional compromise[5], and an enhanced awareness of caloric intake[6]. Furthermore, weight loss incurred by gastrointestinal disorders may trigger pre-existing disordered eating behavior in patients with distorted body-weight perception[7].

Disordered eating is a spectrum which includes well recognized eating disorder syndromes with defined diagnostic criteria such as Anorexia Nervosa, Bulimia Nervosa, and Avoidant/Restrictive Food Intake Disorder (ARFID), which is characterized by restricted food intake or variety, but not motivated by distorted body image[8]. The term disordered eating also includes patients who only display some features of these disorders, but whose eating behaviors or cognitions have health-related consequences or cause psychological distress[9]. Food related anxiety among patients with gastrointestinal disorders has been identified as a key determinant of their quality of life[10].

Disordered eating among patients with gastrointestinal complaints may stem from hypervigilance of gastrointestinal symptoms and dietary intake[11]. Conversely, some patients with eating disorders such as anorexia nervosa may present with somatic symptoms related to starvation or somatisation[12]. Determining the focus of treatment is a complex task for clinicians where some degree of dietary restriction, such as a gluten-free diet in coeliac disease, is the appropriate treatment.

Disordered eating is associated with psychological morbidity, places individuals at risk of malnutrition, and may impede the management of primary gastrointestinal disorders[11]. Similarly, the misdiagnosis of atypically presenting eating disorders as gastroenterological disorders, that require dietary restriction, may compromise treatment of the underlying eating disorder[13]. Psychological interventions[10], careful dietary liberation[14] and treating eating disorders in specialized units[12] are important interventions for patients with gastrointestinal conditions with coexistent disordered eating.

Little is known about the prevalence of disordered eating among adults with gastrointestinal conditions. A previous review[15] found that the rate of disordered eating in individuals with gastrointestinal disorders exceeded that of the general

population, ranging between 5-44%. Since this review, contemporary studies have examined disordered eating among a wider variety of organic gastrointestinal disorders and disorders of gut brain interaction (DGBI). Understanding the prevalence of disordered eating among all gastrointestinal disorders, and their clinical correlates, may allow better identification of patients at risk. Identifying disordered eating may enable better monitoring of psychological wellbeing and nutritional status, as well as provision of tailored dietary management, or interventions focused on dietary liberalisation[14].

This systematic review aims to evaluate the prevalence of disordered eating behaviors in adult patients with gastrointestinal disorders, and associated clinical factors.

METHODS

We performed a systematic review of the medical literature according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement. This systematic review was registered with The International Prospective Register of Systematic Reviews (PROSPERO), registration number CRD42020204450. Meta-analysis was not conducted due to the variation in population, methodology and outcome measures.

Search strategy and study selection

A search of the medical literature was conducted using MEDLINE (January 1950 to June 2021), PubMed and PsycInfo (1967 to June 2021). The search strategy was comprised of terms related to conditions of the gastrointestinal tract, combined using the Boolean operator AND, with terms related to DSM-defined eating disorder syndromes and terminology to describe sub-syndromal disordered eating such as restrictive and avoidant eating. The detailed strategy can be found in supplementary table 1. To ensure literature saturation, reference lists of included studies or relevant reviews were cross-checked. The search was limited to human studies published in the English language. Inclusion criteria were studies of participants aged 18 years and older, with a confirmed or suspected diagnosis of any disorder of the gastrointestinal tract. Articles investigating gastrointestinal disorders in patients with a primary diagnosis of a DSM-defined eating disorder such as anorexia nervosa were

excluded. Case studies and conference abstracts were excluded. Screening was completed independently by 2 reviewers (JP and CB) according to the prospectively defined eligibility criteria. Conflicts were resolved via discussion between the reviewers, and consultation with a third reviewer in the case of disagreement.

Data extraction and quality assessment

Data were extracted from the selected full text manuscripts by two reviewers (JP and CB) onto a Microsoft Excel spreadsheet (Excel for Mac Version 16.40; Microsoft Corp, Redmond, WA). The quality of included studies was independently assessed by two reviewers using the Newcastle-Ottawa Scale adapted for cross-sectional studies and tabulated in the supplementary materials. There was no quality threshold for inclusion in the review, however quality scores were considered throughout data interpretation. Data extracted included study population demographics (gender, age and gastrointestinal disorder), study characteristics (presence of a control group, sample size and study design), the method of assessment of disordered eating behavior, findings related to prevalence of disordered eating behaviors, and predisposing characteristics.

