Journal of Translational Gastroenterology **2026** vol. 4(1) | 33–78
DOI: 10.14218/JTG.2025.00030

Review Article

Herbal Approaches to Gastrointestinal Disorders: Integrating Tradition and Science

Acharya Balkrishna[1,2], Deepika Srivastava[1], Razia Parveen[1], Ankita Kukreti[1] and Nidhi Sharma[1*]

[1]*Patanjali Herbal Research Department, Patanjali Research Foundation, Haridwar, India;* [2]*Department of Allied Sciences, University of Patanjali, Haridwar, India*

Received: July 31, 2025 | **Revised:** September 12, 2025 | **Accepted:** September 22, 2025 | **Published online:** November 06, 2025

Abstract

Gastrointestinal (GI) health is essential for maintaining systemic balance, influencing digestion, immunity, and neuroendocrine signaling. However, GI disorders such as irritable bowel syndrome, inflammatory bowel disease, gastroesophageal reflux disease, peptic ulcers, and constipation are increasingly prevalent, significantly affecting global health and healthcare economics. Although conventional pharmacological treatments offer symptomatic relief, their long-term use is often associated with adverse effects, resistance, and limited efficacy, prompting a shift toward alternative and complementary therapies. Traditional systems of medicine, such as Ayurveda, Traditional Chinese Medicine, Unani, and Siddha, emphasize holistic approaches, including herbal formulations that target underlying causes rather than just symptoms. This review provides a comprehensive analysis of the role of natural products and traditional herbals in GI health. It discusses key bioactive constituents, flavonoids, alkaloids, terpenoids, and polyphenols, known for their anti-inflammatory, antimicrobial, gastroprotective, and prebiotic properties. Widely used herbal remedies such as Triphala, licorice root, peppermint oil, turmeric, and psyllium are highlighted for their proven therapeutic actions. Additionally, the review documents more than 300 medicinal plants traditionally used in diverse cultures worldwide for managing GI conditions, based on ethnopharmacological evidence. While the therapeutic promise is substantial, challenges such as formulation standardization, herb-drug interactions, and limited clinical data remain. The review underscores the need for integrating traditional wisdom with modern scientific validation, offering a path forward for safe, effective, and personalized GI healthcare.

Introduction

The gastrointestinal (GI) system plays a central role in human health as the primary site for digestion and nutrient absorption, while also influencing immunity, endocrine signaling, and mental well-being through the gut–brain axis. A balanced and healthy GI tract is vital for maintaining metabolic homeostasis and overall physiological harmony.[1,2] Recent research has highlighted the gut's influence on systemic functions such as hormone regulation, immune system activity, and even mental health, with over 70% of immune cells located in the GI tract.[3,4] Dysfunctions in this system contribute not only to digestive disorders but also to obesity, diabetes, autoimmune conditions, and neuropsychiatric diseases, underscoring the profound importance of GI health in both preventive and therapeutic medicine.[5,6]

Globally, GI disorders such as irritable bowel syndrome (IBS), inflammatory bowel disease (IBD), gastroesophageal reflux disease (GERD), constipation, dyspepsia, and peptic ulcers represent a major health burden.[7] According to the Rome Foundation Global Study, over 40% of people meet the criteria for functional gastrointestinal disorders, with IBS alone affecting 10–15% of the global population.[8] GERD affects nearly 20% of adults weekly, and constipation prevalence reaches up to 75% in individuals over 45 years. The prevalence of IBD continues to rise, particularly in industrialized nations, with direct healthcare costs in the U.S. exceeding $6 billion annually.[8] Apart from this, peptic ulcers, often linked to Helicobacter pylori infection or non-steroidal anti-inflammatory drug use, continue to pose significant clinical challenges in both developing and developed nations.[9] These chronic conditions typically manifest as abdominal pain, bloating, altered bowel movements, and diarrhea, reducing productivity and inflating healthcare costs. In 2021 alone, GI-related healthcare expenditure was estimated at $111.8 billion, reflecting both clinical and economic challenges.[10] The growing prevalence and burden of GI

Keywords: Gastrointestinal disorders; Herbal medicine; Traditional systems; Natural products; Ethnopharmacology; Integrative therapy.
***Correspondence to:** Nidhi Sharma, Patanjali Herbal Research Department, Patanjali Research Foundation, Haridwar 249405, India. ORCID: https://orcid.org/0000-0001-6123-5194. Tel: +91-9999880322, E-mail: nidhi.sharma@patanjali.res.in
How to cite this article: Balkrishna A, Srivastava D, Parveen R, Kukreti A, Sharma N. Herbal Approaches to Gastrointestinal Disorders: Integrating Tradition and Science. *J Transl Gastroenterol* 2026;4(1):33–78. doi: 10.14218/JTG.2025.00030.

disorders highlight the urgent need for effective, safe, and sustainable treatment approaches.

Limitations of conventional therapies

Modern pharmacological strategies for GI disorders rely on drugs such as antacids, proton pump inhibitors (PPIs), H_2 receptor antagonists, anti-inflammatory agents, antibiotics, and laxatives. While effective for short-term relief, these treatments frequently fail to provide lasting solutions or to address underlying causes of disease. Moreover, long-term use is often associated with safety concerns. For example, PPIs are linked to nutrient deficiencies,[11] bone demineralization,[12] and higher susceptibility to infections, including *Clostridium difficile*.[13–15] Corticosteroids and immunosuppressants used in IBD increase risks of infections and hormonal imbalances.[16] Non-steroidal anti-inflammatory drugs elevate the risk of GI bleeding,[17] while anticholinergic and sedative drugs add further complications.[18,19]

The multifactorial nature of GI diseases, including altered motility, microbial dysbiosis, and visceral hypersensitivity, makes single-target therapies insufficient. Relapse after drug discontinuation, development of tolerance, and drug resistance further limit effectiveness.[20,21] Collectively, these drawbacks emphasize the need for integrative and holistic strategies, spurring renewed interest in natural products and traditional medicine systems as complementary or alternative therapies.

Renewed interest in natural and traditional approaches

In response to the limitations of conventional therapies, there is renewed interest in natural products and traditional medicine for GI disorders. Systems such as Ayurveda, Traditional Chinese Medicine (TCM), and Unani emphasize medicinal plants and dietary regulation, offering holistic approaches that address physical, dietary, emotional, and environmental factors. Herbal medicines, central to these traditions, are increasingly supported by scientific evidence. Natural products from plants, fungi, and marine sources show diverse bioactivities, while phytochemicals including flavonoids, alkaloids, terpenoids, polyphenols, tannins, and glycosides demonstrate anti-inflammatory, antioxidant, antimicrobial, immunomodulatory, and mucosal-protective effects.[22,23] Notable examples include licorice (*Glycyrrhiza glabra*) with mucoprotective and anti-ulcer activity[24,25]; peppermint (*Mentha piperita*) oil for IBS via antispasmodic effects[26,27]; turmeric (*Curcuma longa*), with curcumin's anti-inflammatory effects in IBD[28,29]; and *Triphala*, an Ayurvedic formulation for bowel regulation and detoxification.[30,31] Many formulations also act as prebiotics or modulators of gut microbiota. The herbal medicine market reflects this demand, with revenues of USD 199.07 billion in 2023 projected to reach USD 417.99 billion by 2033.[32]

Advances in analytical chemistry, pharmacology, molecular biology, and systems biology are enabling evidence-based validation of traditional remedies. However, challenges remain, including standardization, herb-drug interaction studies, large-scale clinical trials, and regulatory harmonization. This review will examine natural products and traditional herbals in GI disorders such as IBS, IBD, GERD, peptic ulcers, and constipation, highlighting mechanisms, efficacy, safety, and the clinical relevance of traditional concepts. It will also discuss challenges like formulation variability and regulatory gaps, and explore future directions involving omics technologies, microbiome research, and personalized medicine.

By bridging traditional wisdom with modern science, this review aims to support the evidence-based integration of natural products into comprehensive GI care.

Method of literature search

A comprehensive literature search was conducted to gather relevant information on herbal and traditional medicinal approaches to GI disorders. The databases searched included PubMed, Scopus, Web of Science, and the Ayurveda, Yoga, Naturopathy, Unani, Siddha, and Homeopathy (AYUSH) Research Portal. The search strategy employed a combination of keywords and Boolean operators such as "*gastrointestinal disorders*," "*herbal medicine*," "*natural products*," "*traditional medicine*," "*ethnopharmacology*," "*Ayurveda*," "*TCM*," "*Unani*," and "*Siddha*."

The inclusion criteria comprised studies and reviews focusing on herbal medicines, natural products, and traditional therapeutic practices related to GI health. Publications reporting experimental, clinical, and ethnopharmacological evidence were also considered. Exclusion criteria involved non-peer-reviewed sources, articles lacking primary data or mechanistic insights, and studies unrelated to GI health. The timeframe of the search extended up to July 2025, ensuring incorporation of the most recent evidence. Additional references were identified from the bibliographies of selected articles to strengthen comprehensiveness.

Traditional systems of medicine in gastroenterology

Traditional systems of medicine, rooted in centuries of empirical observations and holistic health philosophies, have provided effective GI remedies long before the advent of modern pharmacology. These approaches, such as Ayurveda, TCM, Unani, Siddha, and various indigenous folk practices, offer distinctive paradigms in understanding and managing digestive health. Collectively, these medical systems view the GI tract not just as a site of digestion but as a central hub for maintaining systemic health. The approaches adopted in these traditions often emphasize dietary regulation, the use of polyherbal formulations, seasonal detoxification, and the balance of internal energies or humors, aligning with modern understandings of the gut as a complex, integrative organ with profound systemic influence.[33,34] With growing evidence of the limitations of conventional pharmacological agents and a surge in functional GI disorders, there is renewed interest in these systems.[35,36] Modern scientific advancements have increasingly begun to validate the efficacy of traditional herbal treatments, uncovering mechanisms that act on sensory receptors, motility, inflammation, and neuromuscular regulation in the GI tract.[37–39]

Ayurveda

In Ayurveda, GI health is central to overall well-being, governed by the concept of *Agni*, or digestive fire, which is responsible for the transformation of food into nourishment. *Agni* is classified into different types: *Jatharagni* (digestive fire in the stomach), *Bhutagni* (digestive processes at the elemental level), and *Dhatvagni* (tissue-level metabolism). A balanced Agni is considered crucial for proper digestion, absorption, assimilation, and elimination. Conversely, impaired Agni is believed to result in the accumulation of *Ama* (toxic undigested material), leading to GI and systemic diseases.[40] According to Ayurvedic theory, the three *Doshas—Vata*, *Pitta*, and *Kapha*—regulate all physiological processes, including those of the GI tract. *Pitta*, associated with enzymatic and metabolic activities, is particularly significant in digestion. Imbalances in these *Doshas* manifest in various GI conditions. For instance, increased *Pitta* is linked to hyperacidity and ulcers,[41,42] *Vata* imbalance is often associated with constipation and bloating,[43,44] and *Kapha* predominance may result in sluggish digestion and mucus accumulation in the GI tract.[45] Treatments focus on restoring *Agni*

and *Dosha* balance through diet, lifestyle, and herbs tailored to an individual's constitution.[46]

Ayurveda offers a wealth of formulations specifically designed to enhance digestive health, manage dyspepsia, relieve constipation, and reduce inflammation. One of the most extensively studied and widely used preparations is *Triphala*, a synergistic blend of three fruits—*Emblica officinalis* (Amla), *Terminalia chebula* (Haritaki), and *Terminalia bellirica* (Bibhitaki). Triphala exhibits antioxidant, anti-inflammatory, and laxative properties, and studies have shown its ability to regulate gut motility and modulate intestinal microbiota.[39,47] Another important polyherbal formulation is *Avipattikar Churna*, traditionally used for hyperacidity and constipation, which contains a combination of cooling and digestive herbs including *Trikatu* (a mixture of ginger, black pepper, and long pepper), Amla, Haritaki, and Licorice.[48,49] These formulations not only provide symptomatic relief but also work to restore the functional balance of Agni and Doshas. Ayurvedic detoxification therapies like *Panchakarma* also aim to cleanse the GI tract and restore physiological homeostasis, often combined with dietary regimens and *Rasayana* (rejuvenative) therapies.[50]

TCM

TCM approaches GI health by focusing on the harmonious flow of Qi, the dynamic balance between Yin and Yang, and the functional integrity of organ systems, especially the Spleen and Stomach. Qi, which flows through meridians, must be abundant and unobstructed for optimal digestive function. GI disorders in TCM are considered consequences of disrupted Qi flow, accumulation of dampness or heat, or deficiencies in Yin.[51] Various Chinese herbs have been identified to target these imbalances. TCM diagnoses GI diseases based on complex syndromes, such as "Spleen Qi Deficiency" or "Stomach Heat," each requiring a specific therapeutic approach. TCM treatments aim to regulate Qi, harmonize Yin-Yang, and strengthen the spleen-stomach system using herbs, acupuncture, and dietary adjustments.[52,53]

A variety of herbs are utilized in TCM to treat GI conditions, often in sophisticated combinations tailored to the individual's constitution and symptoms. Licorice (*Glycyrrhiza uralensis*), known as Gan Cao, is a harmonizing herb frequently used to soothe the stomach, reduce inflammation, and alleviate spasms. Ginger (*Zingiber officinale*), or Sheng Jiang, is employed to warm the digestive tract, dispel cold, and stimulate digestion, especially in cases of nausea or poor appetite.[54] Baikal Skullcap (*Scutellaria baicalensis*), known for its flavonoid content, is used for its anti-inflammatory and antimicrobial effects, particularly in cases of gut inflammation and dysentery.[55–57] Moreover, Chinese herbal formulas like *Tong-Xie-Yao-Fang* and *Tong-Xie-Ning*, composed of *Atractylodis macrocephalae*, *Paeoniae alba*, *Citrus reticulata*, and *Saposhnikoviae*, have shown significant efficacy in randomized controlled trials (RCTs) for treating diarrhea-predominant IBS, reducing pain frequency and improving stool consistency.[58,59] Likewise, TCM decoctions such as *Ban Xia Xie Xin Tang* and *Xiang Sha Liu Jun Zi Tang* are prescribed for conditions like gastritis, bloating, and diarrhea.[60,61] The personalized and adaptive nature of TCM interventions, along with increasing evidence from pharmacological studies, supports their potential integration into gastroenterological practice.

