Original Article

Exploring online health resources and self-care among irritable bowel syndrome patients: analyzing internet use and AI chatbot interactions

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Background: The increasing prevalence of irritable bowel syndrome (IBS) in Saudi Arabia has led to a growing interest in understanding how patients seek health information online. While it is known that digital platforms, such as search engines, social media, and artificial intelligence (AI) chatbots, are commonly used for health information seeking, there is limited knowledge about the specific behaviors of IBS patients in this context and how these behaviors correlate with their self-care activities. This study aimed to explore online health information-seeking behavior and its correlation with self-care activities among patients with IBS in Saudi Arabia, focusing on the use of these digital platforms.

Methods: A cross-sectional survey was conducted at King Khalid University Hospital in Riyadh, Saudi Arabia, from January to July 2023. The survey, available in both English and Arabic, targeted IBS patients aged 16 years or older. The questionnaire covered demographics, general internet usage, online health information-seeking behavior, and IBS knowledge and awareness.

Results: In this study, 451 IBS patients completed the survey. Notably, 95.1% of participants were internet users, primarily accessing health information through mobile phones and search engines. The results highlighted a significant correlation between online health information-seeking behaviors and self-care practices (P=0.009) like exercise and dietary adjustments, despite a moderate basic knowledge [standard deviation (SD) 2.26%] of IBS. Symptomatically, 93.3% experienced abdominal pain weekly, yet 63% did not fully meet the Rome criteria for IBS. Common management strategies included hydration, diet modifications, and exercise. About 28.4% visited the emergency room (ER) for severe symptoms, and 20% regularly consulted doctors every 3–6 months. Surprisingly, 80% were unaware of the FODMAP (fermentable oligosaccharides, disaccharides, monosaccharides and polyols) diet, often suggested for IBS.

Conclusions: The research indicates a rise in digital health literacy among IBS patients in Saudi Arabia, highlighting the need for accurate and culturally appropriate online resources. It suggests that healthcare professionals and policymakers should direct patients to reliable information and address the digital divide to

enhance self-care and IBS management outcomes.

Keywords: Information-seeking behavior; irritable bowel syndrome (IBS); self-care; digital health literacy; artificial intelligence chatbots (AI chatbots)

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Introduction

Background

Irritable bowel syndrome (IBS) is a gastrointestinal (GI) disorder that is characterized by altered bowel habits accompanied by abdominal pain or discomfort in the absence of apparent structural and biochemical abnormalities (1). Millions of individuals all over the globe, including Saudi Arabia, suffer from this persistent GI condition. IBS patients typically need to make behavioral changes to control their symptoms, such as dietary adjustments and increased physical exercise (2). Patients with chronic diseases increasingly turn to the internet for health knowledge as internet usage becomes more widespread in Saudi Arabia (3,4). Many IBS patients use digital platforms for health knowledge, symptom management techniques, and medication information (5). IBS is thought to be more common in women than men in Saudi Arabia, where the prevalence is estimated to be approximately 21.2% (2). Patients with chronic diseases increasingly turn to internet resources for health information as self-care (6). This is particularly true for IBS patients who may have trouble accessing the right healthcare treatments because of a variety of cultural and societal barriers (7). As a result, many participants with IBS look online for information about their disease and strategies for treating their symptoms (8).

Highlight box

Key findings

- A cross-sectional study (n=451) at King Khalid University Hospital (Saudi Arabia) assessed internet use and irritable bowel syndrome (IBS) knowledge among patients aged 16 years or above.
- Saudi IBS patients show a shift to digital health information. This reflects both digital transformation and patient autonomy in managing symptoms and treatment despite the associated challenges.

What is known and what is new?

- Patients use the internet for health knowledge as internet usage becomes more widespread in Saudi Arabia. However, they struggle to access the right healthcare treatments due to cultural and societal barriers.
- While most participants used mobile phones and search engines to find health information, their basic IBS knowledge was moderate. Interestingly, online information seeking correlated with self-care practices despite knowledge gaps.

What is the implication, and what should change now?

- Healthcare policymakers and developers of digital platforms should work together to guide patients towards trustworthy sources of health information.
- This collaborative effort will ensure the provision of accurate, culturally appropriate, and relevant information specific to IBS, ultimately empowering patients with the knowledge to effectively manage their condition and improve their overall health outcomes.

Rationale and knowledge gap

Due to the functional nature and symptomatic treatment of IBS in Saudi Arabia, it is crucial to educate patients through a variety of channels, including online information (2). Patients' conditions are affected by online health information. With the proliferation of the internet and internet-connected devices, participants have greater access to information than ever, allowing them to search for medical uses and side effects, disease information, and tips on handling a given instance (9). With increased awareness of IBS, patients are prone to self-diagnose IBS based on their symptoms. In today's technological age, more patients use the internet as a primary source of medical knowledge about themselves or others (5). A study found that in Saudi Arabia, there is a substantial correlation between online health information-seeking activity and self-care practices (10). Those seeking health information online are more likely to participate in self-care practices like regular exercise and a balanced diet, which is favorably correlated with self-care practices among Saudi patients with chronic conditions (11). The increasing prevalence of online health information and its impact on patient care is evident, with Saudi citizens extensively using social media

platforms and the internet for guidance on medications, disease insights, and symptom management strategies (3). Their primary concern revolves around the authenticity of online health channels, especially when acquiring knowledge about IBS (4).