Data availability statement

The authors confirm that the data supporting the findings of this study are available within the article and its supplementary materials.

RESULTS

The search strategy identified 1706 citations following duplicate removal. Of these, 40 were retrieved for full-text review. 23 of these were ineligible, resulting in a total of 17 studies for inclusion (Figure 1).

[Insert Table 1 here]

Participant characteristics

The total number of participants across eligible studies was 19,545. Four studies included only female participants[6,16,17,18] while the remainder included both females and males[11,19-30].

Study design

Eleven of the 17 studies examined disordered eating in patients with disorders of gut-brain interaction (DGBI)[11,16,17,20-27,], with five comparing DGBI with organic gastrointestinal disorders[16,17,24-26], and three comparing DGBI with healthy controls[11,16,26]. Five of the 17 studies examined disordered eating in organic gastrointestinal disorders alone[6,19,28-30]. All but one of the studies were questionnaires with or without structured interview components; and there was one retrospective chart review[21].

Measurement of disordered eating

The majority of included studies examined the presence of disordered eating behaviors through the use of validated self-report questionnaires. Such behaviors may include preoccupation with body weight or calorie counting, dietary restriction that is out of proportion with disease symptoms, purging behavior and body dysphoria. Two studies assessed current or past eating disorder diagnoses including anorexia nervosa and bulimia nervosa as per criteria set out in the DSM IV[21,25], and one study exclusively examined presence or absence of binge eating[24].

Prevalence of disordered eating by condition

Across all studies included in this review, rates of clinically significant disordered eating ranged between 13%[27] and 55%[23].

Disorders of gut-brain interaction

In adults of both sexes with IBS, two studies[11,20] utilized the SCOFF screening tool[31] to identify patients who scored above the recommended threshold for further assessment of disordered eating behavior. Patients with IBS scored above this cutoff in 23-25% of cases, compared with 21% of healthy controls[11].

In the only study to examine the prevalence of disordered eating in individuals with gastroparesis or dyspepsia symptoms, 55% of adults were found to display significant feeding and eating disorder symptoms[23]. This comprised patients who scored in the clinically significant range of the Nine Item Avoidant/Restrictive Food Intake Disorder Screen[8] (40% of participants), as well as those who met criteria for an eating disorder on the Eating Disorder Diagnostic Scale[32] (22% of participants).

In the sole study of patients with chronic constipation, clinically significant EAT-26 scores were documented in 19% of participants[22].

Two studies examined broader populations of DGBI or neurogastroenterology patients[21,25.] Porcelli et al[25] found 16% of DGBI patients compared with 3% of patients with gallstone disease met DSM-IV criteria for a past or current eating disorder, though sub-threshold disordered eating behavior was not examined. Murray et al[21] observed ARFID symptoms in 24% of adult neurogastroenterology patients, with 6% meeting all DSM-5 ARFID diagnostic criteria.

Coeliac Disease

In studies of adult women with coeliac disease, between 16 and 22% of patients met acknowledged clinically significant thresholds for disordered eating[6,18], compared with rates of 3-6% observed in healthy controls and normative studies[18,33]. One study looked specifically at binge eating in this population, and found that 19% of women with coeliac disease compared with 2% of healthy controls met criteria for clinically significant binge eating.

Food neophobia is described as the reluctance to try novel or unknown foods due to sensory aversion or fear of negative consequences[34]. In the only study to focus solely on food neophobia, adults with coeliac disease were significantly less likely to try new foods compared with those following a self-imposed gluten-free diet[30].

Inflammatory Bowel Disease

Wabich et al[28] administered the EAT-26 to adults with inflammatory bowel disease and found 13% met the suggested clinical threshold for disordered eating. Wardle et al[29] observed moderate severity binge eating according to the Binge Eating Scale[35] in 29% of patents with Crohn's disease, compared with 3% of healthy controls.

