Global prevalence of coeliac disease in patients with Rome III and Rome IV irritable bowel syndrome: a systematic review and meta-analysis

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Data availability statement

Data is available upon reasonable request.

Abstract

Introduction

Irritable bowel syndrome (IBS) and coeliac disease are common disorders that share overlapping symptoms. In this systematic review and meta-analysis, we aimed to provide up-to-date and comprehensive estimates of the prevalence of coeliac disease in patients with IBS.

Methods

We searched several databases through January 2025 for studies reporting the prevalence of coeliac disease in patients with IBS. Eligible studies used Rome III or Rome IV criteria for IBS diagnosis and used serological screening with tissue transglutaminase, endomysial antibodies, or deamidated gliadin peptide, and/or confirmatory duodenal biopsies for coeliac disease diagnosis. We used random-effects meta-analysis to estimate the pooled prevalence of seropositive and biopsy-proven coeliac disease with 95% confidence intervals (CI). We calculated pooled odds ratios (ORs) to compare the likelihood of coeliac disease between patients with IBS and controls.

Results

A total of 29 studies comprising 7,209 patients with IBS were included. The pooled seroprevalence of coeliac disease in patients with IBS was 6% (95% CI, 5% - 8%), and the pooled prevalence of biopsy-proven coeliac disease was 2% (95% CI, 2% - 3%). A significant proportion of seropositive patients (15%; 95% CI, 6% - 24%) did not undergo endoscopy and biopsy. Patients with IBS had significantly higher odds of a positive serology than controls (OR 4.42; 95% CI, 2.82 – 6.92). The odds of coeliac disease were similar across genders and IBS

subtypes. There was a limited number of studies from Europe and no studies from the United States.

Conclusion

Coeliac disease is highly prevalent in patients with IBS, according to the Rome III and Rome IV criteria. A positive diagnosis of IBS should not be made without excluding coeliac disease.

Keywords

Celiac disease, irritable bowel syndrome, serology, duodenal biopsy

Introduction

Irritable bowel syndrome (IBS) is a common disorder of gut-brain interaction that affects approximately 4% - 10% of the global population [1]. It is characterised by recurrent abdominal pain or discomfort associated with altered bowel habits in the absence of structural or biochemical abnormalities. Historically, IBS was diagnosed based on individual physician opinions, leading to considerable variability and inconsistencies. The Rome criteria introduced standardised and uniform definitions for IBS to improve diagnostic accuracy and facilitate meaningful comparisons in research [2]. Over successive iterations, these criteria have evolved to reflect the growing evidence base and the complexity of IBS. The most contemporary Rome III and Rome IV criteria incorporate symptom duration, frequency, and severity, with Rome IV notably removing 'discomfort' as a recognised term and requiring abdominal pain at least one day per week [3].

The symptoms of IBS overlap with those of coeliac disease, a common immune-mediated disorder triggered by gluten ingestion in genetically predisposed individuals [4]. Unlike IBS, untreated coeliac disease is associated with long-term complications, including nutritional deficiencies, osteoporosis, infertility, and increased risk of mortality[5,6]. Therefore, misdiagnosing coeliac disease as IBS could lead to prolonged symptom burden, delayed treatment and increased risk of preventable complications.

Previous meta-analyses, including the most recent one conducted in 2016, have demonstrated a higher prevalence of coeliac disease in patients with IBS-type symptoms compared with healthy controls [7,8]. These findings have informed international clinical guidelines, leading to recommendations for routine coeliac disease screening in patients with IBS [9,10]. However, many of the studies included had broad IBS definitions and relied on outdated serological tests such as antigliadin antibodies (AGA), which could have led to

overestimating the true prevalence of coeliac disease in patients with IBS. It is also argued that the contemporary Rome criteria, due to their higher specificity, might enable clinicians to positively diagnose IBS without the need for routine coeliac disease screening in every case [11]. The aim of this systematic review and meta-analysis was to provide up-to-date and comprehensive estimates of the prevalence of coeliac disease in patients with IBS, according to the Rome III and Rome IV criteria.

