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Original Research Article

Smoking as a Risk Factor for Irritable Bowel Syndrome: A Systematic Review

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Abstract: ***Objectives*:** To assess the data on smoking's role as an irritable bowel syndrome (IBS) risk factor. ***Methods*:** Electronic databases including PubMed, Science Direct, Cochrane Library, and Scopus were thoroughly searched. Qualifying papers were assessed and data was extracted by two impartial reviewers. ***Results*:** Our data consists of eight studies with 1458 children, 864 (59.3%) of whom were female. All of the included studies used ROME criteria for IBS diagnosis. The prevalence of smoking among IBS patients ranged from 3.8% to 37%, with a total prevalence of 405 (27.8%). Five studies have demonstrated that the incidence of IBS was not significantly correlated with cigarette smoking. Two studies reported that smoking was a significant risk factor for IBS incidence and one found that IBS-M was the only variant related to smoking. ***Conclusion*:** There is still no obvious connection between smoking and irritable bowel syndrome because the analyzed research produced inconsistent results. While some studies indicate that smoking may worsen the symptoms of IBS or raise the likelihood of getting the condition, other research rejects this link. Clinicians should keep encouraging smoking cessation due to its many health benefits until more conclusive data is available, but they should also be open to the potential that it could improve the outcomes of IBS patients. To reconcile these contradictory results and get a deeper comprehension of the possible contribution of smoking to the etiology of IBS, more investigation is required.

Keywords: Irritable bowel syndrome, Smoking, Lifestyle, Systematic review.

INTRODUCTION

The gastrointestinal illness known as irritable bowel syndrome, or IBS, is characterized by persistent stomach pain or discomfort and irregular bowel movements without a clear cause. In the adult population as a whole, 10-15% of people suffer from IBS [1]. Due to worker absenteeism, this disorder is predicted to cause $20 billion in indirect expenditures annually and $1.7 billion in direct medical costs in the United States, contributing to a high societal burden of disease [2].

The two primary sets of positive criteria for the diagnosis of IBS are the Manning and the Rome criteria [3]. Several updates to the Rome criteria have resulted in the following classifications of IBS subtypes: with constipation, with diarrhea, mixed, and un-subtyped, based on the main pattern of stools [3, 4].

Recurrent episodes of IBS can be chronic and have a negative impact on quality of life, productivity at work, and healthcare consumption [5, 6]. The link between unhealthy lifestyles and functional gastrointestinal problems is receiving more and more attention [7]. One viable therapy option for IBS is behavioral modification, which includes quitting smoking. It has recently been discovered that smoking, both past and present, is substantially linked to a number of functional gastrointestinal symptoms, particularly constipation, bloating, and functional abdominal pain [8].

It is commonly known that smoking increases the risk of developing a number of chronic illnesses, including as malignancies, respiratory conditions, and cardiovascular disease. Smoking has a substantial negative influence on digestive health since it can make diseases like Crohn's disease and peptic ulcers worse. However, there is still conflicting evidence about the link between smoking and IBS. While some studies find no conclusive evidence, others speculate that smoking may play a role in the development of IBS by modifying immune response, gut motility, and gut-brain connections. To elucidate the association between smoking and IBS, a comprehensive evaluation and synthesis of the available data is necessary, given the high prevalence of both conditions and the possibility that smoking may affect gastrointestinal function.

The purpose of this systematic review is to assess the data on smoking's role as an IBS risk factor. This review aims to ascertain if smoking is a significant factor in the onset and severity of IBS by examining research that investigates the relationship between smoking and the condition. The results could potentially guide clinical treatment and public health actions.

METHODS

Following the recommendations of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) [9], this systematic review was conducted. We performed an extensive electronic search using PubMed, Web of Science, SCOPUS, Cochrane Library, and Science Direct, among other bibliographic databases. English-language research on the association between smoking and IBS was the focus of our search approach. To guarantee a comprehensive search, we employed pertinent terms associated with both IBS and smoking. In order to preserve neutrality, two impartial reviewers went through the search results, chose studies that fit the inclusion requirements, took out data, and used reputable assessment instruments to rate the included research's methodological quality.