Day et al[19] examined food-related QOL in adults with IBD, and found that this was poorer in those who scored more highly on the NIAS tool for restrictive eating. There was no significant difference in scores between Crohn's disease and Ulcerative Colitis subgroups.

Comparative studies

Some studies[16,17,26] compared disordered eating behavior in patients with disorders of gut-brain interaction to those with organic gastrointestinal diseases, healthy controls, or non-gastrointestinal conditions. Across these studies, individuals with DGBI tended to demonstrate higher levels of disordered eating behavior than those with organic gastrointestinal disorders, and both scored higher than healthy controls.

Della Vale et al[16] compared questionnaire responses in three groups of adult females: IBS, Ulcerative Colitis (UC), and healthy controls. Greater disordered eating behaviors were observed among both IBS and UC sufferers compared with healthy controls; with mean Eating Disorder Inventory (EDI)[36] scores of 233, 280 and 20 respectively. The IBS group demonstrated greater disturbance in body shape perception (89% of patients) compared with the other groups (65% in UC and 69% in healthy controls).

Guthrie et al[17] compared results of the Eating Attitudes Test[37] in females with IBS to those with IBD or peptic ulcer disease (PUD). 23% of IBS patients vs 6% of IBD/PUD patients scored greater than 10. Of note, 5% of IBS patients' EAT test scores were suggestive of a diagnosis of anorexia or bulimia nervosa, compared with none in the IBD or PUD groups.

Sullivan et al[26] also compared results of the EAT test in patients with IBS to those with eating disorders, IBD and healthy controls. While the eating disorder group scored highest, the IBS group scored significantly above IBD patients and healthy controls (mean 56.7, 16.7, 10.4, 9.6 respectively).

Associated factors

Fourteen of the included studies assessed parameters that are associated with disordered eating behavior[6,11,17-23,25,27-30], such as sex, age, body mass index (BMI), gastrointestinal symptom severity and psychological distress.

Female sex was associated with a greater likelihood of disordered eating in three studies[20,21,25], as was younger age[21,25]. Murray et al[21] found a lower body mass index correlated with more ARFID symptoms. Porcelli et al[25] also reported that those with

past or current eating disorder diagnoses had a higher level of educational attainment.

Six studies found that psychological distress as measured by the Hospital Anxiety and Depression Scale (HADS)[38], Depression Anxiety Stress Scales (DASS-21)[39], Brief Symptom Inventory[40], or psychiatric assessment based on DSM criteria, was associated with a higher prevalence of disordered eating behavior[11,17,20,25,26,29]. Quality of Life (QOL) scores were also lower in those with disordered eating[6,11,19.] Gastrointestinal symptom severity was also associated with a higher level of disordered eating behavior[22,23,25,27]. Murray et al[21] found disordered eating more likely in patients with functional dyspepsia with postprandial distress syndrome, gastroparesis, centrally-mediated abdominal pain, constipation-predominant IBS, and functional constipation, compared with other DGBI diagnoses. In patients with gastroparesis, symptom severity by Gastroparesis Cardinal Symptom Index (GSCI)[41] was associated with a higher likelihood of disordered eating behavior, but gastric retention time on gastric emptying scintigraphy was not[23]. Similarly, in functional constipation higher Visceral Symptom Index scores were associated with disordered eating, but no association was observed for anorectal manometry or measured colonic transit time[22].

Dietary compliance was also found to be associated with disordered eating in two studies. In their sample of IBS patients, Mari et al[20] found IBS participants scoring above the SCOFF screening tool threshold for disordered eating, were more likely to be adherent with a low FODMAP diet than those who scored below the threshold (57% vs 36% adherence rate). Arigo et al[6] observed a weak correlation (r = 0.19) between dietary compliance and more frequent disordered eating behaviors and body image concerns in a cohort of patients with coeliac disease.

DISCUSSION

This review has demonstrated that disordered eating is highly prevalent in patients with gastrointestinal disorders, ranging between 13% and 55%, depending on the condition and method of assessment used. These rates exceed those of 3-21% observed in the healthy population[6,11,18,33,35].