Methods

This systematic review and meta-analysis was conducted following the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) guidelines (Supplementary material) [12]. The protocol was prospectively registered with PROSPERO (CRD42025632431).

Data sources and search strategy

We developed a comprehensive search strategy with an expert medical librarian from Sheffield Teaching Hospitals, United Kingdom. The search was conducted in MEDLINE, Embase, Scopus, and Web of Science, covering studies published from 2006, the year the Rome III criteria for IBS was introduced, until January 12, 2025. No language restrictions were applied. Both published and unpublished studies were considered, provided full-text versions were available. Reference lists of included studies were manually reviewed for additional eligible studies. The full search strategy is provided in the supplementary material.

Study selection and eligibility criteria

We exported the search results to EndNote 20 (Clarivate Analytics, London, United Kingdom) and removed duplicate records. Two reviewers (MGS & FM) independently screened the titles and abstracts of retrieved records, followed by a full-text assessment based on predefined inclusion and exclusion criteria outlined in the registered protocol. Studies were eligible for inclusion if they involved adult patients aged 16 years or older diagnosed with IBS according to the Rome III or Rome IV criteria. Additionally, studies had to report the prevalence of coeliac disease using modern serological tests, such as tissue transglutaminase (IgA-tTG), endomysial antibodies (IgA-EMA), or deamidated gliadin peptide (IgA-DGP), and/or confirmatory duodenal biopsies. Results of other serological tests, including IgG-based assays, were not considered. Only studies that applied serological testing for coeliac disease to all

patients with IBS were included. Any disagreements between reviewers were resolved by consensus.

We excluded studies that used outdated diagnostic criteria for IBS, such as Manning, Rome I, or Rome II criteria, and those that used obsolete coeliac disease serology, such as AGA. We also excluded conference abstracts, case reports, case series, reviews, editorials, and practice guidelines.

Study outcomes

The primary outcome of this study was the prevalence of coeliac disease in patients with IBS, assessed separately for seroprevalence (positive coeliac-specific serology) and biopsy-proven coeliac disease (Marsh 2 or 3 histology). Secondary outcomes included the prevalence of potential coeliac disease (PCD), defined as positive serology with Marsh 0 or 1 histology, the distribution of coeliac disease across IBS subtypes, and gender differences in prevalence. We also assessed the odds of coeliac disease in patients with IBS compared with non-IBS controls.

Data extraction

Three reviewers (MGS, SM, FM) independently extracted relevant data from included studies onto a standardised Excel spreadsheet (Microsoft Corp, Redmond, WA). The following data were extracted from each study, where available: study characteristics (authors, year, country, design, setting, population), IBS diagnostic criteria (Rome III or Rome IV), coeliac disease diagnostic criteria (serology used, biopsy protocol), and relevant outcome data. Any discrepancies were resolved by consensus.

Quality assessment

Two reviewers (FM & SM) independently assessed the risk of bias in the included studies using the Newcastle-Ottawa Scale (NOS) for observational studies [13]. We evaluated the quality of included studies using a modified NOS based on three domains: selection of study groups, comparability, and assessment of outcomes. Within the selection domain, we evaluated the representativeness of the study population, sample size reporting, and the use of validated diagnostic criteria. The comparability domain was refined to assess whether studies controlled for key confounding factors such as age, sex, or IBS subtypes. The outcome domain included the use of validated serological tests, adherence to guidelines-recommended biopsy protocols, and consistency in reporting prevalence rates. Each study was assigned a total score based on these criteria, with higher scores indicating better methodological quality. Studies were classified into three categories based on their NOS scores: high quality (≥7), moderate quality (4–6), and low quality (<4).