Eligibility Criteria

Inclusion criteria:

- Studies that investigate the association between smoking and IBS.
- Studies that reported the prevalence of smoking habits among IBS patients.
- Studies included adults only (>18 years).
- Only studies written in English.
- Randomized controlled trials (RTCs), observational studies, cohort studies (retrospective and prospective), case-control studies, or cross-sectional studies.

Exclusion criteria:

- Studies that do not focus on the association between smoking and IBS.
- Studies written in languages other than English.
- Case studies, opinions, comments, letters, reviews that don't include original research, and abstracts from conferences.

Data Extraction

Titles and abstracts found from the search were screened for screening accuracy and consistency by using pre-established inclusion and exclusion criteria to determine their relevance to the research issue. To promote effective screening and lessen bias, reference management software such as Rayyan (QCRI) [10] was used. Research that at least one reviewer thought to be pertinent was advanced to full-text inspection by both reviewers. All disputes pertaining to inclusion were settled by consensus and dialogue. Using a standardized data extraction form, important data from the included studies was retrieved, including titles, authors, publication year, research setting, participant demographics (age and gender distribution), IBS diagnostic tool, population type, prevalence of IBS, and primary outcomes. In addition, the risk of bias in the included studies was assessed using a recognized instrument for methodological quality evaluation.

Data Synthesis Strategy

Using information from relevant studies, summary tables were made to provide a qualitative overview of the research findings and elements. The right use of the data from the included studies was determined after the data collection for the systematic review was finished.

Risk of Bias Assessment

The study's quality was assessed using the Aromataris *et al.*, [11] critical assessment criteria for studies reporting prevalence data. This tool consists of nine questions, with positive responses getting a score of one and negative, ambiguous, or irrelevant responses receiving a score of zero. Scores of less than 4, 5 to 7, and 8 or higher will be rated as poor, moderate, and high quality, accordingly. Researchers separately assessed the study quality, and any discrepancies were resolved through discussion.

RESULTS

Search Results

Following the removal of 456 duplicates, a thorough search yielded 1016 study publications. After 560 studies' titles and abstracts were reviewed, 478 papers were rejected. Three of the 82 reports that needed to be retrieved could not be found. 79 publications were screened for full-text review; 46 were rejected because the study findings were incorrect, 19 because the population type was incorrect, 3 were abstracts, and 3 were editor's letters. Eight of the research publications in this systematic review met the qualifying criteria. Figure 1 depicts an overview of the approach used to choose the research.