A higher rate of disordered eating was generally observed among patients with DGBI as compared with organic gastrointestinal disorders.[16,17,18,25,26] It is plausible that the unclear aetiology and unpredictable nature of symptoms in DGBI leads to a greater tendency to excessively restrict dietary intake[21]. Abdominal distension, common in DGBI[42] has been postulated to exacerbate feelings of body dysmorphia and the desire to engage in disordered eating behaviors[17,22]. Factors such as altered microbial flora, inflammatory mediators and heightened visceral sensitivity may also impact cognition and thought processes in this patient group, as proposed in the biopsychosocial model of IBS[43]. A high prevalence of co-existent psychological disorders in this cohort, in particular depression, anxiety and somatoform disorders, is also likely to contribute to disordered eating behavior[44]. For some patients, a gastrointestinal disorder may clearly precede a preoccupation with dietary intake, while in others, a primary eating disorder may predispose to starvation-related gastrointestinal dysfunction or somatic symptoms that are labelled as DGBI[12,45,46]. There is also likely to be a significant cohort of patients in whom disordered eating and gastrointestinal symptoms co-exist without a clear direction of causality[25]. The importance of psychological treatment in DSM-defined eating disorders is well established[47], and there is strong evidence for the role of psychological therapy, conducted in a multidisciplinary format, to address the underlying cognitive processes implicated in DGBI[48,49]. This multi-dimensional approach for patients should not exclusively be reserved for patients with DGBI, as patients with organic gastrointestinal disorders often have overlapping “functional” symptoms[50].

The prevalence of disordered eating observed in each of the included studies was influenced by the tool used to identify disordered eating behavior. Studies using screening tools were more likely to identify disordered eating when compared with those that looked solely at DSM-diagnosed eating disorders. The selection of different cut-off values for classifying patients at risk of disordered eating may further explain the different prevalence rates observed across studies. Murray et al[22] noted that 8% of subjects with EAT-26 scores below the threshold of 20 reported engaging in purging behaviors (self-induced vomiting or laxative/diuretic/diet pill abuse), highlighting the importance of maintaining a high index of suspicion and careful clinical evaluation. Conversely**,** some behaviors that may be considered disordered in otherwise healthy individuals may, in patients with gastrointestinal disorders,

represent adaptive behaviors or consequences of the condition. For example, questions in the EAT-26 tool such as *"I give too much time and thought to food"*, *"I vomit after I have eaten",* and *"I like my stomach to be empty"*[51] may reflect adaptive responses in the setting of certain illnesses. Therefore, clinicians must consider such behaviors in the context of the individual and whether they pose a problem to psychological and physical health.

Factors associated with higher rates of disordered eating included female sex, younger age, higher rates of depression and anxiety, lower quality of life, and gastrointestinal symptom severity. The two studies[6,18] in this review which evaluated patients with coeliac disease may overstate the prevalence of disordered eating as it has been previously demonstrated that females, when compared with males with coeliac disease, are more likely to have disordered eating[52]. However, a recent large population register-based study was unable to demonstrate definite differences in the prevalence of disordered eating between males and females with coeliac disease[53]. BMI was not commonly assessed, and no studies examined recent weight change or markers of nutritional status which could provide important information as to the consequences of disordered eating behavior in this population. Subjective (i.e. symptom scales), but not objective (i.e. gastric emptying scintigraphy and colonic transit time) measures of gastrointestinal symptom severity correlated with disordered eating among the studies identified in this review. Dietary treatment compliance was associated with a tendency to disordered eating in adults with coeliac disease and IBS.[6,20] This underscores the need for screening for disordered eating behavior prior to the implementation of dietary restriction, which Dietitians are optimally placed to perform via individual assessment of eating habits. If identified, referral to a psychologist in the first instance and a consideration of alternative treatment options such as cognitive-behavioral therapy may be more appropriate[10,49,54]. Where dietary modification is essential, regular monitoring of psychological wellbeing should be undertaken[6].