Unani and siddha systems

The Unani system, rooted in Greco-Arabic medicine, conceptualizes GI health through the humoral theory, which posits that the body is governed by the balance of four humors: *Dam* (blood), *Balgham* (phlegm), *Safra* (yellow bile), and *Sauda* (black bile).[62] GI disorders are attributed to humoral imbalances, particularly involving *Safra* (linked to bile and liver function) and *Balgham* (associated with mucus and cold conditions).[63] The stomach and liver are considered key sites for digestion and transformation, with dysfunction leading to diseases such as indigestion, flatulence (*Tabkheer-i-Meda*), and ulcers (*Quroh-e-Ma'ida*). According to Unani scholars, it is caused by *Ghadha-i-Ghalizkham* (foods that are partially cooked and hard to digest), disturbance in *Quwwat-i-Hadm*,[64] stomach weakness, Fudlat (waste product), intake of spicy foods, rotten fruits, hard fibrous diets, alcoholism, indigestion, gastric secretions, prolonged stress, and strain.[65–67]

Unani practitioners frequently prescribe herbal remedies to address symptoms such as bloating, acidity, constipation, and indigestion. Prominent medicinal plants used in this tradition include *Zanjabeel* (*Zingiber officinale*, Ginger), known for its carminative and digestive-stimulating properties; *Aslussoos* (*Glycyrrhiza glabra*, Licorice), valued for its soothing effect on the gastric mucosa and its role in reducing inflammation; and *Sana Makki* (*Cassia angustifolia*, Senna), a well-recognized laxative used to soften stools and relieve constipation.[37,68]

Additionally, *Asgandh* (*Withania somnifera*, Ashwagandha) and *Aslussoos* (Licorice) are widely employed in Unani formulations to strengthen digestive function and regulate metabolism. These herbs support the body's ability to efficiently absorb nutrients and maintain internal equilibrium, thus contributing to overall health and vitality. In cases of gastritis and hyperacidity, Unani prescriptions often include mucosal-protective agents such as *Aslussoos* and *Teel Khushk* (*Ulmus rubra*, Slippery Elm), which help soothe gastric lining inflammation. For irregular bowel movements, personalized polyherbal solutions are administered to restore GI homeostasis. Such therapeutic practices exemplify the individualized and holistic nature of Unani medicine in managing digestive ailments through evidence-informed traditional knowledge.[37,68]

The Siddha system, predominantly practiced in South India, also adheres to a humoral theory, focusing on the equilibrium among three fundamental humors: *Vali* (air), *Azhal* (fire), and *Iyyam* (water). GI diseases are typically understood as disturbances in *Azhal*, which is closely associated with the digestive fire and metabolic activities.[69] Siddha medicine aims to restore internal balance through a combination of herbs, minerals, and dietary modifications, tailored to the individual's humoric constitution and the nature of the ailment. A variety of herbal formulations are traditionally employed to improve digestion and alleviate digestive discomfort. *Kadukkai* (*Terminalia chebula*, Haritaki) and *Thippili* (*Piper longum*, Long pepper) are among the most frequently used agents for their digestive and carminative actions.[70]

Other widely used Siddha formulations include *Triphala Chooranam*, a classical combination of *Amla* (*Emblica officinalis*), *Bibhitaki* (*Terminalia bellirica*), and *Haritaki*, which promotes digestive regularity and bowel health.[71] *Milagu Chooranam*, composed primarily of *Milagu* (black pepper), is taken with warm water to stimulate the digestive fire and relieve bloating. *Omam Chooranam*, derived from *Omam* (carom seeds or ajwain), is valued for its effectiveness against indigestion and flatulence. *Chitrakadi Vati*, another important preparation, enhances appetite and supports metabolic processes. In addition, *Kabasura Kudineer*, though widely known for managing respiratory ailments, is also used to support digestive health and systemic immunity. *Thaaleesathi Chooranam*, containing *Thippili*, *Sathi Vidhai* (*Hedychium spicatum*), and *Milagu*, offers relief from various GI disturbances. *Dadimashtaka Churna*, made from pomegranate seeds and other digestive herbs, is employed to manage acidity and strengthen digestion. *Chukku*

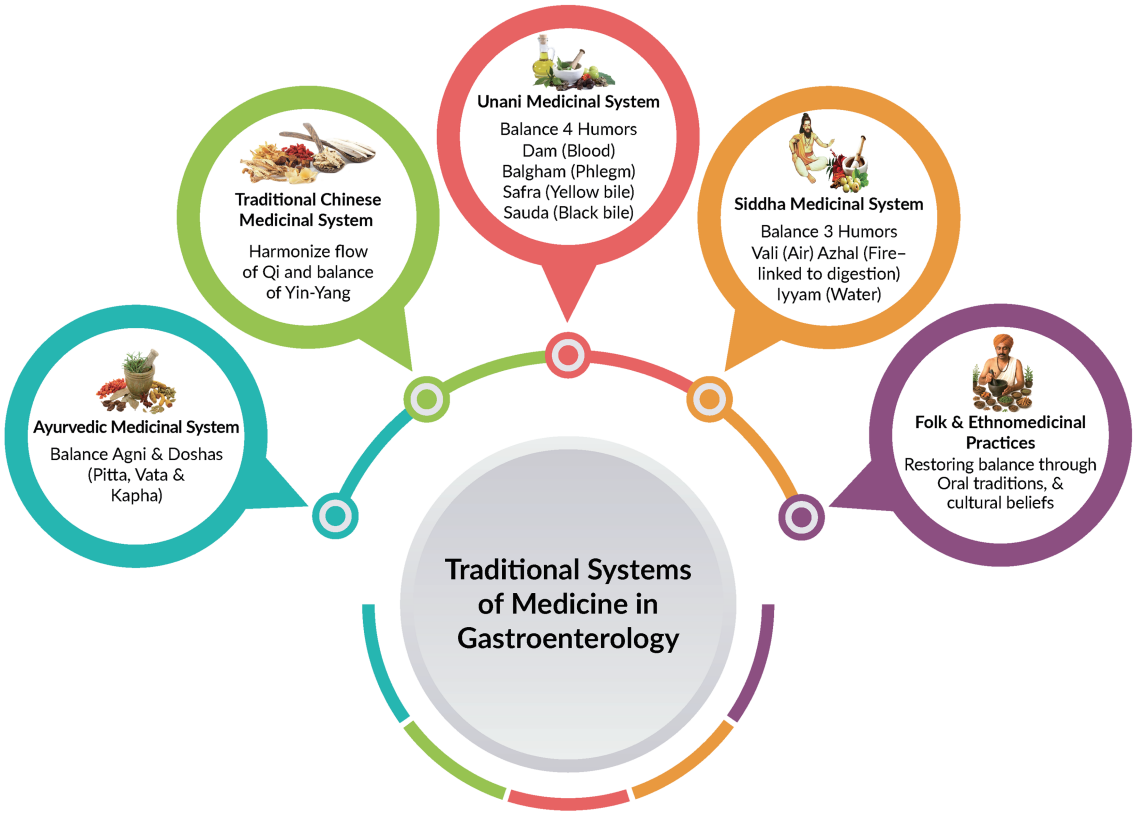

Fig. 1. Traditional systems of medicine in gastroenterology.

Malli Kashayam, a decoction of *Chukku* (dry ginger) and *Malli* (coriander seeds), helps stimulate the digestive system and reduce GI sluggishness. Similarly, *Sitharathai Chooranam*, prepared from the rhizomes of *Alpinia galanga*, is indicated for indigestion and bloating.[72,73] These Siddha remedies are typically used under the supervision of trained practitioners as part of a holistic regimen that may include diet, lifestyle changes, and detoxification. While these formulations are rooted in traditional knowledge and are widely practiced in Southern India, integrating them responsibly with modern healthcare advice is essential for the safe and effective treatment of persistent or chronic digestive disorders.

Other folk and ethnomedicinal practices

Beyond classical traditional systems, folk medicine and ethnoveterinary practices in various rural and tribal communities offer a rich repository of plant-based treatments for GI ailments. These remedies are typically passed down through generations via oral traditions and are shaped by local flora, cultural beliefs, and ecological knowledge. In many parts of Africa, South America, and India, communities rely on locally available plants such as Neem (*Azadirachta indica*) for stomach infections, Bael (*Aegle marmelos*) for diarrhea and dysentery, and Castor (*Ricinus communis*) for constipation and colic. One traditional African remedy, *Garcinia buchananii* bark extract, has shown spasmolytic and motility-inhibitory effects on colonic tissue in preclinical studies, suggesting a plausible mechanism for its antidiarrheal action.[37] These practices, though under-researched, reflect a deep ecological understanding and offer cost-effective, culturally accepted solutions that warrant systematic scientific investigation.

In sum, traditional systems of medicine offer a multidimensional understanding of GI health, rooted in philosophical paradigms and centuries of clinical experience. These systems emphasize restoring physiological balance, enhancing digestive strength, and preventing disease progression through a combination of herbal remedies, dietary regulation, and lifestyle modification.[74] With growing scientific interest and the global resurgence of integrative medicine, there is a renewed impetus to explore and validate these age-old practices through modern research methodologies. Their incorporation into contemporary gastroenterological care holds promise for safer, holistic, and patient-centered therapeutic strategies. An overview of the major traditional systems of medicine and their approaches to GI health is summarized in Figure 1.

Classification of natural products used in GI disorders

Natural products have been at the forefront of traditional and integrative approaches to GI care. Owing to their diverse phytochemical composition, plant-based remedies offer therapeutic benefits in the management of functional GI disorders such as dyspepsia, constipation, diarrhea, indigestion, IBS, GERD, and peptic ulcers. Based on their primary mechanisms and therapeutic actions, natural products can be broadly classified into the following categories. These categories and their representative examples are illustrated in Figure 2.