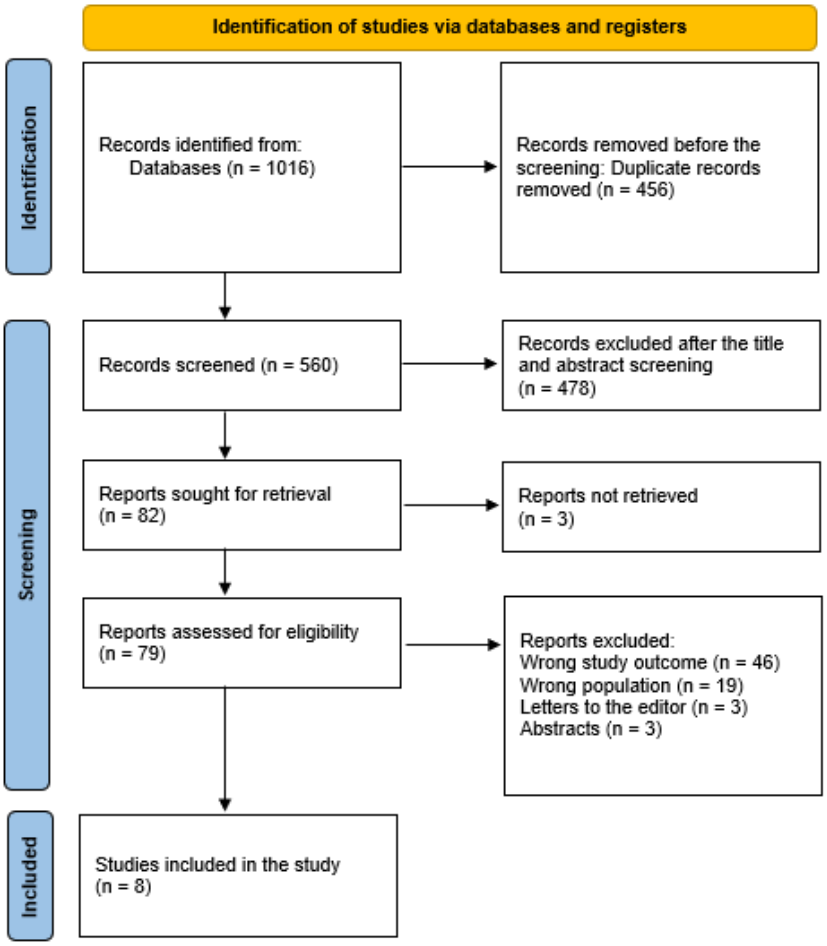

Figure 1: The study decision-making is summarized in a PRISMA diagram

Sociodemographic Parameters of the Researched Subjects

Table 1 illustrates the demographic data from the research articles. Our data consists of eight studies with 1458 children, 864 (59.3%) of whom were female. Six studies were cross-sectional studies [12-15, 17, 19] and two were case controls [16, 18]. Two studies were conducted in Korea [12, 17], two in Iran [15, 16], one in the USA [13], one in Japan [14], one in Turkey [18], and one in Saudi Arabia [19]. The earliest studies was conducted in 2007 [13, 18].

Clinical Outcomes

The clinical parameters are displayed in Table 2. All of the included studies used ROME criteria for IBS diagnosis. The prevalence of smoking among IBS patients ranged from 3.8% [12] to 37% [17], with a total prevalence of 405 (27.8%). Five studies have demonstrated that the incidence of IBS was not significantly correlated with cigarette smoking [12, 13, 15, 18, 19]. Two studies reported that smoking was a significant risk factor for IBS incidence [16, 17] and one found that IBS-M was the only variant related to smoking [14].

Table 1: Sociodemographic variables of the interested populations

Study ID	Study design	Country	Participants	Mean age	Females (%)
Son *et al.*, 2009 [12]	Cross-sectional	Korea	104	NM	104 (100%)
Jung *et al.*, 2007 [13]	Cross-sectional	USA	111	18-65	67 (84.7%)
Kubo *et al.*, 2011 [14]	Cross-sectional	Japan	367	37.3 ± 12	178 (48.5%)
Khademolhosseini *et al.*, 2011 [15]	Cross-sectional	Iran	215	35 to >65	161 (74.9%)
Frank *et al.*, 2013 [16]	Case-control	Iran	146	33.7 ± 13.2	90 (61.6%)
Nam *et al.*, 2010 [17]	Cross-sectional	Korea	393	47.7 ± 8.8	169 (43%)
Uz *et al.*, 2007 [18]	Case-control	Turkey	100	45.6 ± 12.9	81 (81%)
Singh *et al.*, 2014 [19]	Cross-sectional	Saudi Arabia	542	20-59	252 (47.2%)

