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Review Article

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Diseases Susceptibility with Irritable Bowel Syndrome

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A B S T R A C T

IBS is one of the most well-known functional bowel disorders, with more than 10% of the global adult population reporting symptoms consistent with the illness in population-based studies. In standard clinical practice, an IBS diagnosis is obtained based on common symptoms.3 Investigations are frequently limited to a chosen panel of tests that aid in the exclusion of established organic disorders with comparable symptoms, such as inflammatory bowel disease or celiac disease. The actual etiology of IBS is unknown, however anomalies in the gut-brain axis, increased gastrointestinal sensitivity, and dysregulation of gut motility and sensation are thought to have a role. There is evidence that people with IBS are more likely to have fibromyalgia, chronic fatigue syndrome, and depression than the general population. Furthermore, autoimmune illnesses such as rheumatoid arthritis and inflammatory bowel disease are more commonly associated with IBS. The precise processes causing this relationship are unknown, however it is thought that shared genetic, environmental, and neurological variables may contribute to both IBS and other disorders. Understanding this link is critical for effectively managing and treating both IBS and related comorbidities, potentially leading to more complete care plans for affected individuals. Diet has a substantial impact on susceptibility to Irritable Bowel Syndrome (IBS), a common gastrointestinal condition marked by stomach pain, bloating, and changes in bowel movements. Certain dietary components have been identified as triggers for IBS symptoms, which exacerbates the condition in sensitive individuals. Diet does not directly cause IBS, but it can have a substantial impact on illness susceptibility and symptom severity. Adopting a balanced diet high in soluble fiber, probiotics, and nutrient-dense foods while avoiding recognized trigger foods may help to control IBS symptoms and improve overall gastrointestinal health.

Introduction

Irritable bowel syndrome (IBS) is one of the most frequent gut-brain interactions illnesses (formerly known as functional gastrointestinal disorders), affecting approximately one in every ten people worldwide (Black and Ford, 2020). It is not a single disease, but rather a combination of gastrointestinal symptoms that frequently occur simultaneously (Loo *et al.,* 2020). Constipation, straining, and milk intolerance were symptoms that African Americans reported far more frequently than

Caucasians (North Americans). Symptoms supported typically by Caucasians included diarrhea, nausea, and vomiting. (Taub *et al.,* 1995). IBS-related symptoms are frequently chronic and uncomfortable, affecting patients' everyday activities (e.g. sleep, leisure time), social interactions, and productivity at work or school (Orenstein, 2006). The nature of the link between irritable bowel and other functional bowel syndromes and psychiatric problems is unknown (Woodman *et al.,* 1998). This review seeks to provide an overview of the diseases or complications that can emerge if there is mismanagement while having IBS, as well as to recommend significant areas for additional research.

IBS

Irritable bowel syndrome (IBS) is a chronic functional disorder of the gastrointestinal tract, characterized by abdominal pain and alterations in bowel habits (Weaver *et al.,* 2017). Major adjustments in the definition of IBS in the Rome IV criteria includes removal of the term abdominal discomfort (Rome III), leaving only the occurrence of abdominal pain as the key requirement for diagnosis of IBS particularly, at least one day per week in the last three months (Camilleri, 2020). The Rome III criteria for adults divide IBS patients into four subtypes based on stool form: IBS with constipation (IBS-C), IBS with diarrhea (IBS-D), mixed type (IBS-M), and unsubtyped (IBS-U) (Dorn *et al.,* 2009). Children are more likely to have IBS-C and IBS-U than adults, with IBS-D and IBS-M being less prevalent (Self *et al.,* 2014).

Prevalence of IBS

Most studies addressing prevalence of IBS are community surveys, with the majority from Europe, Southeast Asia, and North America. Meta-analysis shows a pooled estimate of international IBS prevalence of 11.2 per cent (95 percent confidence interval [CI] 9.8–12.8), with variation by geographic region; the lowest occurring in South Asia (7.0 percent) and the highest in South America (21.0 percent) (Canavan *et al.,* 2014). IBS symptoms are 1.5 to 2 times more common in women than males in the United States, Canada, and Israel, yet there appears to be more parity in Asia (Chey *et al.,* 2015). A study team discovered that Younger people, women, non-Hispanic Whites, and those with medical conditions had a higher risk of developing IBS. They also noted that concurrent symptoms were common, with bloating, increased gas, and heartburn being mentioned (Almario *et al.,* 2023). Hongyuan Liu and their team assessed 11 studies from seven countries and found that the prevalence of IBS in the medical staff population was about 16 percent, and the prevalence of nurses was higher than that of doctors. The influencing factors are shift work, poor sleep quality, and female gender (Liu *et al.,* 2022). IBS is less common among the Saudi population as compared to the worldwide prevalence rates (Amin *et al.,* 2021). There is a noteworthy lack of data from certain areas of the world. The African continent is almost completely unrepresented and most studies conducted there were on select populations, which disqualified them from inclusion in the present systematic review. Other regions that were seriously underrepresented are Eastern Europe and the Arab world (Sperber *et al.,* 2017).