Data synthesis and statistical analyses

A random-effects meta-analysis was conducted to calculate the pooled prevalence of coeliac disease in patients with IBS with 95% confidence intervals (CIs). For studies including control groups, pooled odds ratios (ORs) with 95% CIs were calculated to compare the likelihood of coeliac disease between patients with IBS and controls. Heterogeneity was assessed using I^2 statistics, with I^2 values of 25%, 50%, and 75% considered low, moderate, and high heterogeneity, respectively. We assessed publication bias using funnel plots and Egger's test when more than ten studies were included. When publication bias was identified, we performed Duval and Tweedie's trim-and-fill method to adjust the pooled estimates and explore the impact of imputed studies [14]. This method estimates how many studies may be

missing from the analysis, imputes their effect sizes, and recalculates the pooled estimates to provide a more conservative effect size in the presence of significant publication bias [14]. Subgroup analyses were performed based on IBS diagnostic criteria (Rome III or Rome IV), IBS subtype, geographical location, and gender. A leave-one-out analysis was conducted By sequentially omitting one study at a time and performing a meta-analysis on the remaining set of studies (K – 1 studies) to evaluate whether any single study unduly influenced the overall effect size estimate. A p-value of < 0.05 was considered statistically significant. All statistical analyses were performed using Stata version 18 (StataCorp, College Station, Texas, USA).

Results

Study selection and characteristics

The systematic literature search identified 6,318 records across the four databases. After removing 564 duplicate records, 5,772 articles underwent title and abstract screening. A total of 60 articles were selected for full-text review. Of these, 29 studies, comprising 7,209 patients with IBS and 1,715 healthy controls, met the eligibility criteria and were included in the meta-analysis [15-43] (Figure 1).

Table 1 summarises the characteristics of the included studies. The studies were conducted in 15 countries and published between 2010 and 2024. All studies had a prospective, cross-sectional design except one retrospective study. Six studies included a control group of healthy individuals without IBS. Rome III diagnostic criteria for IBS were used in most studies, although five studies used Rome IV criteria. IgA-tTG was used in all studies, with five studies also using IgA-DGP or IgA-EMA. Biopsy protocol varied widely between the included studies, with only six explicitly reporting biopsies from the duodenal bulb.

Seroprevalence of coeliac disease

The pooled seroprevalence of coeliac disease in patients with IBS was 6% (95% CI, 5% - 8%), with high heterogeneity between studies (I^2= 88.8%) (Figure 2). There was evidence of funnel plot asymmetry, indicating possible publication bias or small study effects (Egger's test, p<0.0001) (Supplementary Figure 1). After performing the trim-and-fill analysis to account for this asymmetry, the adjusted pooled seroprevalence estimate was 5.5% (95% CI, 4.1% - 7%). Leave-one-out sensitivity analysis showed stable pooled seroprevalence estimates (Supplementary Figure 2), indicating that no study disproportionately influenced the overall results.

On subgroup analysis, there was no statistically significant difference in the pooled seroprevalence of coeliac disease between studies using Rome III criteria (6%; 95% CI, 5% - 8%) and those using Rome IV criteria (6%; 95% CI, 2% - 10%), p=0.99 (Supplementary Figure 3). Similarly, there was no significant difference in seroprevalence between studies with predominantly female patients (6%; 95% CI, 4% - 8%) and those with predominantly male patients (7%; 95% CI, 5% - 8%), p=0.38. However, studies with a higher proportion of female participants showed higher heterogeneity (I^2 = 92.2%) compared with studies with more male participants (I^2 = 43.2%), suggesting that variability in prevalence estimates was more pronounced in female-predominant cohorts (Supplementary Figure 4). Finally, the seroprevalence estimates were similar across geographical regions (p=0.72) (Supplementary Figure 5).

Seroprevalence of coeliac disease across IBS subtypes

Ten studies, including 1,894 patients with IBS, reported differences in the seroprevalence of coeliac disease between IBS subtypes. The odds of a positive serology were higher among patients with IBS-D compared with other IBS subtypes (OR 1.78; 95% CI, 0.99 – 3.20), but this difference was not statistically significant (p=0.06) (Supplementary Figure 6). The between-study heterogeneity was moderate (I^2 = 31.5%).

