Incidence, Prevalence, and Clinical Epidemiology of Inflammatory Bowel Disease in the Arab World: A Systematic Review and Meta-Analysis

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Keywords

Inflammatory bowel disease · Epidemiology · Incidence · Arab world

Abstract

Objectives: Despite the recent findings of the rising incidence of inflammatory bowel disease (IBD) in Arab countries, there are limited data on the characteristics of IBD patients and the disease course in the Arab world. This systematic review aimed to investigate the incidence and epidemiology of IBD in the Arab world. **Material and Methods:** We conducted a systematic literature review that utilized a comprehensive search of PubMed, Cochrane Central, SCOPUS, Google Scholar, and Web of Science from their inception till August 2020. We included cross-sectional, prospective, and retrospective studies that examined the prevalence and/or epidemiological characteristics of IBD in Arab countries. **Results:** A total of 16 studies that examined IBD in Saudi Arabia, Egypt, Kuwait, the United Arab Emirates, Bahrain, Lebanon, and Oman were included. Generally, the included studies covered the period from the early 1990s to the late 2010s. A total of 1,627 ulcerative colitis (UC) patients and 1,588 Crohn's disease (CD) patients were included in this system-

atic review. The mean age at diagnosis ranged from 24.13 to 43.6 years in adult cases and from 4.5 to 16 years in pediatric cases. In most of the included studies, the majority of patients were male. The quantitative analysis revealed a pooled incidence rate of 2.33 (95% confidence interval [CI] 1.2–3.4) per 100,000 persons per year for UC in the Arab world. Likewise, the pooled incidence rate for CD in the Arab world was 1.46 (95% CI 1.03–1.89) per 100,000 persons per year. **Conclusion:** There is a growing incidence of IBD in the Arab world, while IBD patients from Arab countries may present with some different characteristics, compared to their counterparts in Europe.

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Published by S. Karger AG, Basel

Introduction

Crohn's disease (CD) and ulcerative colitis (UC) are chronic inflammatory diseases affecting the gastrointestinal tract and are collectively known as inflammatory bowel diseases (IBDs) [1–3]. UC generally affects the large intestine and rectum, whereas CD can target any part of the gut [3]. Historical data have shown that the younger demographic is more susceptible to IBD, causing

a significant alteration in their quality of life, alongside debilitating morbidity and exacerbations [1, 3]. The etiology of IBD is not well-established; however, contemporary hypotheses implicate an interaction of environmental and immunoregulatory factors in genetically vulnerable individuals [1–4].

Western countries have been historically observed as the populations where IBD is prevalent and continues to rise, whereas the general impression is that countries in the Middle East (ME) experience a lower incidence of IBD [1, 5]. Incidence rates vary considerably depending on the region. In 2017, UC incidence rates ranged from 0.97 to 57.9 per 100,000 in Europe, 8.8 to 23.14 per 100,000 in North America, and 0.15 to 6.5 per 100,000 in Asia and the ME [5]. Nonetheless, recent trends have shown a significant rise in the incidence of IBD in ME countries, which were linked to “westernization” in lifestyle, including dietary habits in these countries [1, 2, 5–7].

Despite the recent findings of the rising incidence of IBD in Arab countries, there are limited data on the characteristics of IBD patients and the disease course in the Arab world. This systematic review aimed to investigate the incidence and epidemiology of IBD in the Arab world.

Methods

This present study was conducted following the recommendations provided by the meta-analysis of observational studies in epidemiology (MOOSE) statement [8] and in strict accordance with the Cochrane Handbook of Systematic Reviews [9].

Literature Search Strategy

We conducted a systematic literature review that utilized a comprehensive search of PubMed, Cochrane Central, SCOPUS, Google Scholar, and Web of Science from their inception till August 2020 using the following query: {(inflammatory bowel diseases [MeSH Terms]) OR (Crohn’s disease [MeSH Terms]) OR (ulcerative colitis [MeSH Terms])} AND (“Egypt” OR “Saudi Arabia” OR “United Arab Emirates” OR “Oman” OR “Qatar” OR “Bahrain” OR “Kuwait” OR “Syria” OR “Libya” OR “Iraq” OR “Tunisia” OR “Algeria” OR “Morocco” OR “Palestine” OR “Yemen” OR “Lebanon”). We also searched the bibliography of eligible studies to find relevant articles.