Objective

This research explores the correlation between online health information-seeking behavior, including interactions with artificial intelligence (AI) chatbots, and the depth of knowledge about IBS among Saudi patients. The findings will provide insights into the effectiveness of online health tools and platforms, guiding future patient education strategies tailored for the Saudi demographic region. We present this article in accordance with the STROBE reporting checklist (available at https://mhealth.amegroups.com/article/view/10.21037/mhealth-24-14/rc).

Methods

Study setting

The research was carried out at King Khalid University Hospital (KKUH) in Riyadh, Saudi Arabia, between January and July 2023. KKUH comprises two teaching hospitals serving as tertiary referral medical facilities, providing comprehensive primary healthcare services to outpatient and inpatient populations. Consequently, the data collected from KKUH encompasses a wide range of patients.

Study design

Our multidisciplinary research team, comprising experts from various disciplines, conducted a cross-sectional survey study. The survey tool was developed in both English and Arabic through a comprehensive search on PubMed, explicitly focusing on studies on online health information among patients with IBS or similar investigations (11-13). To enhance the survey's structure and content, we employed the focus group technique, drawing on the knowledge and expertise of our research team to ensure content validity and relevance.

Subsequently, the survey questionnaire underwent a pilot test on 40 IBS patients at KKUH in Riyadh solely to assess participants' comprehension and validate the questionnaire. It is important to note that the results of this pilot study are not included in this paper.

Participants

The target population for our study consisted of individuals aged 16 years or older who had been diagnosed with IBS, as indicated in the Electronic Medical Records at KKUH. However, it is important to note that medical staff directly involved in the care of IBS patients, including physicians, nurses, and technicians, were excluded from participating in the study. Furthermore, individuals who were not fluent in either the Arabic or English language were also excluded from the study to ensure effective communication and reliable data collection.

Sample size

Based on the presumption that 50% of the population would exhibit online health-information seeking behaviors, we calculated a required sample size of 348 participants to determine the true proportion with a 95% confidence interval and a 5% margin of error. Nevertheless, the survey remained open for additional weeks, yielding a final sample size of 451 participants.

Data collection

The finalized questionnaire, developed in both English and Arabic languages, comprised 72 questions and was categorized into four sections: (I) demographic information, (II) general internet usage, (III) online health information-seeking behavior, and (IV) knowledge and awareness of IBS. Our researcher interviewed the participants individually in Arabic or English, according to their language preference. The survey was conducted from April 2023 to July 2023, employing various modes of communication, such as messaging and calling, to interact with the participants. Data was collected using the SurveyMonkey platform. A Cronbach alpha of greater than 0.70 was determined for the study instrument's reliability.

Evaluation of IBS knowledge with IBS score

Participants' knowledge about IBS was accessed through the IBS score. The IBS score was formulated by combining prior relevant studies and inputs from our multidisciplinary research team (12-14). Consisting of 11 carefully curated questions, the IBS score was specifically tailored to evaluate participants' understanding and awareness of IBS. The selected participants were administered the IBS score

questionnaire, with clear instructions provided to facilitate unbiased and accurate responses.

Scoring mechanism

Each of the 11 questions held equal importance to access participants' knowledge. Responses were scored according to the following criteria:

- ❖ Correct answers were assigned a score of 1.
- ❖ Incorrect answers were assigned a score of 0.
- ❖ The "I don't know" response was considered neutral and allocated a score of 0.

The maximum achievable score was 12, indicating a comprehensive understanding of IBS, while the minimum score was 0, indicating a lack of knowledge about the syndrome.

Statistical analysis

The study data were collected and entered into a computer using standardized entry codes. Data were further analyzed using SPSS IBM statistical computing program version 28.

- ❖ For continuous measured variables, mean and standard deviation were used for description. Median and interquartile range (IQR) were employed when evidence of skewness was present.
- ❖ Categorical variables were described using frequencies and percentages.
- ❖ Variables with multiple response options were described using multiple response dichotomies.
- ❖ To assess the assumption of statistical normality for metric variables, the Kolmogorov-Smirnov test and histograms were utilized.
- ❖ For the assessment of the statistical significance and odds of having IBS, multivariable binary logistic regression analysis was performed. The association between predictor and outcome variables was expressed as a multivariable-adjusted odds ratio (OR) with 95% confidence intervals.
- ❖ Predictors for participants' rate of searching the internet for health information were assessed using multivariable generalized linear models (GLM) with gamma regression. The association between predictor and outcome variables was expressed as a multivariable-adjusted risk rate (RR) with 95% confidence intervals.
- ❖ The significance level, alpha, was set at 0.050.

Ethical statement

The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). The Institutional Review Board at King Saud University approved the study with approval number 23/0236/IRB (22/3/2023). All participants gave their informed consent before taking the electronic survey, which included an explanation of the study's purpose. Participants could ask questions through the principal investigator's email address, and personal identifiers were not collected to maintain confidentiality.