Laxatives and carminatives

Laxatives and carminatives are widely used to regulate bowel movements and relieve flatulence or bloating. *Plantago ovata* (Psyllium

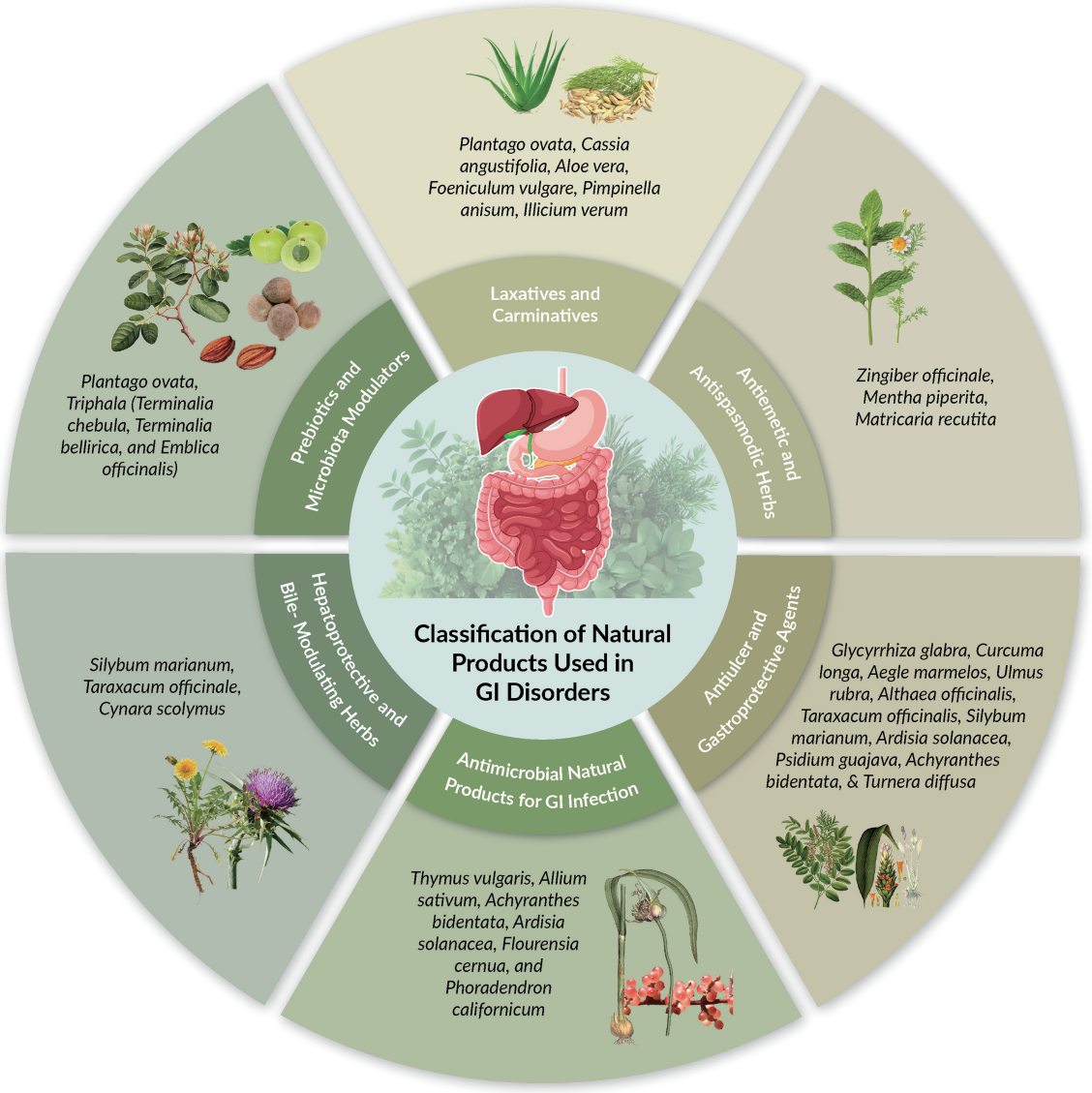

Fig. 2. Classification of natural products used in gastrointestinal (GI) disorders.

husk), also known as Isabgol, is a well-recognized bulk-forming laxative and demulcent, used in IBDs, chronic constipation, and colitis. Its mucilage content helps absorb water in the intestine, softening the stool and easing its passage. It is also useful in GERD and diverticulitis.[75–77] *Cassia angustifolia* (Senna), referred to as Sana Makki in Unani medicine, is an anthraquinone-rich herb commonly used for its stimulant laxative effect, particularly effective in treating acute constipation.[78,79] *Aloe vera*, another potent laxative, contains aloin, which stimulates peristalsis and improves bowel evacuation. Additionally, it exhibits anti-inflammatory and healing properties, making it useful in colitis and other mucosal inflammatory conditions.[80] *Foeniculum vulgare* (Fennel) is a gentle carminative often used to alleviate gas, flatulence, and infantile colic. Its essential oil relaxes GI smooth muscles and inhibits intestinal spasms. Fennel seeds are often consumed post-meal in traditional settings to aid digestion and prevent bloating.[81] *Pimpinella anisum* (Anise) and *Illicium verum* (Star anise) are other well-known carminatives traditionally consumed as teas to relieve indigestion, promote digestion, and reduce gas formation.[81,82]

Antiemetic and antispasmodic herbs

Herbs with antiemetic and antispasmodic properties play a critical role in managing symptoms such as nausea, vomiting, bloating, and abdominal cramps. Among the most thoroughly researched is *Zingiber officinale* (Ginger), used widely in Asian and Western medicine to treat nausea, dyspepsia, and IBS. Gingerols and shogaols, its active constituents, enhance gastric motility, accelerate gastric emptying, and reduce visceral hypersensitivity. Clinical studies confirm its efficacy in nausea of various etiologies, including motion sickness and postoperative recovery.[81,83,84] *Mentha piperita* (Peppermint) is a powerful spasmolytic agent. Its essential oil contains menthol, which acts on calcium channels and TRPM8 receptors, relaxing smooth muscles in the GI tract. It is used in both traditional and modern medicine to manage IBS, flatulence,

dyspepsia, and abdominal cramps.[81,85,86] *Matricaria recutita* (German chamomile) is another popular herb with spasmolytic, anti-inflammatory, and mild sedative properties. Chamomile tea is used for abdominal cramps, GI spasms, anxiety-related IBS, and flatulence. Its flavonoids (like apigenin) interact with benzodiazepine receptors, and its antispasmodic action helps relieve colicky pain.[81,82]

Antiulcer and gastroprotective agents

Herbs with gastroprotective and antiulcer properties offer significant advantages over synthetic agents, particularly for long-term use in GERD, gastritis, and peptic ulcer disease. *Glycyrrhiza glabra* (Licorice), known in Ayurveda and Unani as *Aslussoos*, exerts mucosal protective, anti-inflammatory, and demulcent actions. Deglycyrrhizinated licorice enhances mucus production and promotes ulcer healing in GERD and gastritis patients.[81,82]

Curcuma longa (Turmeric), rich in curcumin, is another extensively researched gastroprotective herb. Curcumin suppresses prostaglandin synthesis and downregulates pro-inflammatory cytokines (interleukin (IL)-1, IL-6, tumor necrosis factor (TNF)-α), providing relief in IBD and gastritis.[87] Similarly, *Aegle marmelos* (Bael), used in Ayurveda and Unani, demonstrates antidiarrheal, mucosal healing, and antimicrobial properties, especially useful in treating dysentery, IBS, and ulcers.[88] Mucilage-rich herbs such as *Ulmus rubra* (Slippery elm), *Althaea officinalis* (Marshmallow root), and *Plantago ovata* also protect the mucosal lining by forming a viscous barrier that reduces irritation and inflammation. These are commonly used in managing GERD, peptic ulcers, and esophagitis.[81]

Other notable herbs with gastroprotective potential include *Cynara scolymus* (Artichoke), which improves bile flow, relieves IBS symptoms, and exhibits hepatoprotective effects; *Taraxacum officinale* (Dandelion) for improving digestion and bile production.[89] *Silybum marianum* (Milk thistle), whose seed extract (silymarin) supports liver detoxification, is traditionally used to improve dyspepsia and gastric inflammation.[90,91] Several ethnobotanical reports also document lesser-known species used by tribal populations for GI care, such as *Ardisia solanacea*, *Psidium guajava*, *Achyranthes bidentata*, *Turnera diffusa*, and *Phoradendron californicum*-employed in forms like leaf juice or infusions for treating ulcers, acidity, diarrhea, and dysentery.[92–95]

Antimicrobial natural products for GI infections

Natural antimicrobials play a crucial role in eradicating GI pathogens like *Helicobacter pylori*, *E. coli*, *Salmonella*, and *Shigella*.[96] *Berberis vulgaris* (Barberry), containing the alkaloid berberine, has potent antimicrobial activity against *H. pylori*, which is implicated in peptic ulcers and gastric cancer.[97] *Thymus vulgaris* (Thyme) and *Allium sativum* (Garlic) are also effective against a wide spectrum of GI pathogens. Allicin in garlic demonstrates broad-spectrum activity and is beneficial in infections and dysbiosis.[98,99]

Traditional tribal remedies include *Achyranthes bidentata*, *Ardisia solanacea*, *Flourensia cernua*, and *Phoradendron californicum*, which have been used for centuries to treat stomach infections, diarrhea, and dysentery through antimicrobial and anti-inflammatory actions.[92–95]

Hepatoprotective and bile-modulating herbs

Several GI disorders, particularly those affecting fat digestion and bile flow, are linked to liver function. *Silybum marianum* (Milk Thistle) has hepatoprotective, anti-inflammatory, and antioxidant properties and is approved by the German Commission E for the treatment of dyspepsia and liver disorders.[90,91]

Cynara scolymus (Artichoke) leaf extract improves bile production, supports liver detoxification, and reduces symptoms of IBS, including bloating and gas. It also inhibits cholesterol biosynthesis and LDL oxidation, promoting digestive efficiency.[100–103] *Taraxacum officinale* (Dandelion root) stimulates bile flow and aids in treating sluggish digestion and hepatic insufficiency.[89]

Prebiotics and gut microbiota modulators

Some natural products act as prebiotics, promoting the growth of beneficial gut microbiota and enhancing mucosal immunity. *Plantago ovata* (Psyllium) not only serves as a bulk laxative but also helps nourish commensal gut flora. *Triphala*, a traditional Ayurvedic formulation containing *Terminalia chebula*, *Terminalia bellirica*, and *Emblica officinalis*, has been shown to modulate gut microbiota, improve gut barrier integrity, and reduce colonic inflammation. Fermentable fibers and mucilage from herbs such as *Ulmus rubra*, *Althaea officinalis*, and *Marshmallow root* support the mucosal environment, enhance probiotic survival, and are useful in IBS and ulcerative colitis.[104]

In addition to the pharmacological classification and mechanistic insights into natural products used in GI health, numerous ethnobotanical and ethnopharmacological surveys across the globe provide compelling evidence of traditional plant use in treating a wide range of GI disorders. These practices, often passed down orally through generations, reflect the cultural, geographical, and ecological diversity of medicinal knowledge systems. The following Table 1 compiles representative examples of such medicinal plants traditionally employed by local communities and indigenous tribes for GI issues such as ulcers, diarrhea, dyspepsia, constipation, gastritis, and colic, offering a practical overview of their cross-cultural relevance and therapeutic diversity.[75,81,82,90,92,97,105–161]

Phytochemical and pharmacological basis of action

The therapeutic efficacy of herbal and natural products in managing GI disorders is largely attributed to the presence of diverse phytochemicals, including alkaloids, flavonoids, terpenoids, iridoids, tannins, and polysaccharides. These bioactive compounds modulate a variety of molecular targets and physiological pathways, contributing to their anti-inflammatory, antioxidant, mucosal protective, immunomodulatory, and microbiota-modulating effects.[162,163] The pharmacological basis of their action is increasingly being elucidated through both *in vitro* and *in vivo* experimental models, especially in conditions like IBS, peptic ulcers, GERD, and IBD, such as Crohn's disease and ulcerative colitis.

Modulation of inflammatory signaling pathways

One of the most well-established mechanisms by which natural products exert therapeutic effects in GI disorders is the modulation of inflammatory signaling pathways, particularly the nuclear factor kappa B (NF-κB) and cyclooxygenase (COX) cascades. Chronic inflammation underlies many functional and structural GI conditions, including IBS, IBD, post-infectious IBS (PI-IBS), and peptic ulcers, making anti-inflammatory phytochemicals a vital area of investigation.

Oridonin, a diterpenoid compound isolated from *Rabdosia rubescens*, was shown to alleviate PI-IBS symptoms in rats by significantly inhibiting phosphorylation of NF-κB p65 and downregulating downstream inflammatory mediators such as inducible nitric oxide synthase (iNOS), COX-2, IL-1β, and IL-6. Furthermore, oridonin increased the expression of the pregnane X receptor,

Table 1. Plants traditionally used in the management of gastrointestinal disorders

S. N.	Plants	Part used	Preparation	Traditional use/properties	Used in country	References
1	*Abelmoschus esculentus* (L.) Moench	Aerial parts		Peptic Ulcers	North Africa	105,106
2	*Abutilon indicum* (L.) Sweet	Leaves	Decoction, Powder or Juice	Constipation, Peptic ulcers	Lakki Marwat, Khyber Pakhtunkhwa province of Pakistan, Kattunaika Tribe of Wayanad district, Kerala (India)	92,107
3	*Acacia karroo* Hayne (syn. of *Vachellia karroo* (Hayne) Banfi & Galasso)	Bark, Gum and Leaves	Infusion	Dysentery, Diarrhoea	Eastern Cape Province, South Africa	108
4	*Acacia mearnsii* De Wild.	Bark and Leaves	Infusions, Concoction, Decoction	Dysentery	Eastern Cape Province, South Africa	108
5	*Acacia modesta* Wall (syn. of *Senegalia modesta* (Wall.) P.J.H.Hurter)	Bark	Decoction	Flatulence	Khyber Pakhtunkhwa province of Pakistan	107
6	*Acacia nilotica* (L.) Delile	Bark and Pods	Decoction, Pods powder mixed with sugar or honey	Diarrhea, Dysentery	Kohat, Khyber Pakhtunkhwa province of Pakistan	107
7	*Acacia senegal* (L.) Willd. (syn. of *Senegalia senegal* (L.) Britton)	Roots and Bark		Peptic Ulcers	North Africa	105,109
8	*Achillea millefolium* L.	Aerial parts and Flowers	Decoction or Infusion	Anorexia, Dyspepsia	Urmia, Iran	110,111
9	*Achyranthes aspera* L	Roots	Decoction, Juice	Abdominal Pain, Dysentery, Cholera, Constipation, Diarrhea, Anorexia, Nausea, Vomiting	Bannu, Khyber Pakhtunkhwa province of Pakistan, and Nepal, Mandai tribe of Bangladesh	107,112,113
10	*Acorus calamus* L.	Rhizomes and Leaves	Juice, Decoction	Abdominal Pain, Diarrhoea, Anthelmintic, Cholera, Colic, Dysentery, Dyspepsia, Constipation	Kuruma, kurichia Tribe of Wayanad district, Kerala (India) and Karen people of northern Thailand and Nepal, Chakma tribe of Bangladesh	92,112–115
11	*Adenostemma lavenia* (L.)O.Ktze.var.*lavenia*	Whole plant	Decoction	Ulcers	Kuruma Tribe of Wayanad district, Kerala (India)	92
12	*Adiantum philippense* L.	Leaves		Dysentery	Chakma tribe of Bangladesh	113
13	*Aegle marmelos* (L.) Corr. Serr.	Root, Dried Bark, Leaves and Fruit	Juice, dried bark along with curd drinking	Dysentery, Vomiting, Abdominal disorders, Colic, Constipation, Diarrhea, Gastritis, Indigestion, Stomach-ache	Kuruma, kattunaika, kurichia, paniya, adiya Tribe of Wayanad district, Kerala (India) and Nepal, North Africa	92,105,112