Eligibility Criteria and Study Selection

We included cross-sectional, prospective, and retrospective studies that examined the prevalence and/or epidemiological characteristics of IBD in one of the following Arab countries: Egypt, KSA, UAE, Oman, Qatar, Bahrain, Kuwait, Syria, Libya, Iraq, Tunisia, Algeria, Morocco, Palestine, Yemen, and Lebanon. We excluded: (a) Studies that included patients with any other inflammatory or autoimmune diseases rather than IBD without separate analysis; (b) studies that included patients with any nationally other than the above-listed countries; (c) studies that were performed

on animal models; (d) review articles; and (e) non-English articles and duplicate references.

Eligibility screening was conducted in 2 steps, each by 2 independent reviewers: (a) title and abstract screening for matching the inclusion criteria and (b) full-text screening for the complete fulfillment of the eligibility criteria. Disagreements were resolved upon the opinion of a third reviewer.

Data Extraction

Two independent authors extracted the data and another reviewer resolved disagreements. The extracted data included the following: (a) baseline characteristics of enrolled patients; (b) general characteristics of study design; (c) type of the patients; (d) incidence and prevalence of IBD; (e) epidemiological characteristics of the affected patients; and (f) summary of the main finding.

Quantitative Analysis

The incidence of IBD was pooled using a Freeman-Tukey transformation. Heterogeneity was assessed by visual inspection of the forest plots and measured by I^2 and χ^2 tests. The χ^2 test measures the existence of significant heterogeneity, while the I^2 quantifies the magnitude of heterogeneity in the effect size. We assessed and interpreted heterogeneity according to the recommendations in the “Cochrane Handbook of Systematic Reviews and Meta-Analysis” (chapter 9). In this handbook, an alpha level (for χ^2 test) below 0.1 is considered to be significant heterogeneity, and the I^2 test was interpreted as follows: (0–40%: might not be important; 30–60%: may represent moderate heterogeneity; 50–90%: may represent substantial heterogeneity). We performed a sensitivity analysis to ensure that none of the included studies affected the results and to examine whether the overall effect size is statistically robust. We excluded 1 study in each scenario. We used Open-Meta (Analyst) for Windows.

Results

Selection of Studies

A total of 1,899 unique citations were retrieved from online bibliographic search and manual retrieval of references. Of them, 147 full texts were retained for a full evaluation, and 16 studies (total no. of IBD patients = 3,221) were finally included in the present systematic review and meta-analysis (Fig. 1).

Summary Characteristics of the Included Studies

A total of 2 case series [1, 10], 1 cross-sectional [11], 1 prospective study [12], and 12 retrospective studies [6, 13–24] were included in the present systematic review. Eight articles examined IBD in Saudi Arabia [6, 10, 14, 16–20], while the rest of the studied included patients from Egypt [1], Kuwait [11, 13, 24], the UAE [15], Bahrain [21], Lebanon [22], and Oman [12]. Generally, the included studies covered the period from the early 1990s to the late 2010s (Table 1).

Fig. 1. PRISMA flowchart of the included studies.

Incidence and Prevalence of IBD

Six included studies reported the incidence and/or prevalence of IBD in the aforementioned countries. In the study reported by Al-Shamali et al. [13], a retrospective review of all patients presented with a confirmed diagnosis of UC in Kuwait City, a total of 346 patients were identified. The authors reported that the local incidence of UC was 2.8 per 100,000 persons per year. Another study from Kuwait reported that the incidence of pediatric IBD was 2.6 per 100,000 persons per year [24]. Al-Ghamdi et al. [19] retrieved the data of all confirmed cases with CD in a tertiary center in Riyadh, KSA, and estimated that the incidence of CD increased from 0.32 per 100,000 persons per year between 1983 and 1993 to 1.66 per 100,000 persons per year between 1994 and 2004 with a combined mean annual incidence of 0.94 per 100,000 persons per year over these 20 years. In another retrospective study from Bahrain, it was found that the average number of CD cases increased from 0.4 between the years 1984 and 2001 to 4 cases per year between 2002 and 2014. For UC, the average number of cases between 1984 and 2001 was 2, while this increased to 8 for the years 2002–2014. Overall, the prevalence of IBD was found to be 26.25 per 100,000 persons [21]. In the prospective study of IBD patients in Oman, it was reported that the incidence of UC was 1.35 per 100,000 persons per year [12]. Abdul-Baki et

al. [22] collected data of IBD patients in Beirut and reported a mean annual incidence of 4.1 per 100,000 people for UC, 1.4 per 100,000 people for CD, and a total annual incidence of IBD of 5.5 per 100,000 people per year (Table 2; Fig. 2).