Results

Response rate and demographic information

Of the 601 IBS patients approached, only 75% (451/601) completed the survey. Meanwhile, 150 of 601 (25%) chose not to participate, primarily due to time constraints. Most IBS patients who participated in the study were females (257/451, 57%). Additionally, the most common age group among the respondents was between 25 and 34 (128/451, 28.4%). Further details on the participants' sociodemographic characteristics can be seen in *Table 1*.

Insights into healthcare behavior and characteristics of IBS patients

Accessing the prevalence of comorbidity is critical for understanding healthcare behaviors (15). In our study, 56% (253/451) of participants were identified as comorbid, with high cholesterol (110/230, 47%) being the most prevalent condition. Additionally, 72.3% (326/451) of respondents reported at least one or more first-degree relatives with a diagnosis of IBS.

The analysis further indicated that 93.3% (421/451) of the participants experienced abdominal pain for at least 1 day per week in the past 3 months. Additionally, 72.5% (327/451) of them reported relief of abdominal pain after defecation, and 36.8% (166/451) experienced a change in stool frequency associated with abdominal pain. Furthermore, 40.8% (184/451) reported a change in stool form with abdominal pain. The median number of abdominal and bowel complaints among these individuals was two, with an interquartile range of one complaint. However, when applying the Rome IBS classification system criteria (16), it was found that 63% (284/451) of these individuals may not necessarily meet the criteria for a positive diagnosis of IBS. In comparison, 37% (167/451) did

Table 1 Sociodemographic details of the participants

Sociodemographic characters	Total N=451, n (%)
Sex	
Male	194 (43.0)
Female	257 (57.0)
Age group (years)	
18–24	95 (21.1)
25–34	128 (28.4)
35–44	90 (20.0)
45–54	83 (18.4)
55–64	55 (12.2)
Marital status	
Never married	177 (39.2)
Ever married	274 (60.8)
Educational level	
Intermediate or less	28 (6.2)
Secondary school	88 (19.5)
University degree	258 (57.2)
Higher education	77 (17.1)
Employment	
Student	99 (22.0)
Unemployed	67 (14.9)
Self-employed	33 (7.3)
Households monthly income (Saudi Riyals)	
<5,000	160 (35.5)
5,000 to <10,000	126 (27.9)
10,000 to <15,000	82 (18.2)
15,000 to <20,000	40 (8.9)
≥20,000	43 (9.5)

Table 2 Descriptive analysis of healthcare behavior and characteristics of IBS patients

Characteristics of IBS patients	Total N=451, n (%) or median [IQR]
Do you think you suffer from IBS?	
Yes	451 (100.0)
Do you have recurrent abdominal pain for at least [1] day per week during the last three months?	
No	30 (6.7)
Yes	421 (93.3)
Is the pain associated with two or more of the following?	
Relieved by defecation	327 (72.5)
Associated with a change in stool frequency	166 (36.8)
Associated with a change in stool form and appearance	184 (40.8)
Rome irritable bowel syndrome score	2 [1]
Irritable Bowel syndrome classification based on Rome IBS scale criteria	
No	284 (63.0)
Yes	167 (37.0)
How many years have you had irritable bowel syndrome symptoms?	
Unsure/recently?	75 (16.6)
1–2 years	57 (12.6)
3–5 years	104 (23.1)
6–10 years	104 (23.1)
>10 years	111 (24.6)
Have you received health education about irritable bowel disease before?	
No	293 (65.0)
Yes	158 (35.0)

IBS, irritable bowel syndrome; IQR, interquartile range.

meet the criteria with at least three or more abdominal pain and bowel complaints (see *Table 2* for details). Moreover, the participants were requested to specify the extent of time they had been suffering from irritable bowel complaints. The results showed that 16.6% (75/451) were unsure about the duration, while the highest percentage, 24.6% (111/451), revealed experiencing these complaints for over a decade. Concerning previous health education related to IBS, 65% (293/451) of the participants reported not receiving such education (*Table 2*). Furthermore, the findings revealed the top three approaches participants employed to manage their IBS symptoms. Specifically, 90% (405/451) drank water, 81.8% (369/451) used dietary modifications, and 63.4% (286/451) engaged in exercises (*Figure 1*).

IBS symptoms analysis and patient experiences

Participants were asked about their actions when experiencing severe signs and symptoms of IBS. The results