Though this review intended to examine the type of disordered eating behaviors demonstrated by patients with gastrointestinal disorders, this could not be reliably assessed due to the heterogeneous nature of disordered eating assessment in the evaluated studies. A wide variety of eating behavior assessment tools were used,

and some studies opted to focus on certain behaviors or diagnoses, such as binge eating, but did not collect data on the presence or absence of other behaviors. It has been postulated that avoidant and restrictive eating behaviors may be more common among patients with gastrointestinal disorders, as opposed to bingeing and purging, due to the desire to avoid gastrointestinal symptoms following ingestion of food.[15] Indeed Murray et al[23] observed disordered eating in 55% of patients with gastroparesis or dyspepsia by including the NIAS questionnaire as an assessment tool, which was developed for ARFID and therefore may improve the detection of disordered eating in this population. Of the other eating behaviors examined, food neophobia was found to be a poor predictor of eating disorder risk[18,30]. For individuals with conditions that necessitate significant dietary modification, food neophobia may be associated with the disease itself, and not with disordered eating habits. This is supported by the finding of a poor correlation between results of the Food Neophobia Scale (FNS) and the Eating Attitudes Test (EAT-26) and Binge Eating Scale (BES)[18]. Nevertheless, food neophobia has been shown to limit dietary variety and compromise nutritional adequacy[55], highlighting the need to address this thought process.

This is the first systematic review to examine disordered eating across the spectrum of gastrointestinal disorders, both organic and DGBI, in an adult population. Strengths of this review include the systematic and comprehensive literature search, and the breadth of gastrointestinal conditions examined in the included studies. A limitation of the review is the inability to directly compare prevalence estimates due to differing disease populations and tools used to measure disordered eating. Most studies included participants drawn from specialist clinics in tertiary centres, and therefore may reflect a more complex cohort with greater disease severity compared with a general outpatient population. Many of the studies included only female participants, or had a greater proportion of females, and data may not be generalisable to male patients. The lack of a control group in some studies did not enable comparison of prevalence rates with a matched population sample, and authors relied upon normative data compiled from different age groups or countries for comparison.

CONCLUSION

This review demonstrates that disordered eating behaviors are more prevalent in adults with gastrointestinal disorders than the general population, and appear more common in individuals with disorders of gut-brain interaction than those with organic gastrointestinal disorders. A heightened risk of disordered eating was seen in female patients, those with greater symptom severity and higher levels of anxiety and depression. Given the impact on quality of life, treatment success and nutritional status, identification of patients is crucial to tailoring a management plan that is cognisant of disordered eating risk, includes psychological intervention, and adopts the least restrictive level of dietary manipulation required for symptom or disease control. Understanding whether a patient's primary underlying diagnosis is that of an eating disorder or gastroenterological disorder remains a challenge for clinicians and an important research area. Further studies should address the various disordered eating profiles seen among patients with gastrointestinal disorders, the best tools to identify risk, and how this issue may be optimally addressed with psychologically supported treatment.

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TABLES

Attached as separate document

Table 1: Summary of included studies

Footnote: AN, anorexia nervosa; BMI, body mass index; BN, bulimia nervosa; ED, eating disorder; FGID, functional gastrointestinal disorder; GERD, gastro esophageal reflux disease; GI, gastrointestinal; IBS, irritable bowel syndrome; IBD, inflammatory bowel disease; PDS, postprandial distress syndrome; PUD, peptic ulcer disease; QOL, quality of life; T2DM, type 2 diabetes mellitus; UC, ulcerative colitis.

FIGURE LEGEND

Figure 1: Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) diagram for literature search and study selection.