Quantitative Analysis

The quantitative analysis revealed that the incidence of UC in the Arab world was 2.33 (95% confidence interval 1.2–3.4; Fig. 3a) per 100,000 persons per year, the pooled estimate showed significant heterogeneity ($p < 0.001$; $I^2 = 83\%$). Likewise, the quantitative analysis revealed that the incidence of CD in the Arab world was 1.46 (95% confidence interval 1.03–1.89; Fig. 3b) per 100,000 persons per year, the pooled estimate showed no significant heterogeneity ($p = 0.91$; $I^2 = 0\%$).

Clinical Characteristics and Diagnosis of IBD Patients

A total of 1,627 UC patients and 1,588 CD patients were included in this systematic review. The full disease characteristics are presented in Tables 3 and 4. The mean age at diagnosis ranged from 24.13 to 43.6 years in adult cases and from 4.5 to 16 years in pediatric cases. In most of the included studies, the majority of patients were males (average 41–59%). The majority of patients in the included studies had no previous history of smoking.

Table 1. Summary characteristics of the included studies

First author	Year of publication	Study period	Country	City	Study design	Population	Total cases IBD cases, <i>n</i>	
Hossain et al. [10]	1991	NR	Saudi Arabia	Riyadh	Case series	Adults with CD	7	7
Al-Shamali et al. [13]	2003	14 years	Kuwait	Kuwait City	Retrospective case studies		346	90
Khan et al. [17]	1996	5 years	Saudi Arabia	Al-Madinah	Retrospective case studies	Al-Madinah patients who underwent lower gastrointestinal endoscopies	1,182	111
Esmat et al. [1]	2014	15 years	Egypt	Cairo	Case series	Patients who presented for gastrointestinal consultations or interventions	24,156	157 (135 with UC/22 with IBD)
Alharbi et al. [18]	2014	4 years	Saudi Arabia	Riyadh	Retrospective case studies	UC patients attending 4 gastroenterology centers		394
Siddique et al. [11]	2014	6 months	Kuwait	Kuwait City	Cross-sectional medical record-based descriptive study	All Arab UC patients in Kuwait	214	182
Aljebreen et al. [6]	2013	3.5 years	Saudi Arabia	Riyadh	Retrospective data-registry based study	CD patients in 4 tertiary care gastroenterology centers		497
Al-Ghamdi et al. [19]	2004	20 years	Saudi Arabia	Riyadh	Retrospective study	All patients attending a gastroenterology unit with a diagnosis of CD.		77
Al Fadda et al. [2, 20]	2012	39 years	Saudi Arabia	Riyadh	Retrospective	All cases of IBD from a tertiary care hospital		312
Abdulla et al. [21]	2017	30 years	Bahrain	Manama	Retrospective	Patients between 4 and 79 years, who had been diagnosed with UC, CD, or IC		187
Abdul-Baki et al. [22]	2007	4 years	Lebanon	Beirut	Retrospective	IBD patients in Beirut	15,073	24
Radhakrishnan et al. [12]	1997	8 years	Oman	Muscat	Prospective	IBD patients in Oman		130 (108 with UC)
Al-Mofarreh and Al-Mofleh [16]	2013	17 years	Saudi Arabia	Riyadh	Retrospective study	IBD patients presenting at a gastroenterology polyclinic between January 1993 and December 2009	43,500	693 (238 with UC/455 with CD)
Al-Qabandi et al. [24]	2011	10 years	Kuwait	Kuwait City	Retrospective study	Children referred to pediatric gastroenterology and hepatology unit in Kuwait	600,500	130 (36 with UC/92 with CD/1 with indeterminate colitis)
El Mouzan et al. [14]	2012	17 years	Saudi Arabia	Riyadh	Retrospective study	Children below 18 years presenting at 2 pediatric gastroenterology centers		218 (71 with UC/147 with CD)
Al Awar et al. [15]	2004	8 years	The UAE	Dubai	Retrospective study	Pediatric cases with IBD in Dubai		12 (8 with UC/3 with CD/1 with IC)

IBD, inflammatory bowel disease; CD, Crohn's disease; UC, ulcerative colitis; IC, indeterminate colitis; UAE, United Arab Emirates.