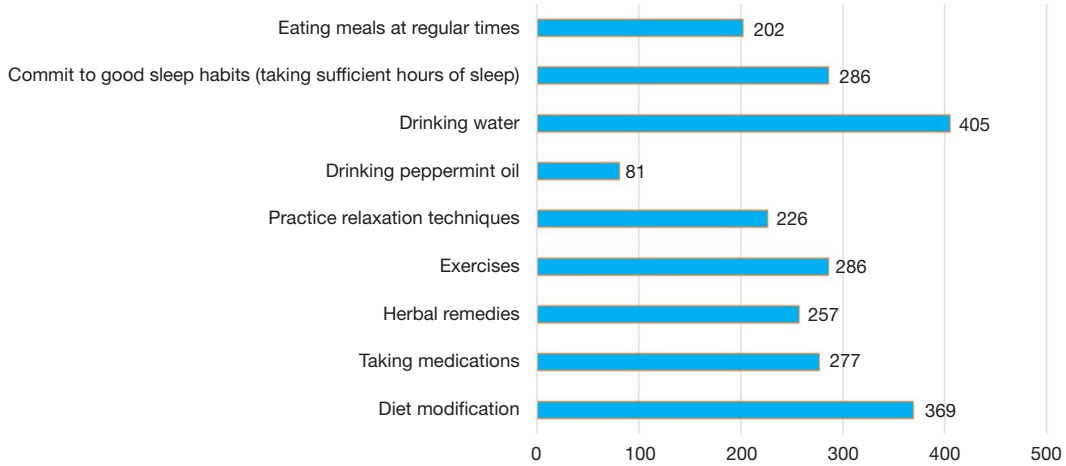

Figure 1 Participants' responses to manage IBS symptoms. IBS, irritable bowel syndrome.

revealed that 28.4% (128/451) visited the emergency room. Additionally, 25.7% (116/451) attempted to adhere more strictly to their prescribed diet and treatments, and 26.8% (121/451) opted to wait for symptoms to subside before taking any further action. To evaluate bowel habits, participants were asked about their frequency of defecation. Of the respondents, 36.8% (166/451) reported using the toilet once daily, and 34.1% (154/451) used it 2–3 times per day. However, a small number of participants (97/154, 1.6%) used the bathroom six or more times daily. Notably, 81.6% (368/451) of participants noticed foods that triggered abdominal pain and diarrhea. Furthermore, findings showed that 20% (90/451) of individuals visited their doctors every 3–6 months due to their bowel symptoms, while 12.6% (57/451) sought medical attention yearly. For 15.3% (69/451) of participants, doctor visits occurred only during worsened IBS symptoms, and 45.2% (204/451) visited doctors when symptoms became unbearable (see *Table 3* for details).

Regarding awareness of the FODMAP (fermentable oligosaccharides, disaccharides, monosaccharides and polyols) diet, results indicated that 80% (361/451) of participants had never heard of it. Furthermore, 17.1% (77/451) were aware of it but had not utilized it for managing their IBS symptoms, and only 2.9% (13/451) incorporated the FODMAP diet into their daily eating habits. The analysis also revealed that 34.4% (155/451) of individuals had consulted with a nutritionist for their IBS diet, and 22.6% (102/451) had sought psychological intervention or consultation for their symptoms (*Table 3*).

Lastly, participants were asked to rate the severity of the impact of their abdominal pain on their activities of daily living (ADLs). Findings revealed that 47.9% (216/451) experienced such difficulties sometimes, while 24.4% (110/451) seldom faced difficulties in performing ADLs due to their bowel symptoms.

General internet use

Among the participants in the study, 95.1% (429/451) reported being internet users. Most participants (351/451, 81.4%) had internet access through their mobile phones, followed by 76.8% (331/451) who had an internet connection at home. The median duration of internet use among participants was 13 years, with an interquartile range of 6 years. When asked about their self-rated internet searching skills, 57.6% (260/451) of participants rated their skills very good, while only 2.1% (9/451) reported poor internet searching skills. Regarding utilizing the internet for health-related information, 88.9% (401/451) of the participants reported doing so. Among them, 24.4% (110/451) had used AI chatbots for health-related searches. The vast majority (402/451, 89.1%) searched the internet independently, without assistance from others (*Table 4*). Participants were asked to select their sources for obtaining health-related information; the majority (364/426, 85.4%) indicated they used information from doctors and health workers as shown in Figure S1. Regarding the frequency of internet searches for health information in the past month, participants reported a median of three times per month, with an interquartile range of four times per month. Further, when asked about their preferred web

Table 3 Descriptive analysis of participants' practices about IBS symptoms

Behaviors of IBS patients	Total N=451, n (%)
In case of severe irritable bowel syndrome symptoms?	
Going to the emergency room	128 (28.4)
Taking and complying by prescribed medications	116 (25.7)
Going to the toilet	70 (15.5)
Waiting for the symptoms to disappear	121 (26.8)
Other	16 (3.5)
How often do you go to the bathroom to defecate?	
Once a day	166 (36.8)
2–3 times/day	154 (34.1)
4–5 times/day	44 (9.8)
≥6 times/day	7 (1.6)
1–2 times per week	34 (7.5)
2–3 times/week	46 (10.2)
Have you identified certain foods that seem to cause pain or diarrhea?	
No	83 (18.4)
Yes	368 (81.6)
How often do you visit the doctor for your condition?	
Every 3–6 months	90 (20.0)
Yearly	57 (12.6)
Each time I had symptoms	69 (15.3)
When symptoms are unbearable	204 (45.2)
Other	31 (6.9)
Have you identified certain foods that seem to cause pain or diarrhea?	
No	83 (18.4)
Yes	368 (81.6)
How often do you visit the doctor for your condition?	
Every 3–6 months	90 (20.0)
Yearly	57 (12.6)
Each time I had symptoms	69 (15.3)
When symptoms are unbearable	204 (45.2)
Other	31 (6.9)
Are you familiar with the "low FODMAP" diet?	
Never heard of it	361 (80.0)
I heard of it but never applied it to my diet	77 (17.1)
I use it in my diet plans	13 (2.9)
Have you ever visited a nutritionist?	
No	296 (65.6)
Yes	155 (34.4)
Have you requested any psychological intervention for your IBS?	
No	349 (77.4)
Yes	102 (22.6)