Diseases Susceptibility With IBS

Lower Resilience

Resilience, defined as the ability to recover quickly from or adjust to a stressful situation, has been linked to social support, which acts as an external coping mechanism, favoring the activation of internal coping and the organism's ability to react (Stanculete *et al.,* 2023). There a model of resilience based on three fundamental concepts: 1) engineering resilience, or the ability to return to equilibrium after a disturbance; 2) ecological resilience, or the ability to withstand a disturbance and retain a stable state; and 3) adaptive resilience, or the ability to adapt and prosper in the face of change (Maltby *et al.,* 2015). Previously, H Shahdadi and their team conducted a study comparing normal women and IBS women and discovered a difference in resilience and components of positive relationships with others, environmental mastery, purpose in life, and acceptance in groups of IBS women and normal women (Shahdadi *et al.,* 2017). Resilience in IBS sufferers is weaker than in healthy controls. Furthermore, resilience is associated with lower IBS symptom severity, higher IBS-QOL, and lower EALs (early adverse life events) in both HCs and IBS (Park *et al.,* 2018).

Altered Brain Function in Females

Girls with IBS exhibit significant brain anatomical and functional changes compared to their healthy peers (Bhatt *et al.,* 2019). Jennifer Labus and her team previously evaluated regional GM volume and determined that: 1) Lower GM (gray matter) volume was found in the insula, cingulate, amygdala, hippocampus,

putamen, and frontal areas for IBS compared to HC(healthy controls). 2) A history of EAL (early adverse life) explained many of the variations, while trait anxiety did not (Labus *et al.,* 2014). Females with IBS had stronger connections between the putamen (basal ganglia) and a region in the DMN (dorsal section of the posterior cingulate gyrus) and somatosensory network (superior frontal gyrus). This indicates topological remodeling of the DMN as well as broad microstructural white matter changes in IBS somatosensory network (Osadchiy *et al.,* 2020).

Sleep Disorders

Ben Wang and his coworker meta-analysis of 36 research found that sleep disturbances are widespread in IBS, with a prevalence rate of 37.6 percent. The aggregated dataset demonstrated a substantial association between sleep problems and IBS. It is unclear why sleep disorders are associated with IBS. Overall, although the cause of prevalent sleep disturbances among IBS patients is unknown, a gut-brain-microbiota axis issue may be at work (Wang *et al.,* 2018). There is a two-way connection between sleep disturbances and IBS symptoms: poor sleep quality among IBS sufferers results from nocturnal GI symptoms, inhibiting the initiation of restorative sleep cycles or leading to waking from sleep, but also Observational research indicates that circadian disruptions instead may play a causal effect in GI discomfort (Patel *et al.,* 2016). According to a study nurses who worked rotational shifts had a much higher prevalence of IBS diagnoses and more stomach pain than their peers who worked fixed schedules (Nojkov *et al.,* 2010). Another study undertaken by Farzin Ghiasi *et al.,* found a link between sleep apnea and IBS, which was more common in men and obese adults. It appears probable that sympathetic nerve dominance could link IBS and sleep apnea (Ghiasi *et al.,* 2017). Finally, sleep difficulties were present in a significant number of people with IBS, with the majority reporting both hypersomnolence-related and insomnia-related symptoms in a large population-based sample in the United States based on a face-to-face household interview (Grover *et al.,* 2021).

Low Quality of Life

A study on the Dutch population using three criteria of the burden of illness & found that IBS patients quality of life was compromised on all aspects, including generic and disease-specific health-related quality of life (Berg *et al.,* 2006). The severity of the patient symptoms and depression have a substantial impact on their quality of life (Cho, 2011). QOL did not differ between IBS subtypes (Jamali *et al.,* 2012). A study found that IBS-M and IBS-C had poorer QOL than IBS-D (Muscatello *et al.,* 2010). Meanwhile, JM Si *et al.,* found that QOL in IBS-C is lower than in IBS-D (Si *et al.,* 2004). However, another investigation was undertaken where it is seen that IBS-D patients often interfere with their everyday activities and avoid food more frequently as compared to patients with IBS-C. Similarly, patients with IBS-M also had more interference in their activities, greater impact on their relationships and lower social reaction score than IBS-C patients (Singh *et al.,* 2015). Another study which collected different testimonials from different IBS-subtypes patients concluded that whether its IBS-C or IBS-D QOL disruption persisted in all conditions and in different ways (Nevots *et al.,* 2023).