Study	Population	Diagnostic criteria	Sample size	Study design	Control group	Assessment of disordered eating	Other outcomes	Disordered eating prevalence	Associations
Arigo et al, 2012[6]	Females >18yo with Coeliac disease	Physician diagnosis	177	Questionnaire	N/A	Eating disorders examination questionnaire (EDE-Q)[56] (*score ≥ 2.3*)	Dietary compliance, symptom severity, psychiatric functioning	22% above threshold for disordered eating	Greater dietary compliance, lower physical & mental QOL associated with disordered eating
Day et al, 2021[19]	Adults with IBD	Physician diagnosis	108	Questionnaire	N/A	Nine Item Avoidant/Restrictive Food Intake Disorder Screen (NIAS)[8] (*score ≥14)*	Food-related Quality of Life (FRQoL-29)[64], Disease activity (Harvey Bradshaw Index for Crohn's Disease[65] or Simple Clinical Colitis Activity Index for UC[66]), Depression Anxiety Stress Scale (DASS-21)[39]	Mean NIAS score of 12.6 (vs mean reference score of 14.8). No significant difference between Crohn's and UC subgroups.	Restrictive eating associated with poorer food-related QOL
Della Vale et al, 2013[16]	Females >18yo with IBS or UC	Physician diagnosis	45	Questionnaire	Healthy controls	Eating disorder inventory (EDI 2)[36], Body shape questionnaire (BSQ)[57] (*comparison with healthy controls*)	N/A	Greater disturbance in body shape in IBS vs UC/controls (89% vs 65/69%). Higher EDI scores in IBS and UC vs controls (233/280 vs 20)	n/a

Guthrie et al, 1990[17]	Females >18yo with IBS	Abdo pain, distension and altered bowel habit + normal biochemistry and colonoscopy +/- biopsy	223	Structured interview & questionnaire	UC or PUD	Eating Attitudes Test (EAT)[37] (*comparison with UC/PUD group*)	Psychiatric assessment schedule	EAT score >10 in 23% of IBS patients vs 6% in IBD/PUD group. 5% IBS vs 0% IBD/PUD met threshold consistent with AN/BN.	Psychiatric morbidity associated with higher EAT scores
Mari et al, 2018[20]	Adults with IBS	Rome III/IV criteria	233	Questionnaire (+ 6 week prospective dietary compliance study)	N/A	SCOFF screening tool[31] (*score ≥2*)	Diet adherence, IBS Symptom Severity Score (IBS-SSS)[67], Hospital Anxiety and Depression Scale (HADS)[38]	23% patients at risk (SCOFF ≥2)	Female sex, depression, anxiety, and high dietary compliance associated with SCOFF ≥2
Melchior et al, 2020[11]	Adults with IBS	Rome III criteria	456	Questionnaire	Matched healthy controls	SCOFF screening tool[31] (*score ≥2*)	IBS Symptom Severity Score (IBS-SSS)[67], Hospital Anxiety and Depression Scale (HADS)[38], Gastrointestinal Quality of Life Index (GIQLI)[68]	25% at risk (SCOFF ≥2) in IBS group vs 21% of controls	Higher anxiety, depression and lower QOL associated with SCOFF ≥2

Murray et al, 2020[21]	Adult neuro-gastroenterology patients	Specialist clinic referral	410	Retrospective chart review	N/A	DSM V feeding and eating disorder criteria identified by coders	Presenting complaint, GI symptoms, GI diagnosis, BMI	24% displayed ARFID symptoms (6% full ARFID criteria, further 17% partial)	Younger age, female sex & low BMI associated with ARFID. Disordered eating more common in PDS, gastroparesis, IBS-C and chronic constipation
Murray et al, 2020[22]	Adults with chronic constipation	Referred for anorectal manometry for chronic constipa-tion	279	Questionnaire	N/A	Self-reported ED diagnoses, Eating Attitudes Test (EAT-26)[51] (*score ≥20)*	BMI, Patient Assessment of Constipation Symptom (PAC-SYM)[69], Visceral Sensitivity Index (VSI)[70], Hospital Anxiety and Depression Scale (HADS)[38], Anorectal manometry (ARM), Colonic transit testing	19% had clinically significant EAT-26 score >20.	Younger age, higher HADS score, higher VSI score associated with disordered eating. No correlation with ARM and colonic transit time.