IBS, irritable bowel syndrome; FODMAP, fermentable oligosaccharides, disaccharides, monosaccharides and polyols.

browser for health information searches, 89.3% (393/440) of participants indicated using search engines like Google, Bing, and Yahoo. Additionally, 38.1% (164/430) reported using social media platforms as search platforms, while 12.1% (52/430) opted to start with AI chatbots as shown in Figure S2. Regarding language preference for internet searches, 59.3% (255/430) of participants indicated using Arabic, followed by 31.6% (136/430) who use both English and Arabic language. The criteria of how they selected a link from search results were related to the compatibility of the result link (340/430, 79.1%), followed by the first results appearing in the search results (157/430, 36.5%), and lastly, (107/430, 24.9%) selected results based on the domain type, such as (org., edu., or gov.). The main reasons for health information search behaviors over the past years were the treatment of health problems (269/430, 62.6%), followed by diagnosis of health problems (251/430, 58.4%). Specifically, the participants searched for symptoms (275/430, 64%), causes (263/430, 61.2%), and treatments (234/430, 54.4%) of IBS. Interestingly, 40% (331/430) of the participants reported using the internet to gain knowledge and improve their overall health (*Table 4*). Participants were asked to rank the websites they had utilized for health-related information and knowledge. The findings indicate that the Ministry of Health (MOH) website was the most frequently used, with 65.1% (280/430) of participants reporting its usage, followed by using social media platforms (197/430, 46%) and then the World Health Organization (WHO) website, which 35.6% (153/430) of participants utilized highlighted in Figure S3.

Online health information-seeking behavior

Participants were asked to select from a list of health

Table 4 Characteristics of general internet users in the study

Characteristics of general internet users	Total N=451, n (%) or median [IQR]
Do you use the internet?	
No	22 (4.9)
Yes	429 (95.1)
Do you have an internet connection?	
Internet at home	331 (76.8)
Internet at work	202 (46.9)
Internet on my phone	351 (81.4)
I rate my information searching skills on the internet as	
Poor	9 (2.0)
Adequate	67 (14.9)
Good	115 (25.5)
Very good	260 (57.6)
Have you ever used the internet to search for health information?	
No	50 (11.1)
Yes	401 (88.9)
Which sources did you use to obtain health-related information? n=426	
Science journals	41 (9.6)
Newspapers and magazines	31 (7.3)
Radio	11 (2.6)
Books	49 (11.5)
Television	52 (12.2)
Doctors and health workers	364 (85.4)
Friends	159 (37.3)
Family members	165 (38.7)
AI chatbots	37 (8.7)
SMS/text messages	9 (2.1)
Health education leaflets	55 (12.9)
Health educators and nurses	123 (28.9)
For how many years you've been using the internet	13 [6]
Have you ever used AI chatbots to search for health information?	
No	341 (75.6)
Yes	110 (24.4)
Do you search for health information by yourself?	
No	49 (10.9)
Yes	402 (89.1)
Which language do you prefer using when searching about your disease?	
Arabic	255 (59.3)
English	39 (9.1)
Both Arabic + English	136 (31.6)
What is the main reason you searched for health information in the past years: n=430	
Treatment of a health problem	269 (62.6)
Diagnosing/identify a health problem	251 (58.4)
Disease related prevention	181 (42.1)
General knowledge of health	182 (42.3)
To gain health information and improve my health	172 (40.0)
Identify signs and symptoms of health condition	188 (43.7)
Getting an answer for a specific medical question/s	191 (44.4)
What are the main health information you have searched for during the past years? n=430	
What is IBS	209 (48.6)
Symptoms of IBS	275 (64.0)
Causes of IBS	263 (61.2)
How to diagnose the IBS	128 (29.8)
Side effects of IBS	133 (30.9)
Healthy style and IBS	178 (41.4)
Treatment of IBS	234 (54.4)
Information about certain health condition/ with IBS	129 (30.0)
Therapeutic diet for IBS	156 (36.3)
Healthy diet to lose weight	116 (27.0)
Complications of disease	91 (21.2)
What's your criteria on which you choose the link from the search list?	
Link from search result related to the compatibility of the result link	340 (79.1)
The first results appearing in the searches	157 (36.5)
Based on the type of domain (org., edu., gov., com.)	107 (24.9)
After you have obtained your health information, has your health behavior changed positively?	
No	120 (26.6)
Yes	331 (73.4)

IQR, interquartile range; AI, artificial intelligence; SMS, Short Messaging Service; IBS, irritable bowel syndrome.

websites that they believed provided sufficient information about the owner organization and persons who operate the websites. The resulting findings showed that 18.6% (84/430) of participants agreed that the Saudi MOH website