(continued)

Table 1. *(continued)*

S. N.	Plants	Part used	Preparation	Traditional use/properties	Used in country	References
14	*Aerva persica* (Burm.f.) Merr. (syn. of *Aerva javanica* (Burm.f.) Juss. ex Schult.)	Roots		Peptic ulcers	North Africa	105
15	*Ageratum conyzoides* L.	Leaves		Acidity	Kuruma, kurichia Tribe of Wayanad district, Kerala (India)	92
16	*Agrimonia eupatoria* L.	Aerial Part and Inflorescence	Decoction Or Infusion	Diarrhoea, Stomach ulcers and Gastritis	Urmia, Iran	110,116
17	*Alangium salvifolium* (L.f.) Wang.	Whole plant	Fried	Heartburn	–	92
18	*Albizia lebbeck* (L.) Benth	Bark	Decoction	Diarrhea	Bannu, Khyber Pakhtunkhwa province of Pakistan	107
19	*Alchemilla vulgaris* L.	Leaves	Decoction	Diarrhea	Setifian High Plateau, Algeria	117
20	*Alepidea amatymbica* Eckl. & Zeyh.	Roots/Rhizome	Decoction	Abdominal cramps	Eastern Cape Province, South Africa	108
21	*Alhagi camelorum* Fisch (syn. of *Alhagi maurorum* var. *maurorum*)	Aerial parts	Decoction Or Infusion	Intestinal infection, Peptic ulcer	Urmia, Iran, North Africa	118,119
22	*Allium cepa* L.	Bulb	Raw, Mixed Equal Amounts Of Extract Of Onion Bulb And Mint	Diarrhoea, Dysentery, Vomiting, Cholera, Colic, Constipation, Dyspepsia, Indigestion, Stomach disorders, Stomachache	Nyamwezi THPs, Tabora region, Tanzania, and Khyber Pakhtunkhwa province of Pakistan and Nepal	107,112,120
23	*Allium sativum* L.	Bulb	Chew or the bulb mix with honey or sugar and ingest a half teaspoon a day	Laxative	Nyamwezi THPs, Tabora region, Tanzania, Algeria, North African regions	105,117,120
24	*Allophylus cobbe* (L.) Raeusch.	Roots and Leaves	Juice	Stomach ulcers	Kuruma Tribe of Wayanad district, Kerala (India)	92
25	*Allophylus serratus* (Roxb.) Kurz	Leaves	Juice	Stomach ulcers	Kuruma Tribe of Wayanad district, Kerala (India)	92
26	*Aloe barbadensis* (Aloes) (syn. of *Aloe vera* (L.) Burm. f.)	Leaves	Juice or Decoction	Constipation, Gastric ulcer, Dysentery, Indigestion, Intestinal Worms, Stomach-ache	United States, Nyamwezi THPs, Tabora region, Tanzania, Nepal, and North Africa	82,110,112
27	*Aloe ferox* Mill.	Leaves	Juice	Constipation, Peptic ulcer	North Africa	105,110
28	*Aloysia citrodora* Paláu (syn. *Lippia citrodora* (Paláu) Kunth)	Leaves	Decoction	Gastrointestinal disorders	Setifian High Plateau, Algeria	110,117
29	*Alpinia malaccensis* (Burm.f.) Rosc.	Roots	Paste	Abdominal problems	Kuruma, Kurichia Tribe of Wayanad district, Kerala (India)	92

(continued)

Table 1. *(continued)*

S. N.	Plants	Part used	Preparation	Traditional use/properties	Used in country	References
30	*Alstonia scholaris* (L.) R.Br.	Plant		Constipation, Diarrhoea, Dysentery, Dyspepsia, Intestinal Worms	Nepal	112
31	*Althaea officinalis* L.	Roots, Leaves, and Flowers		Peptic ulcers, Dyspepsia	North Africa	121,110
32	*Althea hirsute* L. (syn. of *Malva setigera* K.F.Schimp. & Spenn.)	Roots	Decoction or Infusion	Constipation	Urmia, Iran	122
33	*Amaranthus spinosus* L.	Leaves	Leaves paste along with lemon juice	Stomach ulcer	Adiya, Tribe of Wayanad district, Kerala (India)	92
34	*Amorphophallus paeoniifolius* (Dennst.) Nicols. var. paeoniifolius (syn. of *Amorphophallus paeoniifolius* (Dennst.) Nicolson)	Stem and Leaves	Juice	Stomach ulcer	Kurichia, Tribe of Wayanad district, Kerala (India)	92
35	*Amygdalus communis* L. (syn. of *Prunus amygdalus* Batsch)	Unripe Fruits and Seed	Decoction or Infusion	Constipation	Urmia, Iran, and Izmir province, Turkey	123,124
36	*Anacyclus clavatus* (Desf.) Pers.	Leaves	Decoction	Indigestion, Flatulence	Setifian High Plateau, Algeria	117
37	*Andrographis paniculata* (Burm.f.) Wall. ex Nees	Stem and Leaves	Leaves of this plant mixed with *Psidium guajava*, Clerodendron, Olea, Breynia, and Ludwegia leaves, ground well and drink the juice	Ulcer, Intestinal Worms, Acidity	Kuruma, kattunaika, kurichia, Tribe of Wayanad district, Kerala (India)	92
38	*Anethum graveolens* L.	Seeds	Tea, Chew	Digestive Problems (Bloating), Flatulence	Mexican Traditional Medicine, Izmir province, Turkey, and Kurichia, Tribe of Wayanad district, Kerala (India)	82,124
39	*Anthemis tinctoria* L. (syn. of *Cota tinctoria* (L.) J.Gay)	Floral Branches	Decoction or Infusion	Stomach-ache, Gastritis	Urmia, Iran	125
40	*Apium graveolens* L.	Leaves	Tea or Decoction	Digestive problems (Bloating), Flatulence	Mexican Traditional Medicine, in the Setifian High Plateau, Algeria	82,117
41	*Arachis hypogaea* L.	Seeds	Decoction	Dysentery, Gastric ulcer	Nyamwezi THPs, Tabora region, Tanzania	120
42	*Arctium lappa* L. (*Arctium major* Gaertn.)	Roots		Anorexia		110
43	*Arctium minus* (Hill) Bernh.	Roots		Anorexia		110
44	*Arctium tomentosum* Mill.	Roots		Anorexia		110

(continued)

Table 1. *(continued)*

S. N.	Plants	Part used	Preparation	Traditional use/properties	Used in country	References
45	*Argyrolobium roseum* (Cambess.) Jaub. & Spach	Whole plant		Diarrhoea	Bannu, Khyber Pakhtunkhwa province of Pakistan	107
46	*Aristolochia tagala* Cham. (syn. of *Aristolochia acuminata* Lam)	Whole plant	Paste	Abdominal Pain	Paniya, Kattunaika, Kurichia Tribe of Wayanad district, Kerala (India)	92
47	*Artemisia absinthium* L.	Aerial Part and Leaves	Boiled	Anorexia, Dyspepsia, Intestinal Worms, Indigestion, Diarrhoea, Vomiting	Kohat, Khyber Pakhtunkhwa province of Pakistan	107,110
48	*Artemisia dracunculus* L.	Twig and Leaves	Decoction	Anorexia	Urmia, Iran	116
49	*Artemisia herba-alba* Asso.	Aerial parts and Leaves	Decoction	Gastralgia, Gastritis, Ulcer	Setifian High Plateau, Algeria, and other North African regions	117
50	*Artemisia nilagirica* (C.B.Clarke) Pamp.	Leaves	Juice	Abdominal pain	Kuruma, kattunaika, kurichia, paniya, Tribe of Wayanad district, Kerala (India)	92
51	*Artemisia vulgaris* L.	Branches and Fruit	Decoction Or Infusion	Intestinal Worm	Urmia, Iran	116
52	*Artocarpus hirsutus* Lam.	Leaves	Burned and ash taken	Abdominal problems	Kurichia, Tribe of Wayanad district, Kerala (India)	92
53	*Arundinaria densifolia* Munro (syn. of *Kuruna densifolia* (Munro) Attigala, Kaththr. & L.G.Clark)	Leaves	Juice	Stomach problems	Kuruma, paniya, kattunaika, adiya, Tribe of Wayanad district, Kerala (India)	92
54	*Aspalathus linearis* (Burm.f.) R.Dahlgren	Plant		Diarrhoea		126
55	*Asparagus adscendens* Roxb.	Roots (Ground Roots)		Flatulence	Karak, Khyber Pakhtunkhwa province of Pakistan	107
56	*Asparagus filicinus* Buch.-Ham. ex D.Don	Roots	Decoction	Gastric ulcer, Flatulence	Karen people of northern Thailand	115
57	*Asparagus racemosus* Willd.	Plant		Constipation, Diarrhoea, Dysentery, Dyspepsia, Flatulence, Stomach-ache	Nepal	112
58	*Asystasia gangetica* (L.) T.Anderson	Whole plant	Paste	Gastric ulcer	Kuruma, Tribe of Wayanad district, Kerala (India)	92
59	*Atalantia racemosa* Wight var. racemose (syn. of *Atalantia racemosa* Wight ex Hook.)	Leaves	Juice	Acidity	Kurichia, Tribe of Wayanad district, Kerala (India)	92
60	*Avena sativa* L	Seeds	Decoction	Gastralgia	Setifian High Plateau, Algeria	117
61	*Azadirachta indica* A. Juss	Roots and Leaves	Decoction	Digestive and Gastric Problems, Stomachache	Nyamwezi THPs, in the Tabora region, Tanzania, and Lakki Marwat, Khyber Pakhtunkhwa province of Pakistan	107,120

(continued)

Table 1. *(continued)*

S. N.	Plants	Part used	Preparation	Traditional use/properties	Used in country	References
62	*Benincasa hispida* (Thunb.) Cogn.	Seeds		Stomach-ache, Flatulence	Santal tribe of Bangladesh	113
63	*Berberis vulgaris* L.	Aerial parts		Peptic ulcers	North Africa	105
64	*Bergenia ciliata* (Haw.) Sternb.	Plant		Diarrhoea, Dysentery, Gastritis, Indigestion, Stomach-ache, Vomiting	Nepal	112
65	*Bidens pilosa* L	Whole plant	Decoction	Diarrhoea	Nyamwezi THPs, Tabora region, Tanzania	120
66	*Bistorta amplexicaulis* (D. Don)Greene	Whole plant		Constipation	Bannu, Kohat, Khyber Pakhtunkhwa province of Pakistan	107
67	*Boerhavia diffusa* L.	Roots	The Plant Is Pasted With Cumin	Flatulence, Digestive problems	Karak, Khyber Pakhtunkhwa province of Pakistan, and Kurichia Tribe of Wayanad district, Kerala (India)	92,107
68	*Boesenbergia rotunda* (L.) Mansf.	Rhizome	Decoction (Potion)	Flatulence	Karen people of northern Thailand	114,115
69	*Bombax ceiba* L.	Plant		Abdominal pain, Colic, Constipation, Diarrhoea, Dysentery, Stomach disorders, Stomach-ache, Intestinal worms	Nepal	112
70	*Brachylaena ilicifolia* (Lam.) E.Phillips & Schweick.	Leaves	Infusion And Decoction	Diarrhoea	Eastern Cape Province, South Africa	108
71	*Brachystegia spiciformis* Benth.	Roots	Crushed Then Decocts	Diarrhoea	Nyamwezi THPs, Tabora region, Tanzania	120
72	*Brassica oleracea var. botrytis* L. (syn. of *Brassica cretica* subsp. *cretica*)	Aerial parts		Peptic ulcer	North Africa	105
73	*Brassica oleracea* var. capitate L. (syn. of *Brassica oleracea* L.)	Leaves		Peptic ulcer	North Africa	105
74	Bryonia dioica Jacq. (*Bryonia cretica* subsp. *dioica* (Jacq.) Tutin)	Roots and Fruit	Decoction, Powder	Indigestion, Intestinal infection	Urmia, Iran	116
75	*Bulbine abyssinica* A.Rich.	Roots and Leaves	Decoctions	Dysentery	Eastern Cape Province, South Africa	108
76	*Bulbine asphodeloides* (L.) Spreng.)	Tuber	Decoctions	Diarrhoea, Dysentery	Eastern Cape Province, South Africa	108
77	*Bulbine latifolia* (L.f.) Spreng.	Roots	Decoctions	Diarrhoea	Eastern Cape Province, South Africa	108
78	*Cajanus cajan* (L.) Huth	Leaves	Powder mixed with hot water or tea	Diarrhoea	Nyamwezi THPs, Tabora region, Tanzania	120