Anxiety

Patients with anxiety and depression exhibited higher levels of IBS symptoms and GI-specific anxiety compared to those without. Anxious patients were substantially more likely to be females and younger than individuals without reported anxiety (Midenfjord *et al.,* 2019). However, the link between psychiatric illnesses and IBS is stronger in males than in women (Roohafza *et al.,* 2016). Another recent study found no significant gender difference in disease anxiety levels between men and women (Berens *et al.,* 2020). In a meta-analysis, IBS-C patients had the highest SMD for anxiety and depression. This is likely owing to an imbalance in 5-hydroxytryptamine (5-HT) secretion, resulting in a con-situation. 5-HT is part of the intestinal serotonin pathway, which promotes greater gastrointestinal motility (Lee *et al.,* 2017). High levels of anxiety and depression in IBS may contribute to abnormalities in intrinsic brain activity. A study conducted by S Blomhoff and team suggested that the interplay of IBS-related and anxiety-related hyperreactivity in the frontal cortex may contribute to the severity and duration of irritable bowel syndrome (Blomhoff *et al.,* 2001).

Parkinson Disease

Parkinson's disease (PD) is a neurodegenerative disease characterized by the cardinal motor symptoms tremor, bradykinesia, stiffness, and postural instability.IBS was linked to a 44 percent increased risk of Parkinson's disease over time (Liu *et al.,* 2021). Several PD

symptoms have been linked to microbiota-gut-brain axis disruption. (Felice *et al.,* 2016). A study suggests a link between IBS and Parkinson's disease, particularly among those aged 65 and higher. IBS may have been an early sign of Parkinson's disease (Yoon *et al.,* 2022). The increased number of bacteria causes the creation of proinflammatory cytokines by the enteric neurons, which are transported down the vagus nerve to the brain, where they produce neuroinflammation, one of the underlying mechanisms of PD (Li *et al.,* 2021). The vagus nerve is one of the main highways for the microbiota to interact with the brain, but other routes are also relevant (Felice *et al.,* 2016). The incidence rates of Parkinson's disease, as stratified by gender, age and follow-up year, were all higher in subjects with IBS than those without IBS. IBS without diarrhea or constipation may specifically indicate Parkinson's disease (Konings *et al.,* 2023).

Ischemic Colitis (Ic)

Ischaemic colitis (IC) is the most prevalent kind of vascular injury to the large intestine, accounting for 50-60 percent of all gastrointestinal ischemic disorders. Patients with IBS were 3.17 times more likely to develop IC than those without IBS (Suh *et al.,* 2007). IBS and constipation are independent predictors of IC. Because serotonergic medications used to treat IBS and chronic constipation have been linked to the development of IC (Chang *et al.,* 2008), Alosetron is an effective pharmacological agent for the treatment of women with severe, chronic IBS-D. IC is most likely to occur within the first three months of usage (Lewis, 2010). Serotonin transmission may influence colonic mucosal circulation, which could explain the increased incidence of ischemic colitis in IBS patients. Microscopic colitis can be found in people with diarrhea-predominant IBS and in elderly women with IBS (Ozdil *et al.,* 2011).

Lactose Intolerance

Lactose intolerance (LI) is defined by clinical symptoms after consuming lactose-containing products, produced by lactose maldigestion (LM). Subjective LI was more common in IBS compared to HCs, with patients reporting a higher correlation between their abdominal symptoms and lactose-containing goods (Varjú *et al.,* 2019). Another demonstrates that in a tropical country like India, LI is likely to be more prevalent than in the West. This could be due to variances in genetic, ethnic, and geographic background, all of which are known to influence the prevalence of LI in a population (Gupta *et al.,* 2007). Gas production and visceral hypersensitivity both contribute to digestive symptoms in IBS patients, particularly bloating and borborygmi, following lactose consumption. Lactose intolerance symptoms during the Hydrogen Breath Test (HBT) were influenced by both lactose absorption capacity and IBS severity (Dainese *et al.,* 2014). Alpers showed that 45 percent of IBS patients have lactose intolerance, but only 30 per cent attribute their symptoms to milk and dairy products, and that dietary exclusion only reduced symptoms in 52 per cent of patients (Lomer *et al.,* 2008). One study discovered that the prevalence of LI was higher in IBS-D patients than in healthy people (Xiong *et al.,* 2017). Lactose intolerance in IBS-D patients is associated with anxiety, mucosal immune activation, and increased visceral sensitivity (Yang *et al.,* 2014).