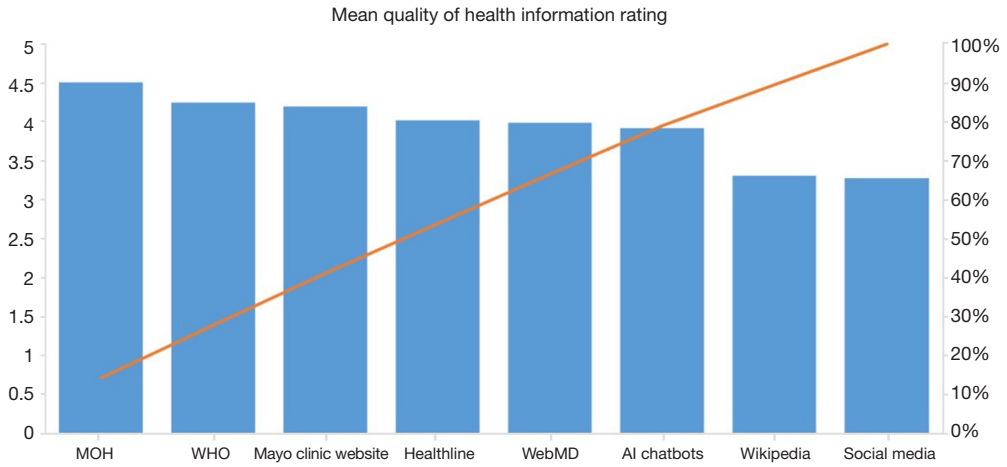

Figure 2 Mean quality of HI rating of websites by the participants. MOH, Ministry of Health; WHO, World Health Organization; AI, artificial intelligence; HI, health information.

provided such clear information on the organization and operating persons who write the content, followed by the Mayo Clinic website (30/430, 6.7%), and Healthline 0.7% (3/430). Regarding the website, does it provide enough information on the confidentiality policy of people's information, 23.1% (104/430) of participants agreed on MOH website confidentiality, followed by Mayo Clinic website (25/430, 5.5%) as confidential, but 1.3% of them agreed that Wikipedia and 0.3% Healthline and 1.3% the WebMD were websites that protect users confidentiality, and 2% and 2.2% of participants had agreed that social media and other online sources might provide sufficient user confidentiality. Also, participants were asked to select the health websites that display the last updated date of health information. The resulting findings showed that 20.3% (93/430) of participants selected the MOH website, followed by 6.9% (31/430) of the Mayo Clinic website. However, another 2.4% (11/430) of participants believed social media provided/displayed the last updated date of the health information.

Participants were asked to rate various health information sources and websites for the quality of provided health information using a Likert-like scale graded. The yielded analysis (*Figure 2*) showed that participants had rated the quality of social media-provided health information as the poorest (mean quality rating =3.28/5); Wikipedia followed this (mean quality rating =3.31/5), and the AI chatbot-provided information (mean quality rating =3.92/5). Conversely, participants rated the Saudi MOH website as providing health information with the highest quality. This was followed from the top by the WHO website providing information and the Mayo Clinic and WebMD websites.

Knowledge and awareness of IBS

The participants in this study show a moderate level of basic knowledge about (IBS), scoring an average of 5.50 out of 11 points (SD =2.26). To gain a deeper understanding of the factors influencing their online health information-seeking behavior, Multivariable Generalized Linear Models with Gamma Regression analysis were conducted on their monthly number of health information searching episodes. The results of the analysis, as presented in *Table 5*, indicated that males were significantly more inclined to search for health information, with a relative increase of 1.183 times compared to females (P=0.02). Moreover, participants aged 45 years and above displayed significantly higher rates of health information search, with a relative increase of 1.242 times than those younger than 45 years (P=0.01). Interestingly, participants with a household monthly income of 15,000 SAR/month or above exhibited significantly lower rates of health information searching, with a relative decrease of 22.5% compared to participants with a household monthly income below 15,000 SAR/month (P=0.009) (see *Table 5*). Furthermore, the multivariable analysis revealed that unemployed participants and students were significantly more inclined to search for health information, with a relative increase of 1.315 times compared to employed, retired, and self-employed participants (P=0.001). However, participants diagnosed with IBS

Table 5 Multivariable gamma regression analysis of participants for health information searches per month, N=451

Parameter	Multivariable adjusted risk rate	95% CI for risk rate		P
		Lower	Upper	
(Intercept)	0.887	0.642	1.225	0.47
Sex (male *vs.* female)	1.183	1.027	1.363	0.02
Age ≥45 years	1.242	1.051	1.467	0.01
Households monthly income ≥15,000 Saudi Riyals	0.775	0.639	0.939	0.009
Unemployed people/students	1.315	1.123	1.541	0.001
Diagnosed with IBS syndrome (pain +2 or more symptoms) per Rome scale	1.093	0.946	1.262	0.23
Years of using the internet	1.057	1.043	1.071	<0.001
Had used AI chatbots previously for health information searching	1.392	1.179	1.643	<0.001
Comorbid (yes *vs.* no)	1.180	1.019	1.367	0.03
Experiences positive health change with searching for information	1.332	1.134	1.565	<0.001
Begins searching the search engines	1.543	1.246	1.911	<0.001
Begins searching the social medial like Twitter/Facebook	1.257	1.086	1.456	0.002

Dependent variable: the number of times searching the internet for health information/month. Estimator: gamma regression with maximum likelihood. CI, confidence interval; IBS, irritable bowel syndrome; AI, artificial intelligence.

did not show a significant correlation with their internet searching rate (P=0.23).