(continued)

Table 1. *(continued)*

S. N.	Plants	Part used	Preparation	Traditional use/properties	Used in country	References
79	*Camellia sinensis* (L.) Kuntze	Leaves	Tea	Gastric Infection, Indigestion, Nausea, Diarrhoea	Bannu, Lakki Marwat, Khyber Pakhtunkhwa province of Pakistan, and Izmir province, Turkey	107,124,126
80	*Carica papaya* L	Fruit		Constipation	Nyamwezi THPs, Tabora region, Tanzania	120
81	*Carissa opaca* Stapf. ex Haines (syn. of *Carissa spinarum* L.)	Roots, Leaves and Fruit		Dysentery	Karak, Khyber Pakhtunkhwa province of Pakistan	107
82	*Carlina acanthifolia* All.	Roots		Peptic ulcers	North Africa	127
83	*Carum carvi* L.	Fruit, Seed and Essential Oil	Decoction	Dyspepsia, Flatulence, Diarrhoea	Setifian High Plateau, Algeria	110,117
84	*Carum copticum* (L.) Benth. &Hook.f. ex C.B. Clarke	Seed		Diarrhoea, Dysentery, Vomiting	Kohat, Khyber Pakhtunkhwa province of Pakistan	107
85	*Cassia abbreviata* Oliv	Leaves	Powder mixed with hot water	Stomach-ache	Nyamwezi THPs, Tabora region, Tanzania	120
86	*Cassia fistula* L.	Fruit With Seeds	Decoction	Dysentery	D. I. Khan,Bannu, Khyber Pakhtunkhwa province of Pakistan	107
87	*Cassia sophera* L. (syn. of *Senna sophera* (L.) Roxb.)	Leaves		Constipation	Santal tribe of Bangladesh	113
88	*Cassipourea mollis* (R.E. Fries) Alston	Roots	Chew then swallow the fluid	Diarrhoea, Stomach-ache, Gastric ulcer	Nyamwezi THPs, Tabora region, Tanzania	120
89	*Catunaregam spinose* (Thunb.) Tirveng.	Plant		Colic, Diarrhoea, Dysentery, Gastritis, Indigestion, Peptic ulcer, Stomach-ache	Nepal	112
90	*Cedrus deodara* (Roxb. ex D.Don) G. Don	Whole plant		Flatulence	Karak, Khyber Pakhtunkhwa province of Pakistan	107
91	*Celastrus paniculatus* Willd.	Bark	Decoction (Potion)	Diarrhoea	Karen people of northern Thailand	114,115
92	*Centaurea chamaerhaponticum* Ball (syn. of *Centaurea acaulis* L.)	Aerial parts		Peptic ulcers	North Africa	105
93	*Centaurea solstitialis* L.	Inflorescence	Decoction	Diarrhoea	Urmia, Iran	125
94	*Centaurium erythraea* Rafn (syn. *Erythraea centaurium* (L.) Pers.	Aerial Part	Powder	Dyspepsia, Diarrhoea, Peptic ulcer	Setifian High Plateau, Algeria and other North African regions	105,110,117
95	*Centaurium majus* (Hoffmanns. & Link) Zeltner (syn. of *Centaurium erythraea* subsp. *majus* (Hoffmanns. & Link) M.Laínz)	Aerial Part		Dyspepsia		110

(continued)

Table 1. *(continued)*

S. N.	Plants	Part used	Preparation	Traditional use/properties	Used in country	References
96	*Centaurium suffruticosum* (Griseb.) Ronniger (syn. of *Centaurium erythraea* subsp. *suffruticosum* (Griseb.) Greuter)	Aerial Part		Dyspepsia		110
97	*Centella asiatica* (L.) Urb.	Roots and Leaves	Raw, Infusion, Decoction or Concoction	Gastric ulcer, Stomach disorders, Dysentery, Diarrhoea	Karen people of northern Thailand and Eastern Cape Province, South Africa	108,115
98	Cerasus avium (L.) Moench (syn. of *Prunus avium* (L.) L.)	Fruit Peduncle	Fruit stalk is boiled and the stock is drunk	Diarrhoea	Izmir Province, Turkey	124
99	*Ceratonia siliqua* L.	Fruit, Leaves, Pods, and Seeds	Chewed	Stomachic, Laxative, Diarrhoea, Peptic ulcers	Izmir Province, Turkey, in the Setifian High Plateau, Algeria, North Africa	117,124,128
100	*Chamaemelum nobile* (L.) All.	Flowers		Dyspepsia		110
101	*Chenopodium album* L.	Leaves	Leaves are boiled and the stock is drunk	Constipation, Dysentery, Dyspepsia, Gastritis, Intestinal worms, Peptic ulcer	Izmir Province, Turkey and Nepal	112,124,129
102	*Chrysophyllum bangweolense* R. E. Fries (syn. of *Donella bangweolensis* (R.E.Fr.) Mackinder)	Roots	Decoction Drunk	Constipation	Nyamwezi THPs, in the Tabora region, Tanzania	120
103	*Cichorium intybus* L.	Roots, Leaves and Flowers	Decoction	Anorexia, Dyspepsia, Stomachic, Laxative, Peptic ulcers	Urmia, Iran, and Izmir province, Turkey, North Africa	110,129,130,105
104	*Cinnamomum aromaticum* Nees	Bark	Tea, Powdered bark used as spice	Digestive problems (Bloating)	Mexican Traditional Medicine	82
105	*Cinnamomum tamala* (Buch.-Ham.) T.Nees & C.H.Eberm.	Plant		Appetizer, Colic pain, Diarrhoea, Gastritis, Intestinal disorder, Nausea, Stomach-ache, Vomiting	Nepal	112
106	*Cinnamomum verum* J.Presl (syn. *Cinnamomum zeylanicum* Blume)	Bark and Essential Oil	Tea, Powdered, Essential Oil, Decoction	Peptic Ulcer, Bloating, Gastrointestinal disorder, Vomiting, Dysentery	Mexican Traditional Medicine, and other North African regions, Kohat, Khyber Pakhtunkhwa province of Pakistan	82,97,105,107,110
107	*Cirsium arvense* (L.) Scop.	Floral Branches	Raw Edible	Intestinal Worms	Urmia, Iran	125
108	*Cissampelos capensis* L.f.	Roots and Leaves	Infusion	Diarrhoea	Eastern Cape Province, South Africa	108
109	*Cissus quadrangularis* L.	Stem		Constipation	Chakma tribe of Bangladesh	113

(continued)

Table 1. *(continued)*

S. N.	Plants	Part used	Preparation	Traditional use/properties	Used in country	References
110	*Citrullus colocynthis* (L.) Schrad	Fruit and Seed	Decoction, Murabba	Constipation, Abdominal disorders	Urmia, Iran and Bannu,Kohat,Lakki Marwat, Khyber Pakhtunkhwa province of Pakistan	107,122
111	*Citrus limon* (L.) Burm. f.	Roots and Fruit	Roots Juice mixed with *Cordia africana* leaves and taken orally, Fresh Fruit are boiled and the stock is drunk	Flatulence, Colic, Constipation, Dysentery, Diarrhoea, Dyspepsia, Intestinal Worms, Stomach-ache, Vomiting	Nyamwezi THPs, in the Tabora region, Tanzania and Izmir Province, Turkey and Nepal	112,120,124
112	*Citrus medica* L.	Plant		Colic, Constipation, Diarrhoea, Dysentery, Dyspepsia, Vomiting	Nepal	112
113	*Clausena anisata* (Willd.) Hook.f. ex Benth.	Roots, Bark and Fresh Leaves	Decoction	Gastrointestinal disorder	Eastern Cape Province, South Africa	108
114	*Clerodendrum myricoides* (Hochst.) R.Br. ex Vatke (syn. of *Rotheca myricoides* (Hochst.) Steane & Mabb.)	Roots and Leaves	Decoction Drunk	Dysentery, Stomach-ache	Nyamwezi THPs, Tabora region, Tanzania	120
115	*Coffea arabica* L.	Seeds	Turkish Coffee	Indigestion	Izmir Province, Turkey	124
116	*Combretum zeyheri* Sond.	Roots and Leaves	powder of the dried parts is mixed with tea or porridge, then taken orally	Diarrhoea, Dysentery, Stomach-ache	Nyamwezi THPs, Tabora region, Tanzania	120
117	*Commiphora myrrha* (T.Nees) Engl.	Plant		Diarrhoea, Irritable Bowel Syndrome, Gastric Infection		126
118	*Convolvulus arvensis* L	Roots	Sap of fresh roots	Stomachic, Laxative	Izmir Province, Turkey	124
119	*Coriandrum sativum* L.	Fruit and Seeds	Fruit crushed and mixed with salt	Flatulence, Indigestion, Gastralgia, Diarrhoea	Khyber Pakhtunkhwa province of Pakistan, in Setifian High Plateau, Algeria	107,115,117
120	*Crocus sativus* L.	Flowers	Powder	Indigestion, Gastralgia	Setifian High Plateau, Algeria	117
121	*Crotalaria burhia* Buch.-Ham. ex Benth.	Whole plant	Dried plant is ground, mixed with water	Diarrhoea, Abdominal disorders	Khyber Pakhtunkhwa province of Pakistan	107
122	*Croton kongensis* Gagnep.	Leaves	Decoction	Gastric ulcer, Diarrhoea	Karen people of northern Thailand	114,115
123	*Cucurbita pepo* L	Seeds	Infusion	Flatulence	Nyamwezi THPs, in the Tabora region, Tanzania	120
124	*Cuminum cyminum* L.	Seeds	Decoction	Intestinal Inflammation, Flatulence, Diarrhoea	Urmia, Iran, in Setifian High Plateau, Algeria	116,117
125	*Cupressus sempervirens* L.	Leaves	Powder	Diarrhoea	Setifian High Plateau, Algeria	117

(continued)

Table 1. *(continued)*

S. N.	Plants	Part used	Preparation	Traditional use/properties	Used in country	References
126	*Curculigo orchioides* Gaertn.	Plant		Cholera, Diarrhoea, Digestive, Peptic ulcer, Stomach-ache	Nepal	112
127	*Curcuma aromatica* Salisb.	Rhizome		Stomach ache, Indigestion	Mandai tribe of Bangladesh	113
128	*Curcuma longa* L.	Rhizome	Powder, Decoction	Gastric ulcers, Dyspepsia, Stomach Cancer, Stomach Bleeding, Flatulence	Kohat, Khyber Pakhtunkhwa province of Pakistan, Karen people of northern Thailand, and North African regions	81,97,105,110, 114,115,131
129	*Curcuma zanthorrhiza* Roxb.	Rhizome		Dyspepsia		110
130	*Curtisia dentata* (Burm.f.) C.A.Sm.	Bark	Decoctions	Stomach disorders	Eastern Cape Province, South Africa	108
131	*Cuscuta reflexa* Roxb.	Roots and Leaves	Juice	Intestinal Worms,	Tribe of Wayanad district, Kerala (India)	92
132	*Cussonia spicata* Thunb.	Leaves	Infusion	Stomach complaints	Eastern Cape Province, South Africa	108
133	*Cydonia oblonga* Mill	Leaves and Fruit	Leaves Are Boiled And The Stock Is Drunk. Fruit Is Directly Eaten	Diarrhoea	Izmir Province, Turkey	129
134	*Cynara cardunculus* L. (syn. *Cynara scolymus* L.)	Leaves		Dyspepsia, Digestive Stimulants, Gastrointestinal disorders		110,132,133
135	*Cynodon dactylon* (L.) Pers.	Roots	Infusion	Diarrhoea, Gastritis	Setifian High Plateau, Algeria	117
136	*Cyperus articulatus* L.	Roots	Decoction Drunk	Stomach-ache	Nyamwezi THPs, Tabora region, Tanzania	120
137	*Cyperus kyllingia* Endl. (syn. of *Rhynchospora colorata* (L.) H.Pfeiff.)	Rhizome	The Rhizome Paste Mixed With Milk I	Dysentery	Tribe of Wayanad district, Kerala (India)	92
138	*Cyperus rotundus* L.	Rhizome		Dyspepsia, Diarrhoea, Vomiting	Bannu, Kohat,Lakki Marwat, Khyber Pakhtunkhwa province of Pakistan	107
139	*Cyperus scariosus* R.Br.	Roots		Dysentery	Santal tribe of Bangladesh	113
140	*Dalbergia melanoxylon* Guill. & Perr.	Roots	Infusion	Stomach-ache	Nyamwezi THPs, Tabora region, Tanzania	120
141	*Daphne mucronata* Royle.	Aerial parts	Decoction or Infusion	Gastric acid	Urmia, Iran	116
142	*Datura stramonium* L	Seeds	Decoction or Poultice	Intestinal worms, Appetizer	Karak, Khyber Pakhtunkhwa province of Pakistan and Urmia, Iran	107,134