Seroprevalence of coeliac disease in patients with IBS according to gender

A total of 20 studies, including 4998 patients with IBS, reported the gender differences in seroprevalence of coeliac disease. There were no statistically significant differences in the odds of a positive serology between females and males (OR 1.24; 95% CI, 0.88 – 1.74; p=0.33), with low between-study heterogeneity (I^2 = 17.3%) (Figure 3).

Seroprevalence of coeliac disease in patients with IBS compared with controls

Six studies, including 1,892 patients with IBS and 1,715 healthy controls, reported the differences in seroprevalence of coeliac disease between patients with IBS and controls. Patients with IBS had significantly higher odds of a positive serology compared with controls (OR 4.42; 95% CI, 2.82 – 6.92; p<0.001), with low between-study heterogeneity (I^2 = 0%) (Figure 4).

Prevalence of biopsy-proven coeliac disease

A total of 22 studies reported the prevalence of biopsy-proven coeliac disease. Two studies were excluded from the final analysis as they did not specify the histopathological criteria for diagnosis [20,35]. The pooled prevalence of biopsy-proven coeliac disease among 5,670 patients with IBS was 2% (95% CI, 2% - 3%), with high between-study heterogeneity (I^2 = 81.8%) (Figure 5). There was evidence of funnel plot asymmetry indicating possible publication bias or small study effects (Egger's test, p<0.0001). After accounting for 6 imputed studies, the adjusted pooled prevalence was 1.8% (95% CI, 0.4% - 3.1%) (Supplementary Figure 7).

A total of 18 studies, including 5095 patients, reported the prevalence of Marsh 0 or 1 lesions in patients with IBS. The pooled prevalence of PCD was 1% (95% CI, 1% - 2%), with high between-study heterogeneity (I^2=90%) (Supplementary Figure 8).

The pooled proportion of patients with IBS and positive coeliac serology who did not have endoscopy and biopsies (22 studies) was 15% (95% CI, 6% - 24%), with high between-study heterogeneity (I^2=95%) (Supplementary Figure 9).

Prevalence of coeliac disease by country

The seroprevalence of coeliac disease was highest in Poland (16.7%), followed by Iraq (10%), Bangladesh (9.3%), Pakistan (9.2%), and Turkey (8.8%), while lower seroprevalence rates

were reported in Norway (0.4%), Tanzania (1.6%), Spain and China with 3.1% (Figure 6a). The prevalence of biopsy-proven coeliac disease in patients with IBS was highest in Egypt (8.0%), followed by Iraq (5.2%), Nepal (5.0%), and Spain (4.0%). Conversely, Norway (0.1%) and India (0.8%) had the lowest prevalence rates (Figure 6b).

Quality assessment

The overall risk of bias in the included studies was low. The modified NOS scores for individual studies ranged between 4 and 8, with a median score of 7 (Table 1). Based on predefined thresholds, 17 studies were classified as high quality (score ≥7), 12 studies were of moderate quality (score 4-6), and no studies were considered low quality (score <4).

Discussion

This systematic review and meta-analysis provides an up-to-date and comprehensive evaluation of the prevalence of coeliac disease in patients with IBS, according to the Rome III and Rome IV criteria. The pooled seroprevalence of coeliac disease among 7,209 patients with IBS was 6%, with more than fourfold increased odds of a positive serology compared with non-IBS controls. The pooled prevalence of biopsy-proven coeliac disease was 2%. However, approximately 15% of patients with positive serology in the included studies did not undergo endoscopy and biopsy. Notably, the odds of coeliac disease were consistent across IBS subtypes and did not significantly differ between males and females.

Although the Rome IV criteria has been shown to perform significantly better than the Rome III criteria in diagnosing IBS [44]. We did not find a significant difference in the prevalence of coeliac disease between patients with IBS diagnosed using the Rome III criteria and those diagnosed using the Rome IV criteria. This suggests that, despite the higher accuracy of Rome IV, a positive diagnosis of IBS still cannot be made without first excluding coeliac disease.