While the prevalence of family history ranged from 1.5 to 26.1%. Only 1 study from Saudi Arabia reported the consanguinity rate, which was 32.6%. Studies reported that hematochezia, diarrhea, urgency, and tenesmus were the main presenting features of the patients. Concerning the

time to diagnosis, studies in Saudi population reported that the average time to diagnosis was nearly 6 months in >90% of the patients with UC; while the study from Oman demonstrated that the average time to diagnosis was 13.2 months. The most common site of colon involvement

Table 2. Incidence and prevalence of IBD in the Arab world

Study	Year of publication	Country	City	Patients with IBD, <i>n</i>		Incidence	Prevalence
				UC	CD		
Al-Shamali et al. [13]	2003	Kuwait	Kuwait City	90		2.85	41.73
Al-Ghamdi et al. [19]	2004	Saudi Arabia	Riyadh		77	0.94	NR
Abdulla et al. [21]	2017	Bahrain	Manama	123	61	NR	IBD: 26.25/CD: 8.56/ UC: 17.27/IC: 0.42
Abdul-Baki et al. [22]	2007	Lebanon	Beirut	16	8	CD: 1.4/UC: 4.1	CD: 53.1/UC: 106.2
Radhakrishnan et al. [12]	1997	Oman	Muscat	108	22	UC: 1.35	NR
Al-Qabandi et al. [24]	2011	Kuwait	Kuwait city	36	92	IBD: 2.16/CD: 1.53/ UC: 0.6/IC: 0.03	

IBD, inflammatory bowel disease; CD, Crohn's disease; UC, ulcerative colitis; IC, indeterminate colitis; NR, not reported.

among the included studies was the left colon. Concerning disease severity and extent, ulcerative proctitis accounted for 6.9–27.3% of the cases, while pancolitis accounted for 10–45% of the cases. The proportion of patients with pancolitis was notably higher among patients from Kuwait, Lebanon, and Saudi Arabia. The majority of patients had mild/moderate severity of the disease. The protocol of IBD diagnosis was consistent across the included studies and composed mainly of endoscopy and biopsy. The extent of colon involvement was variable across the included studies.

Treatment and Disease Outcomes

The included studies reported similar treatment patterns, with the majority of patients receiving aminosalicylates or corticosteroids (alone or in combination) (Table 5). For example, a study from Saudi Arabia reported that 85.2% of the patients were responsive to corticosteroids, while 7% were corticosteroid-dependent, and 6.2% did not respond to corticosteroid treatment. Immunomodulators were used the least, and in all studies, few patients received anti-TNF α drugs. Hospitalization rates were reported for 3 studies and were generally considered to be high (Kuwait: 44.5%; Saudi Arabia: 47%; and Kuwait: 71%).

Rates of UC-related surgery varied between 2.7 and 20% among the included studies. Total colectomy rates in Egypt were 2.9%. Among patients with UC in Bahrain, younger age correlated positively with the need for surgical intervention, anemia, and gastrointestinal complications. On the other hand, among Egyptian patients with UC, there was no correlation between extraintestinal manifestations and presence and UC severity. Among the included studies, 1

Fig. 2. Incidence and prevalence of IBD in the Arab world over the years. IBD, inflammatory bowel disease; CI, confidence interval.

case of colorectal cancer was reported in Egypt, 9 patients in Saudi Arabia, and 2 cases from Lebanon.

Only one included reported the impact of IBD on quality of life (QoL). Patients from Lebanon reported a moderately severe impact on QoL, as measured by the IBD QoL questionnaire.

Discussion

Although many recent reports highlighted a notable increase in the incidence of IBD in different parts of the Arab world, there is no published high-quality evidence