(continued)

Table 1. *(continued)*

S. N.	Plants	Part used	Preparation	Traditional use/properties	Used in country	References
143	*Desmodium triquetrum* (L.) DC. (syn. of *Tadehagi triquetrum* (L.) H.Ohashi)	Leaves		Dysentery	Chakma tribe of Bangladesh	113
144	*Dillenia pentagyna* Roxb.	Bark	Decoction	Gastric ulcers	Karen people of northern Thailand	114,115
145	*Dioscorea bulbifera* L.	Bulb	Boiled	Gastric ulcers	Kurichia, Tribe of Wayanad district, Kerala (India)	92
146	*Diospyros abyssinica* (Hiern) F.White	Roots	Infusion	Constipation	Nyamwezi THPs, Tabora region, Tanzania	120
147	*Dipsacus laciniatus* L.	Roots, Leave and Seeds	Decoction, Poultice	Constipation	Urmia, Iran	116
148	*Ekebergia benguelensis* Welw. ex C.DC.	Roots	Powder mixed with tea or porridge	Diarrhoea	Nyamwezi THPs, Tabora region, Tanzania	120
149	*Ekebergia capensis* Sparrm.	Bark	Decoction	Dysentery	Eastern Cape Province, South Africa	108
150	*Elaeagnus angustifolia* L	Fruit and Seed skin	Raw Edible, Decoction	Detoxification, Constipation	Urmia, Iran and Lakki Marwat, Khyber Pakhtunkhwa province of Pakistan	116,123,107
151	*Elettaria cardamomum* (L.) Maton	Fruit		Gastrointestinal disorders		131,135
152	*Embelia sessiliflora* Kurz	Fruit	Raw	Laxative	Karen people of northern Thailand	115
153	*Engelhardia spicata var. colebrookeana* (Lindl.) Koord. & Valeton (syn. of *Engelhardia spicata* var. *integra* (Kurz) W.E.Manning ex Steenis)	Bark	Decoction (Potion)	Gastric ulcers	Karen people of northern Thailand	114,115
154	*Ensete glaucum* (Roxb.) Cheesman	Leaves	Decoction (Potion)	Diarrhoea, Food poisoning	Karen people of northern Thailand	114,115
155	*Entada abyssinica* Steud. ex A.Rich.	Roots	Powder Mixed With Tea Or Porridge And Drunk	Gastritis	Nyamwezi THPs, Tabora region, Tanzania	120
156	*Ephedra gerardiana* Wall. ex Klotzsch & Garcke	Shoot, Leaves and Fruit		Dyspepsia	Lakki Marwat, Khyber Pakhtunkhwa province of Pakistan	107
157	*Equisetum arvense* L.	Leaves	Decoction	Diarrhoea	Lakki Marwat, Khyber Pakhtunkhwa province of Pakistan, in Setifian High Plateau, Algeria	107,117
158	*Eucalyptus globulus* Labill.	Leaves	Infusion	Diarrhoea	Setifian High Plateau, Algeria	97,117
159	*Eucomis autumnalis* (Mill.) Chitt.	Bulbs	Decoction	Stomach ache	Eastern Cape Province, South Africa	108

(continued)

Table 1. *(continued)*

S. N.	Plants	Part used	Preparation	Traditional use/properties	Used in country	References
160	*Eugenia jambolana* Lam. (syn. of *Syzygium cumini* (L.) Skeels)	Leaves and Seed	Powder or Infusion	Stomach problems, Gastric ulcer	Bannu, Khyber Pakhtunkhwa province of Pakistan, Nyamwezi THPs, in the Tabora region, Tanzania	107,120
161	*Euphorbia candelabrum* Trémaux ex Kotschy (syn. of *Euphorbia murielii* N.E.Br.)	Twigs	Decoction mixed with chicken meat taken orally	Constipation	Nyamwezi THPs, Tabora region, Tanzania	120
162	*Euphorbia heterophylla* L.	Leaves and Latex	Decoction	Constipation	Karen people of northern Thailand	114,115
163	*Euphorbia hirta* L.	Whole plant	Powder mixed with porridge or used as decoction	Stomach ache, Constipation, Gastric ulcer	LakkiMarwat, Khyber Pakhtunkhwa province of Pakistan, Nyamwezi THPs, in the Tabora region, Tanzania, Karen people of northern Thailand	107,115,120
164	*Euphorbia royleana* Boiss.	Plant		Constipation, Diarrhoea, Dysentery, Gastric problem, Indigestion	Nepal	112
165	*Evolvulus nummularius* (L.) L.	Roots and Rhizome	Mixed with *Zingiber officinale* and *Alternanthera sessilis*	Dysentery	Mandai tribe of Bangladesh	113
166	*Ficus carica* L.	Leave and Fruit	Decoction	Constipation	Urmia, Iran, in Setifian High Plateau, Algeria	117,136
167	*Ficus religiosa* L.	Bark	Burned Bark Powder	Diarrhoea	Bannu, Khyber Pakhtunkhwa province of Pakistan	107
168	*Flacourtia indica* (Burm.f.) Merr.	Roots	Decoction Drunk	Constipation	Nyamwezi THPs, Tabora region, Tanzania	120
169	*Flacourtia jangomas* (Lour.) Raeusch.	Bark	Decoction (Hold In Mouth, Potion)	Gastric ulcer, Diarrhoea	Karen people of northern Thailand	115
170	*Foeniculum vulgare* Mill	Stem, Leaves, Fruit and Seeds	Tea, equal quantity of fennel fruit, coriander fruit and sugar are mixed and ground together to make powder	Gastralgia, Constipation, Irritable Bowel Syndrome, Dyspepsia, Acidity, Abdominal pain	Mexican Traditional Medicine, Khyber Pakhtunkhwa province of Pakistan, in Setifian High Plateau, Algeria and Eastern Cape Province, South Africa	82,97,107, 108,117,126
171	*Fragaria × ananassa* (Duchesne ex Weston) Duchesne ex Rozier	Leaves		Diarrhoea		110
172	*Fragaria moschata* Duchesne ex Weston	Leaves		Diarrhoea		110
173	*Fragaria vesca* L.	Leaves		Diarrhoea		110
174	*Fragaria viridis* Weston	Leaves		Diarrhoea		110

(continued)

Table 1. *(continued)*

S. N.	Plants	Part used	Preparation	Traditional use/properties	Used in country	References
175	*Friesodielsia obovata* (Benth.) Verdc. (syn. of *Monanthotaxis obovata* (Benth.) P.H.Hoekstra)	Roots	Decoction	Constipation	Nyamwezi THPs, Tabora region, Tanzania	120
176	*Fumaria indica* (Hausskn.) Pugsley	Whole plant		Diarrhoea, Vomiting	Kohat, Khyber Pakhtunkhwa province of Pakistan	107
177	*Galium humifusum* M.Bieb.	Aerial parts	Decoction	Parasitic Diarrhoea	Urmia, Iran	137
178	*Galium verum* L.	Roots and Aerial parts	Decoction	Parasitic Diarrhoea	Urmia, Iran	137
179	*Gentiana lutea* L.	Roots		Anorexia, Dyspepsia		110
180	*Globularia alypum* L.	Roots, Leaves and Flowers		Peptic Ulcers	North Africa	105
181	*Glycyrrhiza glabra* L.	Roots, Rhizome and Aerial parts	Decoction, Licorice Candy that is produced from the roots is dissolved in water and drunk	Dyspepsia,Gastritis, Peptic Ulcer	Urmia, Iran and Izmir province, Turkey, in Setifian High Plateau, Algeria, and other North African regions	105,110,116, 117,129
182	*Glycyrrhiza inflata* Batalin	Roots		Dyspepsia		110
183	*Glycyrrhiza uralensis* Fisch. ex DC.	Roots		Dyspepsia		110
184	*Gmelina arborea* Roxb. ex Sm.	Bark and Flowers	Decoction	Gastric ulcer, Constipation	Karen people of northern Thailand	115
185	*Gomphostemma heyneanum* Wall. ex Benth.	Leaves	Paste	Dysentery, Diarrhoea	kurichia, kuruma, kattunaika, Tribe of Wayanad district, Kerala (India)	92
186	*Grammosciadium daucoides* DC.	Fresh Leaves	Decoction	Bloating, Stomach and Intestinal ulcers, Indigestion, Acidity	Urmia, Iran	138,139
187	*Gymnopetalum integrifolium* (Roxb.) Kurz (syn. of *Trichosanthes scabra* var. *scabra*)	Stem and Leaves	Decoction	Flatulence	Karen people of northern Thailand	115
188	*Harpagophytum procumbens* (Burch.) DC. ex Meisn.	Roots		Anorexia, Dyspepsia		110
189	*Harrisonia abyssinica* Oliv.	Roots	Decoction Drunk	Stomachache	Nyamwezi THPs, Tabora region, Tanzania	120
190	*Helianthemum kahiricum* Delile	Aerial parts		Peptic ulcers	North Africa	105,140
191	*Helianthemum lippii* (L.) Dum.Cours.	Aerial parts		Peptic ulcers	North Africa	105,141
192	*Helichrysum arenarium* (L.) Moench.	Flowers		Dyspepsia		110
193	*Hexalobus monopetalus* (A.Rich.) Engl. & Diels	Leaves	Decoction	Gastric ulcer, Constipation	Nyamwezi THPs, Tabora region, Tanzania	120

(continued)

Table 1. *(continued)*

S. N.	Plants	Part used	Preparation	Traditional use/properties	Used in country	References
194	*Holarrhena antidysenterica* (G.Don) Wall. ex A.DC. (syn. of *Holarrhena pubescens* Wall. ex G.Don)	Stem Bark and Seed	Powder	Stomach problems, Dysentery	Kurichia, Tribe of Wayanad district, Kerala (India), Santal tribe of Bangladesh	92,113
195	*Hydnora africana* Thunb.	Whole plant	Infusion or Decoction	Diarrhoea, Dysentery	Eastern Cape Province, South Africa	108
196	*Hymenocardia mollis* Pax (syn. of *Hymenocardia acida* Tul.)	Roots	Decoction	Diarrhoea	Nyamwezi THPs, Tabora region, Tanzania	120
197	*Hypericum perforatum* L.	Aerial parts	Above ground parts are kept in olive oil for at least 3 months and then consumed on an empty stomach in the morning. Above ground parts are also boiled and the stock is consumed	Dyspepsia, Stomachic, Stomach Ulcer		110,124
198	*Illicium verum* Hook.f.	Plant	Tea	Bloating	Mexican Traditional Medicine	82
199	*Ipomoea crassipes* Hook.	Whole plant	Infusions And Decoctions	Dysentery	Eastern Cape Province, South Africa	108
200	*Jatropha gossypiifolia* L.	Bark	Infusion Drunk	Diarrhoea	Nyamwezi THPs, Tabora region, Tanzania	120
201	*Juniperus communis* L.	Aerial parts, Fruit, and Essential oil		Dyspepsia, Peptic ulcer	North Africa	110,105
202	*Juniperus indica* Bertol.	Plant		Abdominal pain, Flatulence, Constipation, Diarrhoea, Indigestion	Nepal	112
203	*Juniperus phoenicea* L.	Leaves		Peptic ulcers	North Africa	105,142
204	*Kaempferia parviflora* Wall. ex Baker	Rhizome	Decoction	Flatulence, Gastric ulcer	Karen people of northern Thailand	114,115
205	*Lagenaria siceraria* (Molina) Standl.	Aerial parts		Diarrhoea, Dysentery, Indigestion, Acidity, Peptic ulcer	Nepal, North Africa	112,105
206	*Lannea schimperi* (Hochst. ex A.Rich.) Engl.	Bark	Chew and swallow the fluids	Stomachache	Nyamwezi THPs, Tabora region, Tanzania	120
207	Lannea stuhlmannii (Engl.) Eyles (syn. of *Lannea schweinfurthii* var. *stuhlmannii* (Engl.) Kokwaro)	Roots	Decoction	Diarrhoea	Nyamwezi THPs, Tabora region, Tanzania	120
208	*Launaea cornuta* (Hochst. ex Oliv. & Hiern) C.Jeffrey	Leaves	Infusion	Diarrhoea	Nyamwezi THPs, Tabora region, Tanzania	120

(continued)