The study found a positive and significant correlation between participants' self-reported years of internet use and their rate of health information searching per month. For each additional year of internet use, there was an average increase of 5.7% in the rate of health information searches. This correlation was statistically significant with P<0.001. Furthermore, participants who used AI chatbots for health information seeking were significantly more inclined (1.392 times more) to search for health information per month compared to those who did not use AI chatbots, with P<0.001. Participants with comorbidities were also significantly more inclined (1.180 times more) to seek health information compared to participants without comorbidities, with P=0.03 (*Table 5*).

Participants who reported positive health behaviors with online health learning were significantly more likely (1.332 times more) to access health information per month compared to those who did not experience positive health behavior changes with learning, with P<0.001. Likewise, participants who initially searched for health information using search engines were significantly more inclined (1.543 times more) to engage in health information seeking compared to those who used other interfaces or did not search for health information at all, with P<0.001. Similarly, participants who initially searched for health information using social media interfaces were significantly more inclined (1.257 times more) to seek health information compared to those who used other interfaces or did not search for health information at all, with P<0.001. The other predictor-independent variables measured in the study did not show a significant correlation with participants' rate of health information seeking in the past month when tested in alternate models. Therefore, these factors were not considered in the analysis. The study utilized Multivariable Logistic Binary Regression Analysis to explore factors contributing to the likelihood of individuals having IBS based on the Rome Criteria. The analysis revealed significant findings. Firstly, males were found to have a significantly higher likelihood (1.48 times or 48% higher) of having IBS compared to females, with P<0.05. Additionally, participants aged 45 years or older were significantly less likely (18.6% less likely) to have IBS compared to those below 45 years old (P=0.049). Furthermore, participants with a history of migraines were significantly more likely (2.096 times more likely) to have IBS compared to those without a history of migraines, with P=0.009.

On the contrary, the analysis did not show a significant correlation between educational level, marital status,

Table 6 Multivariable linear regression analysis of people's knowledge score on IBS

Factors concerning participants' IBS knowledge levels	Unstandardized beta coefficient	95% CI for beta coefficient		P value
		Lower	Upper	
(Constant)	2.413	1.422	3.403	<0.001
Sex (male *vs.* female)	0.171	–0.236	0.578	0.41
Age ≥35 years	–0.925	–1.384	–0.467	<0.001
Unemployed or students	0.459	0.008	0.911	0.046
Had received health education about irritable bowel disease before	0.980	0.561	1.398	<0.001
Rome scale total IBS symptoms	0.463	0.207	0.718	<0.001
Duration years of IBS symptoms/disease	0.283	0.129	0.437	<0.001
Duration years of internet use	0.055	0.019	0.091	0.003
Experiences positive health behavior change after learning health searched content	0.596	0.149	1.043	0.009

Dependent outcome variable: people's mean IBS knowledge score. Model overall significance f(8,438)=10.15, P value <0.001. Model R-squared =0.16, adjusted R-squared =0.141. CI, confidence interval; IBS, irritable bowel syndrome.

household income, and the odds of having IBS as shown in Table S1. Additionally, participants' IBS knowledge score was positively correlated with their odds of having IBS (OR =1.153, P=0.002). This implies that individuals with greater knowledge about IBS according to the Rome IBS criteria are significantly more likely to have the condition.

The study further employed multivariable linear regression analysis to investigate factors contributing to participants' knowledge levels of IBS. Detailed analysis is presented in *Table 6*. Participants' sex did not demonstrate a significant correlation with their mean IBS disease knowledge score (P=0.41). However, individuals aged 35 years or older exhibited significantly lower mean IBS disease knowledge scores compared to those below 35 years old. This was represented by a beta coefficient of –0.925 and P<0.001. Furthermore, on average, unemployed participants and students displayed significantly higher mean IBS disease knowledge scores compared to those who were employed, retired, or self-employed. The beta coefficient was 0.459, with a corresponding P=0.046. Additionally, participants who had previously received educational sessions on IBS obtained significantly higher mean IBS knowledge scores compared to those who had not undergone such sessions. The beta coefficient was 0.980, and P<0.001. The number of reported IBS symptoms exhibited a significant positive correlation with participants' mean IBS knowledge scores (beta coefficient =0.463, P<0.001). Similarly, the duration of IBS symptoms in years was positively correlated with mean IBS knowledge scores (beta coefficient =0.283, P<0.001). Patients with longer symptom durations tended to possess higher mean IBS knowledge scores. Moreover, participants' years of internet use demonstrated a positive correlation with their mean IBS disease knowledge scores. The beta coefficient was 0.055, and P=0.003. Furthermore, participants who perceived an improvement in health behavior through internet searching for health information attained significantly higher mean IBS knowledge scores compared to those who did not experience such positive health behaviors. The beta coefficient was 0.596, and P=0.009.