Our findings align with previous meta-analyses, which showed a significantly higher prevalence of coeliac disease in patients with IBS-type symptoms compared with healthy controls [7,8]. However, these studies included patients with IBS-type symptoms regardless of the diagnostic criteria, incorporating physician's opinion, questionnaire data and historical classification systems such as the Manning, Rome I, and Rome II criteria. Additionally, some of the studies included in previous meta-analyses relied on outdated serological tests such as AGA antibodies, which have low sensitivity and specificity for coeliac disease and could lead to overestimation or misclassification of coeliac disease cases [4]. In contrast, our meta-analysis focused on a more homogeneous and well-defined group of patients diagnosed using the standardised Rome III and Rome IV criteria. Furthermore, we only included studies utilising

modern and highly accurate serological tests to provide a more precise and clinically relevant estimate of coeliac disease prevalence in patients with IBS. The consistently high prevalence of coeliac disease, despite these methodological differences, suggests that the association between IBS and coeliac disease is robust and independent of the specific diagnostic criteria used for IBS. It also reinforces the current recommendations that excluding coeliac disease should remain a fundamental step before making a positive diagnosis of IBS.

Two studies conducted in the United States have argued against routine screening for coeliac disease in patients with IBS [45,46]. The first, a multicenter study by Cash et al., reported a biopsy-proven coeliac disease prevalence of 0.41% in non-constipated patients with IBS, nearly identical to the 0.44% prevalence observed in controls [45]. However, key methodological differences likely account for the lower prevalence compared with our meta-analysis. Patients were diagnosed using Rome II criteria, including patients who might not meet contemporary IBS diagnosis according to the Rome III or Rome IV criteria. Additionally, their IBS group was recruited from gastroenterology clinics, where many patients may have already undergone prior investigations, excluding previously diagnosed cases of coeliac disease and thus underestimating its true prevalence. While all seropositive patients were offered endoscopy and biopsy, it is unclear how many actually underwent the procedure, further underestimating the prevalence of coeliac disease. The second was a population-based study by Choung et al. in a predominantly white community in Olmsted County, Minnesota [46]. In this study, the seroprevalence of coeliac disease was 1%, which was similar between individuals with and without IBS. However, IBS was self-reported via a questionnaire rather than diagnosed using Rome criteria. This method introduced misclassification bias, as some participants may have had short-lived or transient symptoms that did not meet the 3-month symptom duration requirement of Rome criteria. Furthermore, the study was

conducted in a region with active coeliac disease research, where many individuals with coeliac disease may have already been diagnosed and treated.

We found that 1% of patients with IBS had PCD, defined as positive coeliac serology with normal or minimal changes on duodenal biopsies. While these individuals do not meet the histological criteria for coeliac disease, growing evidence suggests that they may still be part of the coeliac disease spectrum and could progress to overt disease over time. A recent systematic review and meta-analysis found that approximately one-third of patients with PCD who continued to consume gluten developed villous atrophy, while a similar proportion of patients experienced spontaneous normalisation of serology over time [47]. Importantly, most symptomatic patients with PCD reported improvement on a gluten-free diet, supporting the notion that patients with IBS and positive coeliac serology but normal histology could still benefit from dietary intervention.

Multiple recent studies have shown that almost 1-in-3 patients with positive coeliac serology do not undergo endoscopy and biopsy despite being mandated in current guidelines, leading to empirical dietary changes without histological confirmation or missed diagnoses [48–51]. In our meta-analysis, 15% (95% CI, 6% - 24%) of seropositive patients with IBS did not proceed to biopsy. The most commonly reported reason for this was patient refusal, likely due to concerns over the invasiveness of the procedure. Implementing a no-biopsy approach in patients with a high pre-test probability of coeliac disease and significantly elevated IgA-tTG could address this diagnostic gap, as many patients prefer serology-based diagnoses over endoscopy when given the option [52,53].