Table 1. *(continued)*

S. N.	Plants	Part used	Preparation	Traditional use/properties	Used in country	References
209	*Laurus nobilis* L.	Leaves	Boiled and the stock is drunk either plainly or mixed with honey	Indigestion	Izmir Province, Turkey	124,129
210	*Lavandula officinalis* L.	Flowers	Infusion	Flatulence	Setifian High Plateau, Algeria	117
211	*Lavandula stoechas* L.	Leaves		Peptic ulcers	North Africa	105,143
212	*Lawsonia inermis* L.	Leaves		Peptic ulcers	North Africa	105
213	*Leea indica* (Burm. f.) Merr.	Roots and Stem	Decoction	Diarrhoea, Gastric ulcer	Karen people of northern Thailand	114,115
214	*Leonotis leonurus* (L.) R.Br.	Whole plant	Infusion or Decoction	Dysentery	Eastern Cape Province, South Africa	108
215	*Linum usitatissimum* L.	Seeds	Chewed	Dyspepsia, Constipation	IIzmir province, Turkey, Setifian High Plateau, Algeria	110,117,124,129
216	*Lupinus termis* L.	Seeds	Powder	Constipation	Setifian High Plateau, Algeria	117
217	*Lycium barbarum* L.	Leaves	Extract	Bloody diarrhoea, Vomiting	Bannu, Khyber Pakhtunkhwa province of Pakistan	107
218	*Malva neglecta* Wallr.	Shoot, branches, Leaves and Seeds		Stomach Pain, Dyspepsia, Constipation	Lakki Marwat, Khyber Pakhtunkhwa province of Pakistan and Urmia, Iran	107,110,116
219	*Malva parviflora* L.	Leaves	Decoction	Constipation	Karak, Khyber Pakhtunkhwa province of Pakistan	107
220	*Malva sylvestris* L.	Aerial part and Leaves	Decoction, Infusion	Dyspepsia, Gastralgia, Laxative	Izmir province, Turkey, Setifian High Plateau, Algeria	110,117,124,129
221	*Mangifera indica* L.	Leaves		Peptic Ulcer, Abdominal Pain, Constipation, Diarrhoea, Dysentery, Flatulence, Gastritis, Gastropathy, Intestinal Spasm, Peptic Ulcer, Stomach Worms, Stomachache	Nepal, North Africa	105,112
222	*Marrubium vulgare* L.	Aerial parts	Decoction	Anorexia, Dyspepsia, Diarrhoea	Setifian High Plateau, Algeria	110,117
223	*Matricaria chamomilla* L.	Flowers	Decoction	Dyspepsia, Gastrointestinal disorders, Diarrhoea, Constipation, Irritable Bowel Syndrome Symptoms, Dyspepsia, Indigestion, Acidity, Peptic ulcer	Izmir province, Turkey, North African regions	105,110,124,126
224	*Melia azadirachta* L. (syn. of *Azadirachta indica* A.Juss.)	Leaves and Fruit	Decoction	Intestinal Worms	Lakki Marwat, Khyber Pakhtunkhwa province of Pakistan	107
225	*Melissa officinalis* L.	Leaves		Dyspepsia		110

(continued)

Table 1. *(continued)*

S. N.	Plants	Part used	Preparation	Traditional use/properties	Used in country	References
226	*Mentha × piperita* L.	Leaves and Essential oil	Chewed, Decoction	Dyspepsia, Nausea, Indigestion, Gastric Infection, Flatulence,	Setifian High Plateau, Algeria, Eastern and Western traditional systems, Izmir province, Turkey	110,117,126,124, 129,144,145
227	*Mentha aquatica* L.	Leaves	Infusion	Stomach ache	Eastern Cape Province, South Africa	108
228	*Mentha longifolia* (L.) L.	Aerial parts	Fresh leaves are boiled in water with green tea and sugar	Diarrhoea, Bloating Intestinal colic; Flatulence	Kohat, Lakki Marwat, Karak D. I. Khan, Khyber Pakhtunkhwa province of Pakistan and Urmia, Iran	107,146
229	*Mentha microphylla* K.Koch (syn. of *Mentha spicata* subsp. *condensata* (Briq.) Greuter & Burdet).	Leaves		Peptic ulcers	North Africa	105,147
230	*Mentha pulegium* L.	Plant	Tea	Bloating	Mexican Traditional Medicine	82
231	*Mentha spicata* L.	Aerial parts and Leaves	Tea, Essential Oil, Decoction,	Digestive Problems (Bloating), parasitic Diarrhoea, Intestinal Colic; Duodenum And Ileum Muscle Relaxants, Flatulence Gastralgia, Peptic ulcer	Mexican Traditional Medicine, Urmia, Iran, Izmir province, Turkey and North African regions	82,105,124, 146–151
232	*Menyanthes trifoliata* L.	Leaves		Anorexia, Dyspepsia		110
233	*Momordica charantia* L.	Fruit	Thinly sliced fruits are kept in honey or olive oil until completely dissolved and then consumed (1–2 tbsp) on an empty stomach in the mornings	Stomach ache, Gastritis, Peptic ulcer	Izmir Province, Turkey	124,129
234	*Moringa oleifera* Lam	Fruit	Infusion	Stomachache, Gastric ulcer	Nyamwezi THPs, in the Tabora region, Tanzania	120
235	*Morus nigra* L	Fruit	Fruits are boiled and the stock is drunk	Diarrhoea	Izmir province, Turkey	124
236	*Mundulea sericea* (Willd.) A.Chev.	Roots	Decoction	Stomachache	Nyamwezi THPs, Tabora region, Tanzania	120
237	*Musa × sapientum* L. (syn. of *Musa × paradisiaca* L.)	Fruit		Heartburn, Gastric Ulcer, Diarrhoea	Nyamwezi THPs, Tabora region, Tanzania, Karen people of northern Thailand	114,115,120
238	*Mussaenda sanderiana* Ridl.	Roots and Leaves	Decoction	Anorexia	Karen people of northern Thailand	114,115
239	*Myristica fragrans* Houtt.	Plant		Flatulence, Colic, Diarrhoea, Dyspepsia, Stomachache, Vomiting	Nepal	112

(continued)

Table 1. *(continued)*

S. N.	Plants	Part used	Preparation	Traditional use/properties	Used in country	References
240	*Myrtus communis* L.	Leaves and Fruit	Decoction	Gastrointestinal disorders, Diarrhoea, Peptic ulcer	Izmir province, Turkey, Setifian High Plateau, Algeria, North African regions	105,117,124,129
241	*Nardostachys grandiflora* DC. (syn. of *Nardostachys jatamansi* (D.Don) DC.)	Plant		Flatulence, Colic, Constipation, Diarrhoea, Dysentery, Dyspepsia, Food poisoning, Gastritis, Indigestion, Intestinal parasites	Nepal	112
242	*Nasturtium officinale* W.T.Aiton	Leaves		Constipation	Khyber Pakhtunkhwa province of Pakistan	107
243	*Neopicrorhiza scrophulariiflora* (Pennell) D.Y.Hong	Plant		Gastritis, Intestinal Worms, Stomachache	Nepal	112
244	*Nigella sativa* L.	Seeds	Powder	Acidity, Flatulence, Peptic ulcer	Setifian High Plateau, Algeria and other North African regions	105,117,126
245	*Ochna integerrima* (Lour.) Merr.	Leaves	Decoction	Diarrhoea, Constipation, Gastric ulcer	Karen people of northern Thailand	114,115
246	*Ocimum basilicum* L.	Aerial parts	Decoction	Anorexia, Digestive System Booster; Flatulence	Urmia, Iran	122
247	*Olea europaea* L.	Leaves and Fruit		Peptic ulcers	North Africa	105,148
248	*Olea europaea* subsp. *africana* (Mill.) P.S.Green	Roots, Bark and Leaves	Infusions or Decoctions	Diarrhoea	Eastern Cape Province, South Africa	108
249	*Opuntia dillenii* (Ker Gawl.) Haw. (syn. of *Opuntia tuna* (L.) Mill.)	Leaves and Fruit	Ripened fruit is boiled in water with some sugar	Constipation	Khyber Pakhtunkhwa province of Pakistan	107
250	*Opuntia ficus-indica* (L.) Mill.	Fruit and Seeds		Peptic ulcers	North Africa	105
251	*Opuntia monacantha* Haw.	Whole plant		Indigestion	Khyber Pakhtunkhwa province of Pakistan	107
252	*Origanum compactum* Benth.	Leaves		Peptic ulcers	North Africa	105,149
253	*Origanum dictamnus* L.	Aerial parts		Dyspepsia	–	110
254	*Origanum majorana* L.	Aerial parts	Decoction	Dyspepsia, Indigestion, Gastralgia, Peptic ulcers	Setifian High Plateau, Algeria, Izmir province, Turkey, North Africa	110,117,124, 126,129,105
255	*Origanum onites* L	Aerial part	Aerial parts are boiled and the stock is drunk	Gastralgia	Izmir province, Turkey	124,151
256	*Origanum syriacum* L.	Leaves		Peptic Ulcers	North Africa	105

(continued)

Table 1. *(continued)*

S. N.	Plants	Part used	Preparation	Traditional use/properties	Used in country	References
257	*Oroxylum indicum* (L.) Kurz	Plant		Anorexia, Dyspepsia, Flatulence, Constipation, Diarrhoea, Dysentery, Stomachache	Nepal	112
258	*Osyris quadripartita* Salzm. ex Decne. (syn. of *Osyris lanceolata* Hochst. & Steud.)	Roots, Stems, Bark and Leaves		Peptic ulcers	North Africa	105,152
259	*Oxalis corniculata* L.	Leaves, Plant	Decoction or Juice	Stomach problems, Anorexia, Biliousness, Constipation, Diarrhoea, Dysentery, Dyspepsia, Indigestion, Peptic Ulcer, Stomachache Vomiting	Bannu, Khyber Pakhtunkhwa province of Pakistan, Nepal	92,107,112
260	*Ozoroa insignis* Delile.	Roots and Leaves	Decoction	Diarrhoea	Nyamwezi THPs, Tabora region, Tanzania	120
261	*Paliurus spina-christi* Mill.	Fruit	Fresh or dried fruits are boiled and the stock is drunk	Stomachic, Laxative	Izmir province, Turkey	124,129
262	*Papaver rhoeas* L.	Flowers	Decoction	Indigestion	Setifian High Plateau, Algeria	117
263	*Paronychia argentea* Lam.	Aerial parts	Decoction	Diarrhoea	Setifian High Plateau, Algeria	117
264	*Pelargonium reniforme* (Andrews) Curtis	Roots	Decoction	Dysentery	Eastern Cape Province, South Africa	108
265	*Persicaria lapathifolia* (L.) Gray	Roots and Leaves	Infusion	Stomach complaints, Diarrhoea	Eastern Cape Province, South Africa	108
266	*Petroselinum crispum* (Mill.) Fuss	Plant	Tea, Condiment	Digestive Problems (Bloating)	Mexican Traditional Medicine	82
267	*Peumus boldus* Molina.	Leaves		Dyspepsia		110
268	*Phoenix dactylifera* L.	Palm sap and Pulp		Peptic Ulcers	North Africa	105
269	*Phragmites australis* (Cav.) Trin. ex Steud.	Rhizome	Decoction	Gastritis, Intestinal Inflammation	Urmia, Iran	116
270	*Phyllanthus emblica* L.	Fruit, Plant		Diarrhoea Dysentery, Acidity, Anthelmintic, Colic, Constipation, Diarrhoea, Dysentery, Dyspepsia, Gastric Trouble, Intestinal Spasm, Jaundice, Laxative, Stomachache, Stomatitis And Vomiting	Kohat, Khyber Pakhtunkhwa province of Pakistan, Nepal	107,112

(continued)