Discussion

Key findings

Our study focuses on the specific online behaviors of IBS patients. We examine how frequently these patients use the internet to seek health information, identifying their preferred platforms. This analysis provides insights into how internet usage patterns impact patients' understanding and management of IBS. The study finds that while some patients rely heavily on popular search engines and health forums, others are more inclined toward specialized medical websites and AI chatbots. The diversity in internet usage patterns underscores the need for varied and accessible online health resources tailored to different user preferences and levels of digital literacy (17). Another critical aspect

of our study is investigating how the increasing reliance on online sources and AI chatbots impacts the patient-physician relationship. We explore whether this digital shift empowers patients in their healthcare decisions and how it affects their interactions with physicians. The study highlights a complex dynamic; while some patients feel more informed and confident in their discussions with healthcare providers, others challenge medical advice with online information. This finding emphasizes the need for healthcare professionals to adapt to the changing information landscape and engage effectively with patients increasingly informed by digital sources (18,19). Our study's consideration of the cultural and societal influences in Saudi Arabia that shape the health information-seeking behaviors of IBS patients stands in comparison to findings from other regions and studies. We identify various barriers and facilitators to accessing online health information and AI chatbot services, such as cultural norms, societal attitudes toward health, and the digital divide (11,20). This analysis is crucial for understanding how cultural and societal contexts impact the adoption and effectiveness of digital health tools among IBS patients. For instance, a study in China highlighted how cultural factors such as language and health beliefs can significantly influence online health information-seeking behaviors (21). Similarly, a European study emphasized the impact of general health literacy on digital health tools (22), At the same time, our findings suggest that in Saudi Arabia, the digital divide, influenced by factors like internet accessibility and technological infrastructure, is more pronounced (11). Our study delves into how patients perceive and trust online and AI-driven health advice, reflecting the evolving landscape of health information acquisition. We examine the degree of trust patients place in online health information versus traditional sources, uncovering varied attitudes. Some exhibit skepticism towards the reliability of AI chatbots, while others are receptive. These differing perceptions play a crucial role in influencing patients' decision-making and overall management of IBS, underscoring the need to adapt AI chatbot technology to better align with patient expectations. Participants predominantly use the internet to enhance their lifestyle and alleviate IBS symptoms. This online engagement often leads to reported changes in health behavior; in line with another study's findings, online health information seeking can enhance patient involvement in medical decision-making, improve satisfaction with healthcare choices, facilitate communication with caregivers, and boost overall quality of life (23). Furthermore, it is essential to note the specific websites participants use for health information, as this relates to trust, reliability, privacy, and confidentiality concerns. Popular sources include the MOH website, WHO, Wikipedia, and various social media channels. This preference suggests a lean towards platforms considered authoritative. However, it also highlights the need to ensure the accuracy and reliability of the information on these sites. Understanding these preferences is crucial in developing online strategies that provide accurate, trustworthy, and private health information (24). The findings of our study have significant implications for healthcare policy and patient education strategies. We suggest ways to improve the delivery of online health information and AI chatbot services to IBS patients. These include recommendations for ensuring accuracy, reliability, and cultural sensitivity in digital health content. The study also highlights the importance of policy interventions to bridge the digital divide and enhance digital health literacy, ensuring equitable access to online health resources.

Strengths and limitations

The strengths of this study lie in its unique focus on Saudi adult patients with IBS and their online health information-seeking behaviors, as well as its effort to explore the impact of these behaviors on self-care practices. The sample size used in this study is expected to accurately represent the patient population in the primary care clinics and inpatient wards of a specific healthcare center, enhancing the reliability of the findings within this context. However, it is vital to acknowledge the limitations of this study. Although suitable for the specific healthcare center, the sample size may not generalize to the broader population, thereby limiting the external validity of the findings. Furthermore, this study does not consider the perspectives of healthcare providers, or the quality of the online health information accessed by patients, which could provide additional insights into the phenomenon. These limitations should be considered when interpreting and applying the findings of this study.

Conclusions

Our study reveals a significant shift in health information-seeking behaviors among Saudi patients with IBS, highlighting an increasing reliance on digital platforms such as search engines, social media, and AI chatbots.

This trend reflects not only a digital transformation in health information acquisition but also indicates a move towards greater patient autonomy, with IBS sufferers actively seeking online re-sources to manage their symptoms, treatments, and lifestyle changes. Importantly, the study emphasizes the importance of digital health literacy in effective chronic condition management, while also acknowledging the challenges associated with the accuracy and reliability of online health information. This situation necessitates a collaborative effort from healthcare professionals, policymakers, and digital platform developers to steer patients towards credible sources and ensure the provision of accurate, relevant, and culturally sensitive health information, thereby enhancing self-care practices and overall health outcomes for IBS patients in a rapidly evolving digital environment.

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Footnote

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Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at https://mhealth.amegroups.com/article/view/10.21037/mhealth-24-14/coif). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). The Institutional Review Board at King Saud University approved the study with approval number 23/0236/IRB (22/3/2023). Informed consent was obtained from all subjects involved in the study.

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