Our study has several notable strengths. We used a rigorous methodology to conduct and report this meta-analysis, following the PRISMA guidelines and based on a priori registered protocol. The systematic and comprehensive literature search across multiple databases

minimised the risk of missing relevant studies. Two reviewers independently conducted study selection and data extraction to reduce the risk of bias. Furthermore, our study included well-defined and comparable populations diagnosed with IBS using the standardised Rome III and IV criteria. We also performed extensive subgroup and sensitivity analyses to explore the causes of between-study heterogeneity and to ensure the robustness of our results. We formally assessed study quality using a validated tool, and no studies were classified as having a high risk of bias. Notably, this is the first meta-analysis to systematically assess the prevalence of PCD in patients with IBS and to report the proportion of seropositive individuals who did not undergo endoscopy, which could explain the prevalence gap between coeliac autoimmunity and biopsy-proven coeliac disease.

It is also important to acknowledge some limitations to our meta-analysis. First, there was a high between-study heterogeneity, reflecting differences in study populations, biopsy protocols, and male-to-female ratio across included studies. Despite this variability, the high prevalence of coeliac disease in patients with IBS remained consistent, even after extensive subgroup and sensitivity analyses. Second, there was evidence of publication bias or small-study effects. However, the overall results were not significantly altered after statistically adjusting for this. Third, while we included studies from 15 different countries, our findings may not be fully generalisable to European and North American populations. In Europe and the United States, serological screening for coeliac disease has been part of the routine work-up for suspected IBS for more than a decade. Consequently, there is a limited number of contemporary cohorts of untested patients with IBS from these regions. Therefore, our findings should be framed within the context of low-resource and/or international settings. Finally, only a small number of studies included routine duodenal bulb biopsies, which are now recommended to detect ultra-short coeliac disease [9,10]. The omission of bulb biopsies in

many studies may have led to an underestimation of the true prevalence of coeliac disease in patients with IBS [54].

In conclusion, this systematic review and meta-analysis of 29 studies, including 7,209 patients with IBS and 1,715 controls, confirms the high prevalence of coeliac disease in patients with IBS when diagnosed using the Rome III and Rome IV criteria. Patients with IBS have more than fourfold increased odds of a positive serology compared with controls. Our results support the current recommendation that a positive diagnosis of IBS should not be made without excluding coeliac disease.

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Tables

Table 1 – Study characteristics

Authors, year	Country	Design	Diagnostic criteria for IBS	Serological tests for coeliac disease	Biopsy protocol	Number of patients with IBS	Mean age, years	Female, %	Newcastle-Ottawa Scale scores
Korkut et al., 2010	Turkey	Prospective, cross-sectional	Rome III	IgA-tTG	Four biopsies taken from the second part of the duodenum	100	40	75	7
El-Salhy et al., 2011	Norway	Prospective, cross-sectional	Rome III	IgA-tTG	Four biopsies taken from the second part of the duodenum	968	32	95	7
Akhondi-Meybodi et al., 2011	Iran	Prospective, cross-sectional	Rome III	IgA-tTG	NR	125	29.8	40.8	6
Bakhshipour et al., 2012	Iran	Prospective, cross-sectional	Rome III	IgA-tTG	Six duodenal biopsies - three from	364	37.4	60.7	7

					the proximal part and three from the distal part				
Kuyumcu, 2012	Turkey	Retrospective	Rome III	IgA-tTG	NR	188	39.9	61.2	6
Houshiayr et al., 2013	Iran	Prospective, cross-sectional	Rome III	IgA-tTG	NR	105	31.4	55.2	7
Rodrigo et al., 2013	Spain	Prospective, cross-sectional	Rome III	IgA-tTG	Four biopsies taken from the second part of the duodenum	229	50	86	7
Shayesteh et al., 2014	Iran	Prospective, cross-sectional	Rome III	IgA-tTG	Six biopsies taken from the second part of the duodenum	465	NR	54.8	7
Ahmadi et al., 2015	Iran	Prospective, cross-sectional	Rome III	IgA-tTG	Four biopsies taken from the second part of the duodenum and two	143	34.5	60.1	6