Murray et al, 2020[23]	Adults with gastroparesis or dyspepsia	Specialist clinic referral	288	Questionnaire	N/A	Nine Item Avoidant/Restrictive Food Intake Disorder Screen (NIAS)[8] (*score ≥12)*, Eating Disorder Diagnostic Scale (EDDS)[32] (*comparison with DSM V criteria)*	Patient Assessment of Upper GI Symptoms (PAGI-SYM)[71], Gastric Emptying Scintigraphy	55% displayed significant DE behaviour. 23% met full ARFID criteria; further 14% partial	Higher symptom severity associated with disordered eating. No correlation with GES results
Peat et al, 2013[24]	Swedish Twin study of Adults: participants with IBS or GERD	Rome III criteria (IBS), Montreal definition (GERD)	15,668	Questionnaire	N/A	Binge eating items of Structured Clinical Interview for DSM IV axis 1 disorders	BMI	Binge eating positively associated with IBS (males OR 4.61 p<0.01, females OR 1.94 p<0.01)	n/a
Porcelli et al, 1998[25]	Adults with FGID	Specialist clinic referral	290	Structured interview & questionnaire	Gall-stone disease	Structured Clinical Interview for DSM IV eating disorder criteria	Hospital Anxiety and Depression Scale (HADS)[38], GI Symptom Rating Scale (GSRS)[72]	15.7% FGID vs 3.1% gallstone disease met DSM 4 criteria for current or past ED	Younger age, female sex, education, higher anxiety/depression scores and more severe dyspeptic symptoms associated with past ED

Satherley et al, 2016[18]	Females >18yo with coeliac disease	Self-reported biopsy-confirmed Coeliac disease	503	Questionnaire	IBD, T2DM and healthy controls	Eating Attitudes Test (EAT-26)[51] (*score ≥20*), Binge Eating Scale (BES)[35] (*score >17*), Food Neophobia Scale (FNS)[58] (*score >35*)	Illness Perception Questionnaire (IPQ-R)[73], Depression Anxiety Stress Scale (DASS-21)[39]	EAT-26 score higher in CD/IBD vs DM/healthy (16/20% above clinical threshold vs 7/4%). BES higher in CD/IBD/T2DM vs healthy controls (19%/25%/22% above clinical threshold vs 2%)	Greater psychological distress, higher GI symptom severity and lower BMI associated with disordered eating
Sullivan et al, 1997[26]	Adults with IBS	Manning criteria	139	Questionnaire	ED, IBD and healthy controls	Eating Attitudes Test (EAT)[37] (*Comparison with controls*)	N/A	IBS and ED groups scored significantly higher than IBD and healthy controls (mean score 16.7/56.7/10.4/9.6)	n/a
Tang et al, 1998[27]	Adults with IBS	Rome I criteria	331	Questionnaire (+ 2 week prospective symptom diary)	Normat-ive sample data (female only)	Eating Disorder Inventory (EDI)[36] (*Comparison with normative data*)	2 week daily GI symptom diary	Ineffectiveness was the only EDI subscale with higher score in IBS patients vs controls (mean 4.18 vs 2.30, $p<0.05$)	Physical pain/discomfort and vomiting correlated with perfectionism and ineffectiveness scores

Wabich et al, 2020[28]	Adults with IBD	Physician diagnosis	109	Questionnaire	N/A	Eating Attitudes Test (EAT-26)[51] (*score ≥20*)	Brief Symptom Inventory[40], Body Image Scale (BIS)[59], Crohn's disease & UC activity indices	13% above clinical threshold for disordered eating	Greater psychological distress, somatisation and body dissatisfaction associated with higher EAT-26 score
Wardle et al, 2018[29]	Adults with Crohn's disease	Physician diagnosis	61	Questionnaire	Healthy controls	Binge Eating Scale (BES)[35], Power of Food Scale (PFS)[60], Control of Eating Questionnaire (CoEQ)[61], Dutch Eating Behaviour Questionnaire (DEBQ)[62], Three Factor Eating Questionnaire (TFEQ)[63] *(Comparison with healthy controls)*	24h dietary recall, Hospital Anxiety and Depression Scale (HADS)[38]	Clinically significant binge eating higher in Crohn's disease vs healthy controls (29% vs 3.3%). Craving control lower, and emotional and external eating higher in Crohn's disease group	Mood negatively associated with BES score
Zysk et al, 2019[30]	Adults with Coeliac Disease	Biopsy-confirmed Coeliac Disease	225	Questionnaire	Self-imposed gluten-free diet	Food Neophobia Scale (FNS)[58] *(Comparison with healthy controls)*	BMI, education, place of residence, employment status	FNS score higher in CD than GFD (mean 39.4 vs 33.6, $p<0.0001$)	Nil significant