Table 3. IBD characteristics among the included studies

Study	Patients with IBD, <i>n</i>		Mean age (SD)	Age at diagnosis, years	Male, %	Risk factors, %		Time to diagnosis, months
	UC	CD				smoking	family history	
Hossain et al. [10]	–	7	32.4 (7.1)	32.4 (7.1)	57.1	11.4	15.0	–
Al-Shamali et al. [13]	90	–	45	43.6	52.0	–	–	–
Khan et al. [17]	111	–	36.5	–	58.7	–	–	–
Esmat et al. [1]	135	22	–	CD: 29.7/ UC: 27.3	Male to female ratio 1:1.15 in UC/2.6:1 in CD	–	–	–
Alharbi et al. [18]	394	–	30.1	30.2	51.0	7.8	7.0	–
Siddique et al. [11]	182	–	36.5	28.5	50.0	14.8	14.3	–
Aljebreen et al. [6]	–	497	–	25	58.6	–	–	–
Al-Ghamdi et al. [19]	–	77	25.3	–	42.9	–	–	–
Al Fadda et al. [2, 20]	115	197	25.5	–	48.7	18.8	11.1	–
Abdulla et al. [21]	123	61	–	CD: 24.13/UC: 28.35/IBD total: 27.03	CD: 59/UC: 52.85/ IBD total: 54.55	7.8	–	–
Abdul-Baki et al. [22]	16	8	–	CD: 28.8/UC: 32.0	48.5	25.0	26.1	–
Radhakrishnan et al. [12]	108	22	–	–	48.0	13.9	–	13.2
Al-Mofarreh and Al-Mofleh [16]	238	455	UC: 34/CD: 27	–	Male to female ratio–1.5:1 in UC/2:1 in CD	–	9.0	6 in 92%
Al-Qabandi et al. [24]	36	92	–	10.3	47 (<i>n</i> = 61)	–	31.0	–
El Mouzan et al. [14]	71	147	–	Median ages– UC: 15.00/CD: 16.00	UC: 41 (<i>n</i> = 29)/ CD: 56 (<i>n</i> = 82)	–	–	–
Al Awar et al. [15]	8	3	–	IBD: 6.5/UC: 4.5/CD: 10	4170.0	–	–	–

IBD, inflammatory bowel disease; CD, Crohn's disease; UC, ulcerative colitis; SD, standard deviation.

Fig. 3. Pooled estimates of the incidence of UC (a) and CD (b). IBD, inflammatory bowel disease; UC, ulcerative colitis; CD, Crohn's disease.

Table 4. IBD characteristics among the included studies

Study	Method of diagnosis	Extent of the disease in the colon				Disease severity, %			
		proctitis	proctosigmoiditis	left-sided colitis	pancolitis	remission	mild	moderate	severe
Hossain et al. [10]	Biopsy	-	-	-	-	-	55	36	9
Al-Shamali et al. [13]	Histopathology, colonoscopy, clinical	20% (n = 18)	21% (n = 19)	14% (n = 13)	45% (n = 40)	-	44	46	10
Khan et al. [17]	Lower gastrointestinal endoscopy	22.5% (n = 18)	30% (n = 24)	27.5% (n = 22)	-	-	-	-	-
Esmat et al. [1]	Clinical, laboratory, endoscopic, histological, and/or radiological criteria	n = 25	-	n = 88	n = 22	-	-	-	-
Alharbi et al. [18]	Standard clinical, endoscopic, radiological, and histological criteria	22%	-	0.353	-	51	20	18	11
Siddique et al. [11]	Clinical grounds, colonoscopy, biopsy, and negative stool examination	18.7% (n = 34)	-	36.8% (n = 67)	-	71	28	10	-
Aljebreen et al. [6]	Full colonoscopy and biopsy (when not precluded by stenosis)	-	-	-	-	-	-	-	-
Al-Ghamdi et al. [19]	History, colonoscopic findings, colonic biopsies, small bowel enema, and CT scan of abdomen	-	-	-	-	-	-	-	-
Al Fadda et al. [2, 20]	Colonoscopic findings, colonic biopsies, small bowel enema, and CT scan of the abdomen	6.9% (n = 8)	13.9% (n = 16)	35.7% (n = 41)	43.5% (n = 50)	-	-	-	-
Abdulla et al. [21]	Clinical history and examination, inflammatory markers such as ESR and CRP, endoscopy, and biopsy confirmation	IBD: 21%/CD: 5%/UC: 30%	IBD: 12%/CD: 2%/UC: 17%	-	IBD: 34%/CD: 10%/UC: 47%	-	-	-	-
Abdul-Baki et al. [22]	Computerized search was conducted for records carrying the diagnosis of IBD, UC, or CD	UC: 27.3%	-	UC: 27.3%	UC: 45.5%	-	-	-	-
Radhakrishnan et al. [12]	Chronic diarrhea, endoscopy, and histology	8% (n = 9)	29% (n = 31)	-	18% (n = 19)	-	-	-	-
Al-Mofarreh and Al-Mofleh [16]	Endoscopy/positive histopathology	-	-	-	-	-	-	-	-
Al-Qabandi et al. [24]	Clinical presentation + biochemical, radiological, endoscopic, and histopathological examinations	0.03	-	0.33	0.64	-	-	-	-
El Mouzan et al. [14]	Clinical, laboratory, imaging, endoscopic, and histopathology	-	-	-	-	-	-	-	-
Al Awar et al. [15]	-	-	-	-	-	-	-	-	-