Increased Risk of Pregnancy

Circulating cytokine disturbances have been linked to both IBS pathogenesis and unfavorable pregnancy outcomes such as spontaneous miscarriage, ectopic pregnancy, preeclampsia, and still birth. Young women, smokers, and women without other comorbidities who had IBS and depression/anxiety had a 25-30 percent higher risk of miscarriage. Women with IBS and depression/anxiety showed a consistently higher risk of stillbirth in all analyses, however the numbers were too small to draw strong conclusions (Khashan *et al.,* 2012). Ectopic pregnancies (EPs) i.e. embryo implantations taking place outside the uterus were more likely to develop among those women who are diagnosed with IBS. (Talavera *et al.,* 2021). In our study, patients with IBS were more likely to develop pregnancy-induced hypertension and preeclampsia. Higher risk of delivery complications was observed related to the occurrence of DVTs. On the other hand, neonatal outcomes did not differ from the general population except in the increased risk of con-genital anomalies (Alnoman *et al.,* 2022). Children are at increased risk of developing IBS if they were born to young mothers or if they were raised by parents with a history of IBS (Low *et al.,* 2020). Increased hormone levels and the high prevalence of IBS in women of childbearing age suggest that, in women who already have IBS, pregnancy may lead to an exacerbation of symptoms (Roisinblit, 2013).

Dietary Management of IBS

Several disease susceptibility is there with IBS, so management of IBS is very important in general. Most

people with IBS believe dietary intake plays a significant role in their symptoms, and 63 percent want to know which foods to avoid (Ostgaard *et al.,* 2012). The most commonly reported triggers are carbohydrates and fatty foods, milk and dairy products, wheat products, caffeine, hot spices, certain meats, cabbage, onions, peas, beans and fried and smoked foods (Mazzawi *et al.,* 2013). Different types of diet types are provided below:

There is a lot of interest in and research being done on the connection between irritable bowel syndrome (IBS) and vulnerability to other illnesses. Although IBS is a functional gastrointestinal problem in and of itself, with symptoms including bloating, changes in bowel habits, and abdominal pain, its correlation with other medical conditions has sparked concerns about possible common mechanisms or contributing variables. Some comorbidities, including as psychiatric conditions like anxiety and depression and other functional illnesses like fibromyalgia and chronic fatigue syndrome, may be more common in people with IBS, according to a number of studies. Because of the apparent clustering of disorders, scientists are examining shared underlying pathways, including immune system hyperactivity, gut-brain axis dysfunction, and changes in the microbiome. However, it is important to emphasize that, while links have been established, causality is still unknown, and the precise nature of these relationships requires further research. Understanding the connection between IBS and other disorders is critical for improving patient care because it can guide focused therapy approaches and personalised management methods adapted to the unique needs of people living with this multidimensional condition.

Table.1 Factors relevant to the occurrence of IBS symptoms

	Mechanisms	Causes	References
Genetic Factors	link between a specific polymorphism and IBS has been found for the serotonin transporter gene	• Genetically determined	Öhmanand Simren, 2007, Camilleri, 2009,
Bile Acid Malabsorption	Most likely genetically determined alteration of the function of the apical ileal bile acid transporter	• Type 2, or idiopathic, likely due to a genetic defect in the apical ileal bile acid transporter	Holtmann *et al*., 2016
Role of Diet	The presence of bacteria that break down FODMAPs and fiber with gas production such as Clostridium spp. gives rise to distension of the large intestine with abdominal discomfort or pain	• Inclusion of low fiber and FODMAPS in diet —-unabsorbed carbohydrates enter the distal small intestine and colon, where they increase the osmotic pressure in the luminal cavity and provide a substrate for bacterial fermentation.	El-Salhy *et al*., 2011 Salhy, 2015 Hadjivasilis*et al*., 2019
Role of Gut Microbiome	Activation of mucosal immunity and inflammation, Altered mucosal permeability and the epithelial barrier, Sensory-motor disturbances	• Modifications in Gut Microbiota Diversity • Host physiology influences the alterations in their gut microbiota • Gut microbiota heritable, host-dependent	Lutgendorff *et al*., 2008 Jiang *et al*., 2015 Bhattarai *et al*., 2017
Role of Serotonin	Alterations in SEROTONIN (5-HT) biosynthesis, content, release, or reuptake may contribute to gastrointestinal dysfunction and hypersensi-tivity found in IBS patients	• Altered 5-HTsignalling may influence GI function in IBS via alteration inSERT(5-HT transporter)	Crowell, 2004
Decreased Gut Hormones	The cell density of Musashi 1 and neurogenin 3 are lower in IBS	• Reduced progenitor cells in stem and enteroendocrine cells cause sparse	El-Salhy *et al*., 2019