Table 2: Clinical and epidemiological outcomes

Study ID	IBS diagnostic tool	Population type	Smoking prevalence	Main outcomes	JBI
Son *et al.*, 2009 [12]	ROME II	Adolescents	4 (3.8%)	The incidence of IBS was not significantly correlated with cigarette smoking.	High
Chatila *et al.*, 2007 [13]	ROME II	General population	54 (22.1%)	The incidence of IBS was not significantly correlated with cigarette smoking.	Moderate
Kubo *et al.*, 2011 [14]	ROME II	General population	124 (33.8%)	Although there is debate over the correlation between smoking and IBS, IBS-M has been linked to smoking habits.	Moderate
Khademolhosseini *et al.*, 2011 [15]	ROME II	General population	18 (8.8%)	The incidence of IBS was not significantly correlated with cigarette smoking.	Moderate
Frank *et al.*, 2013 [16]	ROME II	General population	24 (16.4%)	Multivariate logistic regression determined smoking (OR = 6.2, 95% CI: 1.03-37.2) as a risk factor for IBS incidence.	Moderate
Nam *et al.*, 2010 [17]	ROME III	General population	147 (37%)	Multivariate logistic regression determined smoking (OR = 1.31, 95% CI: 1.00-1.71) as a risk factor for IBS incidence.	Moderate
Uz *et al.*, 2007 [18]	ROME II	General population	30 (30%)	The incidence of IBS was not significantly correlated with cigarette smoking.	Low
Singh *et al.*, 2015 [19]	ROME III	IBS patients	32 (8.1%)	The incidence of IBS was not significantly correlated with cigarette smoking.	High

***NM=Not-mentioned**

DISCUSSION

The findings of this systematic study provide contradictory data about the link between smoking and IBS. While some research indicates a direct correlation between smoking and a higher risk of IBS, other studies find no conclusive evidence of this relationship. The inconsistent results underscore the intricate nature of the relationship between smoking and IBS and imply that additional variables could influence or obscure this correlation. We found that the prevalence of smoking among IBS patients ranged from 3.8% [12] to 37% [17], with a total prevalence of 405 (27.8%). Despite the high prevalence, our study could not find a strong association between smoking and IBS. The variable study designs and populations could be one reason for the contradictory findings. There may be variations in the results found because different studies have utilized different definitions of IBS (such as Rome criteria II and III) and smoking status (e.g., current vs. former smokers, smoking intensity, and duration). Furthermore, a wide range of demographic groups and geographic locations were covered by the research that made up this review, which may have introduced differences in environmental factors, lifestyle choices, and genetic predispositions that affect the association between smoking and IBS.

The presence of confounding variables may also be a factor in the contradictory findings. In addition to stress, eating a poor diet, and drinking alcohol, smoking is frequently linked to other risk factors that can also affect the onset and severity of IBS. The individual studies differed in how much these confounders were adjusted for, which could have skewed estimates of the correlation between smoking and IBS [20]. Furthermore, little is known about the biochemical pathways via which smoking may affect IBS. The precise mechanisms relating smoking to IBS are not entirely understood, although it has been demonstrated that smoking affects the gut-brain axis, inflammation, and gastrointestinal motility. Due to the possibility that smoking may have varying effects on different populations' gastrointestinal systems, this uncertainty may contribute to the heterogeneity in study findings [21].

Clinicians should proceed cautiously when considering a possible link between smoking and IBS due to the contradictory results. Although there is evidence that smoking may make IBS symptoms worse, there is currently insufficient data to conclusively identify smoking as a risk factor for IBS. As part of comprehensive patient treatment, doctors should continue to support smoking cessation due to the well-established harmful effects of smoking on general health. Although additional study is required to establish this, stopping smoking may still offer potential benefits, such as the

chance of symptom reduction, for people with IBS who smoke.

Limitations

The design of the research that made up this evaluation varied greatly, with variations observed in population characteristics, geographic locations, and methods employed to evaluate smoking status and IBS diagnosis. This heterogeneity makes it difficult to reach firm conclusions and may have contributed to the inconsistent results. There may have been differences in the observed relationships due to the lack of consistency in identifying smoking status (e.g., current vs. former smokers, smoking intensity and duration) across studies, which limited the capacity to directly compare findings.

CONCLUSION

There is still no obvious connection between smoking and IBS because the analyzed research produced inconsistent results. While some studies indicate that smoking may worsen the symptoms of IBS or raise the likelihood of getting the condition, other research rejects this link. Clinicians should keep encouraging smoking cessation due to its many health benefits until more conclusive data is available, but they should also be open to the potential that it could also improve the outcomes of IBS patients. To reconcile these contradictory results and get a deeper comprehension of the possible contribution of smoking to the etiology of IBS, more investigation is required.

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