IBD, inflammatory bowel disease; CD, Crohn's disease; UC, ulcerative colitis; CT, computed tomography; ESR, erythrocyte sedimentation rate; CRP, C-reactive protein.

IBD, inflammatory bowel disease; CD, Crohn's disease; UC, ulcerative colitis; CT, computed tomography; ESR, erythrocyte sedimentation rate; CRP, C-reactive protein.

Table 5. Treatment characteristics among the included studies

Study	Amino-salicylates, %	Cortico-steroids, %	Immuno-modulators, %	Anti-TNF α , %	Hospital-ization, %	Surgery, %
Al-Shamali et al. [13]	93	60.0	68.0	–	–	–
Alharbi et al. [18]	100	73.6	37.9	4.9	44.5	3.8
Siddique et al. [11]	100	59.0	11.1	–	71.0	–
Al Fadda et al. [2, 20]	62	62.5	17.5	8.3	–	5.8
Abdulla et al. [21]	86	69.0	33.0	4.0	47.0	20.0

TNF α , tumor necrosis factor alpha.

so far that attempted to examine the epidemiology of IBD in this part of the world. In the present systematic review, we found that the incidence of IBD is increasing exponentially in most of the Arab countries; our pooled estimates revealed that the incidence of UC and CD is approximating 2.33 and 1.46 per 100,000 persons per year, respectively. The highest incidence of IBD appears to be in Kuwait and KSA. On the other hand, the majority of IBD cases are diagnosed in young people, with a male preponderance. However, diagnostic modalities, the extent of the disease, and response to treatment appear to be similar to Western countries.

Prior to 1982, IBD was viewed as a rare condition in the ME, particularly in the KSA and Morocco [2]. This view was challenged in 1984 when a 6-year study on the epidemiology and incidence of IBD in the ME was conducted in Kuwait, reporting 91 patients with UC and 17 patients with CD [2, 4]. Further studies spanning the 1990s and 2000s in the KSA, Kuwait, Oman, and Egypt have since confirmed increasing annual rates of IBD [1, 2, 4, 12]. In Egypt, a 15-year case series study from 1995 to 2009 featuring 24,156 patients referred to a gastroenterology center found 135 UC patients and 22 CD patients, with a ratio of 6:1 for UC to CD etiologies [1]. Notably, more recent reports confirmed the significant rise in the incidence of IBD in Arab countries; for example, Al-Ghamdi et al. [19] retrieved the data of all confirmed cases with CD in a tertiary center in Riyadh City of KSA; it was found that the incidence of CD increased from 0.32 per 100,000 persons per year in the period of 1983–1993 to 1.66 per 100,000 persons per year in the period of 1994–2004 with a total mean annual incidence of 0.94 per 100,000 persons per year over these 20 years. In the present systematic review and meta-analysis, we confirmed that the upward trajectory of IBD incidence in the Arab world; we demonstrated that the incidence of UC and CD is approximating 2.33 and 1.46 per 100,000 persons per

year, respectively. Many factors can contribute to this significant rise of IBD incidence, the increased “westernization” of a country is linked to subsequent increases in IBD incidence [1, 5–7, 20]. Another important factor to consider in the epidemiology of IBD is consanguinity [3], especially in the ME where consanguinity can be prevalent in some cultures [3, 7]. The links between IBD and consanguinity are reinforced when considering the familial clusters of IBD, in addition to the 10-fold increase in IBD susceptibility seen in individuals with first-degree relative to IBD [3]. A study of 600 women from the KSA demonstrated a parental IBD consanguinity of 30% [3]. Nevertheless, current literature examining the influence of consanguinity on IBD prevalence in the ME have conflicting conclusions [3, 7], which merits further studies in this area.