	patients than that of healthy subjects . Musashi 1 is a marker for intestinal stem cells and their early progeny	gut hormones.	
Endometriosis	Endometriosis is characterized as a chronic, estrogen dependent inflammatory disorder with the presence of endometrial tissue outside the uterine cavity.	• Immunological linkage through increased mast cell activation • The abnormal levels of inflammatory cytokines and immune cell activation in the peritoneal cavity • Higher risk of IBS in women with endometriosis	Nabi *et al*., 2022 Chiaffarino *et al*., 2021
Sex Steroids	Mechanism is still unclear	• Estrogens and androgens regulate IBS symptoms, such as visceral sensitivity, gut motility, and psychosocial states, perhaps via affecting the gut-brain axis.	Mulak *et al*., 2014 So and Savidge, 2021

Table.2 Diet linked with IBS

Diet	Description	Summary	Reference
Low FODM Diet (Fermentable Oligosaccharides Disaccharides Monosaccharides And Polyols)	Reducing some specific type of carbohydrates	• Effective in lowering bloating, stomach pain, fecal frequency, and borborygmus, and it can be given to individuals with IBS-D and bloating . • The average reduction in the overall IBS-SSS (severity scoring system) score was 164 after three weeks of limiting high-FODMAP foods.	Galica *et al.,* 2022 Manning *et al.,*2020 Hustoft *et al*., 2017
Low Histamine Diet Diet	Reduce the quantity of foods that release histamine.	• There are not any randomized trials for diet or medication, • No studies for adult IBS patients	•Spiller, 2021 •Rej *et al*., 2019
Lactose Free Diet	No lactose-containing goods, save for those processed with lactase.	• Only useful for persons with lactose intolerance; • Ineffective for patients with IBS without lactose intolerance.	•Böhmer *et al*.,2001 •Cancarevic *et al*., 2020
Fiber Supplementation	Psyllium supplementation	• Long-chain, intermediate viscosity, soluble, and moderately fermentable dietary fiber (e.g., psyllium) has demonstrated effects in the management of IBS	•Garg *et al*., 2023 •Moayyedi *et al*., 2014
Gluten-Free Diet	Gluten refers to a protein family known as prolamins (glutenin and gliadin), which are found in the starchy endosperm of numerous cereal grains, including wheat, barley, and rye. In a GFD, these grains, as well as	• Undergoing a GFD exhibited clinically substantial reductions in IBS symptom severity at 6 weeks. • Taking LF-GFD showed a significant reduction in IBS symptoms and normalized gut microbiota. • The LFD and GFD are more expensive, difficult to follow, and inconvenient.	•Vazquez–Roque *et al*., 2013 •Naseri *et al*., 2021 •Rej *et al*., 2022

	their hybrids or derived cereals like kamut, spelt, and triticale, are not allowed.	• There is significantly less data on gluten-free or exclusion diets based on IgG antibody testing.	
Very Low Carbohydrate Diet/Ketogenic Diet	The classic KD is based on a ratio of fat to carbohydrate plus protein grams of 3:1 or 4:1, which means that 90% of the energy comes from fat and only 10% from carbohydrate and protein combined mixture	• VLCD effectively relieves IBS-D symptoms, reduces stomach pain, improves stool frequency and consistency, and boosts quality of life. • KD's impact consists of a shift toward proteolytic fermentation, leading to a reduction in intestinal mucosa inflammation - a rat-based study. • The fundamental fault of KD is that this diet is extremely restricted, showing a decreased microbial diversity	•Austin *et al*., 2009 •Chimienti *et al*., 2021 •Reddel *et al*., 2019
Probiotic Supplementation	Probiotics are live bacteria that, when administered in sufficient quantities, provide health advantages to the host.	• Probiotics show promise for treating IBS. • It raises the mass of beneficial bacteria in the digestive tract, lowering bacterial overgrowth in the small bowel and rectifying the imbalance between proinflammatory and antiinflammatory cytokines. • A larger sample size-based study is necessary.	•Farland, 2008 •Dai *et al.,* 2013 •Dimidi *et al*., 2017

Author Contributions

Jyoti Rani: Investigation, formal analysis, writing—original draft. Rimpa Karmakar: Validation, methodology, writing—reviewing. Sakshi Saini:—Formal analysis, writing—review and editing.

Data Availability

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethical Approval Not applicable.

Consent to Participate Not applicable.

Consent to Publish Not applicable.

Conflict of Interest The authors declare no competing interests.

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