					from the duodenal bulb				
Sharma et al., 2015	India	Prospective, cross-sectional	Rome III	IgA-tTG	Four biopsies taken from the second part of the duodenum	362	29.2	26.8	6
Wang et al., 2015	China	Prospective, case-control	Rome III	IgA-tTG, IgA-DGP	Four to six biopsies taken from the second part of the duodenum	395	48.3	53.7	5
Sánchez-Vargas et al., 2016	Mexico	Prospective, case-control	Rome III	IgA-tTG, IgA-DGP	Four biopsies taken from the second part of the duodenum and two from the duodenal bulb	400	44.7	83.8	7
Shalaby et al., 2016	Egypt	Prospective, cross-sectional	Rome III	IgA-tTG	Four to eight biopsies taken from the second	100	35.1	48	7

					part of the duodenum				
Al-Ajlan et al., 2016	Saudi Arabia	Prospective, case-control	Rome III	IgA-tTG, IgA-EMA	NR	498	NR	NR	6
Chowdhury et al., 2016	Bangladesh	Prospective, cross-sectional	Rome III	IgA-tTG	NR	107	31.5	NR	5
Domżał-Magrowska et al., 2016	Poland	Prospective, case-control	Rome III	IgA-tTG, IgA-DGP	NR	48	41.1	83.3	4
Moradniani et al., 2017	Iran	Prospective, cross-sectional	Rome III	IgA-tTG	Six biopsies taken from the second part of the duodenum and the duodenal bulb	338	31	48.8	8
Khadka et al., 2018	Nepal	Prospective, cross-sectional	Rome III	IgA-tTG	Four biopsies taken from the second and third parts of the duodenum	100	33.8	41	7
Kou et al., 2018	China	Prospective, case-control	Rome III	IgA-tTG	Two targeted biopsies taken from	246	45.2	52.4	6

					the second part of the duodenum				
Atkas et al., 2018	Turkey	Prospective, cross-sectional	Rome III	IgA-tTG, IgA-EMA	NR	100	42.8	64	6
Mohammad et al., 2019	Iraq	Prospective, cross-sectional	Rome III	IgA-tTG	NR	70	33	63	7
Gembe, 2020	Tanzania	Prospective, cross-sectional	Rome IV	IgA-tTG	NR	192	25	60	7
Ibrahim, 2020	Iraq	Prospective, cross-sectional	Rome III	IgA-tTG	Multiple biopsies taken from the second part of the duodenum	140	39.2	77.1	7
Khayyat, 2020	Saudi Arabia	Prospective, case-control	Rome III	IgA-tTG	Six biopsies from the duodenum	305	34.8	50.5	7
Ullah et al., 2020	Pakistan	Prospective, cross-sectional	Rome IV	IgA-tTG	NR	210	28.4	46.2	6
Al-Abachi, 2022	Iraq	Prospective, cross-sectional	Rome III	IgA-tTG	Six biopsies taken from the second part of the duodenum	100	40.8	58	8

					and the duodenal bulb				
Joukar et al. 2022	Iran	Prospective, cross-sectional	Rome IV	IgA-tTG	Four biopsies taken from the second part of the duodenum and one from the duodenal bulb	475	40.4	52.6	6
Sohail et al., 2023	Pakistan	Prospective, cross-sectional	Rome IV	IgA-tTG	Five biopsies taken from the second part of the duodenum and the duodenal bulb	240	26.7	45	8
Khan et al., 2024	Pakistan	Prospective, cross-sectional	Rome IV	IgA-tTG	NR	96	37.6	38.5	7

Figure Legends

Figure 1 – PRISMA flow diagram of study selection

Figure 2 – The seroprevalence of coeliac disease in patients with IBS

Figure 3 – The odds of a positive serology between females and males

Figure 4 – The odds of a positive coeliac serology in patients with IBS compared with controls

Figure 5 – The prevalence of biopsy-proven coeliac disease in patients with IBS

Figure 6 – The global seroprevalence (a) and biopsy-proven prevalence (b) of coeliac disease in patients with IBS across different countries

Author contributions

Conception: MGS, AS. Literature search and data extraction: MGS, SM, FM. Statistical analysis and data visualisation: MGS. Quality assessment: MGS, SM, FM. Initial drafting of the manuscript: MGS. Data interpretation, critical revision of the manuscript and final approval of the submitted version: all authors.

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