The gender preponderance (higher number of males) observed among the IBD patients from Arab countries contrasts with studies of the adult IBD population, where there are a slightly greater proportion of females with IBD in studies from Iran [25] and Sri Lanka [26], while studies in Japan [27], Korea [28], and other Asian countries [29] have shown a similar incidence in males and females.

Although the present systematic review is one of the few high-quality evidence about the IBD situation in the Arab world, there are some limitations that must be considered when assessing our findings. Our findings were based on data from 7 Arab countries only, with half of the report from KSA; thus, the generalizability of our findings in all Arab world countries is limited. In addition, only 1 study assessed the pediatric IBD, and thus, further studies are warranted to examine pediatric IBD in Arab countries. The small sample size and potential confounders may have either overestimated or underestimated the incidence of IBD as well.

Conclusion

In conclusion, there is a growing incidence of IBD in the Arab world, while IBD patients from Arab countries may present with peculiar characteristics, compared to their counterparts in Europe. A deeper investigation into the variety of factors governing the incidence of IBD in the Arab world is warranted, especially when taking into account the increasing rate of IBD, alongside the peculiar socioeconomic variables in the local population.

Conflict of Interest Statement

All authors declared that they have no proprietary interests in the products described in the article.

References

- 1 Esmat S, El Nady M, Elfekki M, Elsherif Y, Naga M. Epidemiological and clinical characteristics of inflammatory bowel diseases in Cairo, Egypt. *World J Gastroenterol*. 2014;20(3):814–21.
- 2 Al Fadda M, Peedikayil MC, Kagevi I, Al Kahtani K, Al Ben Mousa A, Al Ashgar HI, et al. Inflammatory bowel disease in Saudi Arabia: a hospital-based clinical study of 312 patients. *Ann Saudi Med*. 2012;32(3):276–82.
- 3 Mosli M, Alzahrani A, Showlag S, Alshehri A, Hejazi A, Alnefaie M, et al. A cross-sectional survey of multi-generation inflammatory bowel disease consanguinity and its relationship with disease onset. *Saudi J Gastroenterol*. 2017; 23(6):337–40.
- 4 Siddique I, Alazmi W, Al-Ali J, Al-Fadli A, Alateeqi N, Memon A, et al. Clinical epidemiology of Crohn's disease in Arabs based on the Montreal classification. *Inflamm Bowel Dis*. 2012; 18(9):1689–97.
- 5 Sharara AI, Al Awadhi S, Alharbi O, Al Dhahab H, Mounir M, Salese L, et al. Epidemiology, disease burden, and treatment challenges of ulcerative colitis in Africa and the Middle East. *Expert Rev Gastroenterol Hepatol*. 2018;12(9):883–97.
- 6 Aljebreen A, Alharbi O, Azzam N, Almalki A, Alswat K, Almadi M. Clinical epidemiology and phenotypic characteristics of Crohn's disease in the central region of Saudi Arabia. *Saudi J Gastroenterol*. 2014;20(3):162–9.
- 7 El Mouzan M, Al-Mofarreh M, Assiri A, Hamid Y, Saeed A. Consanguinity and inflammatory bowel diseases: is there a relation? *J Pediatr Gastroenterol Nutr*. 2013;56(2):182–5.
- 8 Stroup DF, Berlin JA, Morton SC, Olkin I, Williamson GD, Rennie D, et al. Meta-analysis of observational studies in epidemiology: a proposal for reporting. Meta-analysis of Observational Studies in Epidemiology (MOOSE) group. *JAMA*. 2000;283(15):2008–12.
- 9 Higgins JP, Green S. *Cochrane handbook for systematic reviews of interventions: cochrane book series*; 2008. vol. Version 5.
- 10 Hossain J, Al-Mofleh IA, Laajam MA, Al-Rashed RS, Al-Faleh FZ. Crohn's disease in Arabs. *Ann Saudi Med*. 1991;11(1):40–6.
- 11 Siddique I, Alazmi W, Al-Ali J, Longenecker JC, Al-Fadli A, Hasan F, et al. Demography and clinical course of ulcerative colitis in Arabs: a study based on the Montreal classification. *Scand J Gastroenterol*. 2014;49(12):1432–40.
- 12 Radhakrishnan S, Zubaidi G, Daniel M, Sachdev GK, Mohan AN. Ulcerative colitis in Oman: a prospective study of the incidence and disease pattern from 1987 to 1994. *Digestion*. 1997;58(3):266–70.
- 13 Al-Shamali MA, Kalaoui M, Patty I, Hasan F, Khajjah A, Al-Nakib B. Ulcerative colitis in Kuwait: a review of 90 cases. *Digestion*. 2003;67: 218–24.
- 14 El Mouzan MI, Al Mofarreh MA, Assiri AM, Hamid YH. Presenting features of childhood-onset inflammatory. 2012;33:423–8.
- 15 Al Awar B, Almurabti B. P1188 inflammatory bowel disease in children in United Arab Emirates. *J Pediatr Gastroenterol Nutr*. 2004; 39(Suppl 1):S508.
- 16 Al-Mofarreh M, Al-Mofleh I. Emerging inflammatory bowel disease in Saudi outpatients: a report of 693 cases. *Saudi J Gastroenterol*. 2013;19:16–22.
- 17 Khan HA, Mahrous AS, Fachartz FI, Khawaja FI. Ulcerative colitis amongst the Saudis: six-year experience from Al-Madinah region. *Saudi J Gastroenterol*. 1996;2(2):69–73.
- 18 Alharbi OR, Azzam NA, Almalki AS, Almadi MA, Alswat KA, Sadaf N, et al. Clinical epidemiology of ulcerative colitis in Arabs based on the Montreal classification. *World J Gastroenterol*. 2014;20(46):17525–31.
- 19 Al-Ghamdi AS, Al-Mofleh IA, Al-Rashed RS, Al-Amri SM, Aljebreen AM, Isnani AC, et al. Epidemiology and outcome of Crohn's disease in a teaching hospital in Riyadh. *World J Gastroenterol*. 2004;10(9):1341–4.
- 20 Al Fadda M, Peedikayil MC, Kagevi I, Al Kahtani K, Al Ben Mousa A, Al Ashgar HI, et al. Inflammatory bowel disease in Saudi Arabia: a hospital-based clinical study of 312 patients. *Ann Saudi Med*. 2012;32:276–82.
- 21 Abdulla M, Al Saeed M, Fardan RH, Alalwan HF, Ali Almosawi ZS, Almahroos AF, et al. Inflammatory bowel disease in Bahrain: single-center experience. *Clin Exp Gastroenterol*. 2017;10:133–45.
- 22 Abdul-Baki H, ElHajj I, El-Zahabi LM, Azar C, Aoun E, Zantout H, et al. Clinical epidemiology of inflammatory bowel disease in Lebanon. *Inflamm Bowel Dis*. 2007;13(4):475–80.
- 23 Larkin MA. Ulcerative colitis in children. *South Med J*. 1961;54:880–6.
- 24 Al-Qabandi WA, Buhamrah EK, Hamadi KA, Al-Osaimi SA, Al-Ruwayeh AA, Madda J. Inflammatory bowel disease in children, an evolving problem in Kuwait. *Saudi J Gastroenterol*. 2011 Sep-Oct;17(5):323–7.
- 25 Safarpour AR, Hosseini SV, Mehrabani D. Epidemiology of inflammatory bowel diseases in Iran and Asia: a mini review. *Iran J Med Sci*. 2013;38:140–9.
- 26 Subasinghe D, Nawarathna NM, Samarasekera DN. Disease characteristics of inflammatory bowel disease (IBD): findings from a tertiary care centre in South Asia. *J Gastrointest Surg*. 2011;15(9):1562–7.
- 27 Yoshida Y, Murata Y. Inflammatory bowel disease in Japan: studies of epidemiology and etio-pathogenesis. *Med Clin North Am*. 1990;74.
- 28 Yang SK, Hong WS, Min YI, Kim HY, Yoo JY, Rhee PL, et al. Incidence and prevalence of ulcerative colitis in the Songpa-Kangdong district, Seoul, Korea, 1986–1997. *J Gastroenterol Hepatol*. 2000;15(9):1037–42.
- 29 Ng SC, Tang W, Ching JY, Wong M, Chow CM, Hui AJ, et al. Incidence and phenotype of inflammatory bowel disease based on results from the Asia-Pacific Crohn's and colitis epidemiology study. *Gastroenterology*. 2013;145(1):158–65.e2.

Funding Source

This work was supported by a financial grant from Gilead Sciences, Inc. as part of the company's support for Medical research in Saudi Arabia.

Author Contributions

All authors contributed equally in interpreting the results, editing, and finally approving the manuscript prior to submission.