Table 1. *(continued)*

S. N.	Plants	Part used	Preparation	Traditional use/properties	Used in country	References
271	*Phyllanthus engleri* Pax	Roots	Decoction Drunk	Diarrhoea	Nyamwezi THPs, Tabora region, Tanzania	120
272	*Pimpinella anisum* L.	Fruit, Essential Oil and Seeds	Tea, Powder	Irritable Bowel Syndrome Symptoms, Gastric Infection, Gastric Acidity, Bloating, Dyspepsia, Flatulence	Mexican Traditional Medicine, in Setifian High Plateau, Algeria	82,110,117,126
273	*Piper longum* L.	Plant		Cholagogue, Colic, Digestive, Dyspepsia, Indigestion, Laxative, Piles, Splenopathy, Stomachache And Vomiting	Nepal	112
274	*Pistacia lentiscus* L.	Aerial parts, Leaves, Gum and Oleoresin		Dyspepsia, Against Gastralgia, Peptic Ulcer	Izmir province, Turkey and North Africa	105,110,124
275	*Pistacia terebinthus* L.	Leaves	Leaves Are Boiled And The Stock Is Drunk	Stomachic, To Treat Gastritis And Ulcer	Izmir province, Turkey	124
276	*Plantago afra* L.	Seeds		Constipation		110
277	*Plantago indica* L	Seeds		Constipation		110
278	*Plantago lanceolate* L.	Leaves	Infusion	Diarrhoea, Dysentery	Eastern Cape Province, South Africa	108
279	*Plantago major* L.	Roots, Leaves and Seeds	Decoction	Peptic ulcer, Gastritis, Gastralgia	Urmia, Iran and Izmir province, Turkey, in Setifian High Plateau, Algeria and other North African regions	105,116,117, 124,129
280	*Plantago ovata* Forssk.	Seed (Husk)		Diuretic, Cholinergic		75,110
281	*Platanus orientalis* L.	Bark	Decoction	Anorexia, Diarrhoea	Urmia, Iran	116
282	*Plectranthus barbatus* L	Roots	Infusion mixed with honey	Gastric ulcer, Flatulence	Nyamwezi THPs, Tabora region, Tanzania	120
283	*Polypodium vulgare* L.	Rhizome		Constipation		110
284	*Pongamia pinnata* (L.) Pierre	Seeds	Powder	Kills Pinworm	Kurichia, kattunaika, Tribe of Wayanad district, Kerala (India)	92
285	*Portulaca oleracea* L.	Aerial parts		Peptic ulcers	North Africa	105
286	*Potentilla erecta* (L.) Raeusch.	Rhizome		Diarrhoea		110
287	*Prunus kotschyi* (Boiss. & Hohen. ex Spach) Meikle	Seeds	Decoction or Infusion	Constipation	Urmia, Iran	123
288	*Psidium guajava* L	Leaves	Decoction	Dysentery, Diarrhoea, Abdominal Pain, Anthelmintic, Cholera, Colic	Nyamwezi THPs, Tabora region, Tanzania, Karen people of northern Thailand, Nepal	112,114,115,120

(continued)

Table 1. *(continued)*

S. N.	Plants	Part used	Preparation	Traditional use/properties	Used in country	References
289	*Psorospermum febrifugum* Spanch	Roots	Powder mixed with hot water or tea	Worm Infections	Nyamwezi THPs, Tabora region, Tanzania	120
290	*Pterocarpus angolensis* DC.	Bark	Decoction	Dysentery	Nyamwezi THPs, Tabora region, Tanzania	120
291	*Pterocarpus tinctorius* Welw.	Roots and Bark	Decoction	Diarrhoea, Heartburn, Dysentery	Nyamwezi THPs, Tabora region, Tanzania	120
292	*Punica granatum* L.	Roots, Leaves, Peel and Fruit	Decoction Infusion, Juice or Powder	Gastric ulcer, Diarrhoea, Gastritis	Nyamwezi THPs, Tabora region, Tanzania and Izmir province, Turkey and Khyber Pakhtunkhwa province of Pakistan and Karen people of northern Thailand, Setifian High Plateau, Algeria and other North African regions	105,107,114,115, 117,120,124,129
293	*Quercus ilex* Lour. (syn. of *Quercus helferiana* A.DC.)	Fruit		Diarrhoea, Gastritis, ulcer	Setifian High Plateau, Algeria	117
294	*Quercus ithaburensis* subsp. *macrolepis* (Kotschy) Hedge & Yalt.	Fruit	Dried fruits are boiled; this stock is mixed with water and drunk	Stomachic, Against Diarrhoea	Izmir province, Turkey	124,129
295	*Quercus petraea* (Matt.) Liebl.	Bark		Diarrhoea		110
296	*Quercus pubescens* Willd.	Bark		Diarrhoea		110
297	*Quercus robur* L.	Bark		Diarrhoea		110
298	*Rhamnus alaternus* L.	Seeds	Decoction	Gastralgia	Setifian High Plateau, Algeria	117
299	*Rhamnus frangula* L. (syn. of *Frangula alnus* Mill.)	Bark		Constipation		110
300	*Rhamnus purshiana* DC. (syn. of *Frangula purshiana* (DC.) A.Gray ex J.G.Cooper)	Bark	Tea or capsules made from the bark	Constipation		82,110
301	*Rhaphidophora pertusa* (Roxb.) Schott.	Stem	Juice	Abdominal pain	Tribe of Wayanad district, Kerala (India)	92
302	*Rheum palmatum* L.	Roots		Constipation		110
303	*Rheum rhaponticum* L.	Roots		Constipation		82
304	*Rhus tripartita* (Ucria) Grande (syn. of *Searsia tripartita* (Ucria) Moffett)	Roots, Stem, and Leaves		Peptic ulcers	North Africa	105
305	*Ricinus communis* L.	Fruit, Seed and Virgin Oil	Chewed, Extract	Constipation, Diarrhoea	Nyamwezi THPs, Tabora region, Tanzania, Setifian High Plateau, Algeria	81,117,120

(continued)

Table 1. *(continued)*

S. N.	Plants	Part used	Preparation	Traditional use/properties	Used in country	References
306	*Rosa indica* L.	Flowers	Flower mixed with sugar put in sun place take orally with water and fennel	Vomiting, Dyspepsia	Bannu, Kohat, Khyber Pakhtunkhwa province of Pakistan	107
307	*Rosmarinus officinalis* L. (syn. of *Salvia rosmarinus* Spenn.)	Leaves and Essential oil	Decoction	Dyspepsia, Gastralgia	Setifian High Plateau, Algeria	110,117
308	*Rubia manjith* Roxb.	Plant		Flatulence, Gastritis, Intestinal Spasm, Laxative, Stomach Worms, Vomiting	Nepal	112
309	*Rubia petiolaris* DC.	Roots and Leaves	Infusion, Decoction or Concoction	Stomach problems, Haemorrhagic diarrhoea, Amoebic Dysentery	Eastern Cape Province, South Africa	108
310	*Rubus idaeus* L.	Leaves		Diarrhoea	–	110
311	*Rumex patientia* L	Leaves	Decoction	Laxative	Izmir province, Turkey	124,129
312	*Ruta graveolens* L.	Aerial parts	Decoction	Gastralgia	Setifian High Plateau, Algeria	117
313	*Saccharum officinarum* L.	Stem	Extract	Indigestion	D. I. Khan, Lakki Marwat Bannu, Khyber Pakhtunkhwa province of Pakistan	107
314	*Salvia officinalis* L.	Leaves	Decoction	Dyspepsia, Gastralgia	Izmir province, Turkey	110,124,129
315	*Santolina chamaecyparissus* L	Leaves	Extract	Indigestion, Gastralgia	Setifian High Plateau, Algeria	117
316	*Sarcophyte sanguinea* Sparrm	Whole plant	Infusion, Decoction	Diarrhoea, Dysentery	Eastern Cape Province, South Africa	108
317	*Schizocarphus nervosus* (Burch.) Van der Merwe	Roots	Decoction	Dysentery	Eastern Cape Province, South Africa	108
318	*Schotia afra* (L.) Thunb.	Roots and Bark	Decoction	Diarrheoa	Eastern Cape Province, South Africa	108
319	*Schotia brachypetala* Sond.	Roots and Bark	Decoction	Dysentery, Diarrhoea	Eastern Cape Province, South Africa	108
320	*Schotia latifolia* Jacq.	Roots and Bark	Decoction	Diarrheoa	Eastern Cape Province, South Africa	108
321	*Sclerocarya birrea* (A.Rich.) Hochst.	Bark	Infusion	Constipation	Nyamwezi THPs, Tabora region, Tanzania	120
322	*Scorzonera cinerea* Boiss. (syn. of *Gelasia cinerea* (Boiss.) Zaika, Sukhor. & N.Kilian)	Roots	Decoction	Laxative	Urmia, Iran	116
323	*Securidaca longepedunculata* Fresen.	Roots	Powder mixed with hot water and drunk	Stomachache, Gastric ulcer, Constipation	Nyamwezi THPs, Tabora region, Tanzania	120

(continued)

Table 1. *(continued)*

S. N.	Plants	Part used	Preparation	Traditional use/properties	Used in country	References
324	*Senecio mollis* Willd. (syn. of *Jacobaea mollis* (Willd.) B.Nord.)		Decoction	Diarrhoea	Urmia, Iran	137
325	*Senna alata* (L.) Roxb.	Leaves	Decoction	Laxative	Karen people of northern Thailand	114,115
326	*Senna alexandrina* Mill. (syn. *Cassia senna* L.)	Leaflets, Leaves and Fruit	Tea, Capsules, Pills, Infusion	Constipation, Diarrhoea,	Setifian High Plateau, Algeria	82,110,129,120
327	*Senna occidentalis* (L.) Link	Leaves	Decoction	Laxative	Karen people of northern Thailand	114,115
328	*Senna siamea* (Lam.) H.S.Irwin & Barneby	Roots	Decoction Drunk	Stomachache, Diarrhoea	Nyamwezi THPs, Tabora region, Tanzania	120
329	*Silybum marianum* (L.) Gaertn.	Fruit and Seeds	Decoction	Indigestion, Dyspepsia	Basque people	90,110,131,153,154
330	*Sisymbrium irio* L.	Leaves		Stomach Problems	Karak, Khyber Pakhtunkhwa province of Pakistan	107
331	*Sisymbrium officinale* (L.) Scop.	Seeds	Decoction	Laxative	Urmia, Iran	116
332	*Smilax zeylanica* L.	Roots		Stomach ache, Indigestion	Mandai tribe of Bangladesh	113
333	*Solanum aculeastrum* Dunal	Roots, Bark and Berries	Infusion, Decoction And Concoction	Dysentery	Eastern Cape Province, South Africa	108
334	*Solanum incanum* L.	Roots and Fruit	Decoction Drunk	Gastric ulcer, Constipation	Nyamwezi THPs, Tabora region, Tanzania	120
335	*Solanum nigrum* L.	Roots, Stem, Leaves and Berries		Peptic ulcers	North Africa	105,155
336	*Solanum surattense* Burm.f. (syn. of *Solanum virginianum* L.)	Fruit	Powder	Abdomen pain, Gastritis	Bannu, Kohat, Khyber Pakhtunkhwa province of Pakistan	107
337	*Solanum tomentosum* L.	Roots, Bark and Berries	Infusion, Decoction And Concoction	Dysentery	Eastern Cape Province, South Africa	108
338	*Sorghum bicolor* (L.) Moench.	Leaves	Infusion Drunk	Flatulence	Nyamwezi THPs, Tabora region, Tanzania	120
339	*Stipa tenacissima* L. (syn. of *Macrochloa tenacissima* (L.) Kunth)	Leaves	Decoction	Gastrointestinal disorders	Setifian High Plateau, Algeria	117
340	*Streblus asper* Lour.	Roots		Dysentery	Santal tribe of Bangladesh	113
341	*Streblus asper* Lour. With *Hemidesmus indicus* (L.) R.Br.	Gum and Roots		Stomach ache, Diarrhoea	Mandai tribe of Bangladesh	113
342	*Strychnos henningsii* Gilg	Stem Bark	Decoctions Of The Bark And Infusions Of The Leaves	Stomach ache	Eastern Cape Province, South Africa	108
343	*Strychnos heterodoxa* Gilg (syn. of *Strychnos potatorum* L.f.)	Bark	Decoction Drunk	Dysentery	Nyamwezi THPs, Tabora region, Tanzania	120

(continued)

Table 1. *(continued)*

S. N.	Plants	Part used	Preparation	Traditional use/properties	Used in country	References
344	*Strychnos innocua* Delile.	Bark	Decoction Drunk	Gastric ulcer	Nyamwezi THPs, Tabora region, Tanzania	120
345	*Strychnos nitida* G.Don	Whole plant	Decoction Drunk	Constipation	Nyamwezi THPs, Tabora region, Tanzania	120
346	*Syzygium aromaticum* (L.) Merr. & L.M.Perry	Leaves	Decoction	Diarrhoea, Gastralgia, Flatulence	Setifian High Plateau, Algeria and other North African Regions	97,105,117,126
347	*Syzygium cordatum* Hochst. ex C.Krauss.	Roots, Bark and Leaves	Decoction or Concoction	Stomach complaints, Diarrhoea	Eastern Cape Province, South Africa	108
348	*Tamarindus indica* L	Fruit		Constipation, Diarrhoea	Karen people of northern Thailand, Nyamwezi THPs, Tabora region, Tanzania	114,115,120
349	*Tanacetum parthenium* (L.) Sch.Bip.	Leave and Flowers	Decoction	Gastritis	Urmia, Iran	116
350	*Taraxacum officinale* F.H.Wigg. (syn. of *Taraxacum* sect. *Taraxacum* F.H.Wigg.	Roots, Aerial parts, and Leaves		Gastrointestinal disorders, Anorexia, Dyspepsia		110,156
351	*Terminalia bellirica* (Gaertn.) Roxb.	Plant		Constipation, Diarrhoea, Dysentery, Dyspepsia, Gastritis, Gastrointestinal diseases, Indigestion, Stomachache, Vomiting	Nepal	112
352	*Terminalia chebula* Retz.	Plant		Flatulence, Constipation, Diarrhoea, Dysentery, Gastropathy, Indigestion, Stomachache, Vomiting	Nepal	112
353	*Terminalia sericea* Burch. ex DC	Roots	Infusion Drunk	Gastric ulcer, Stomachache,	Nyamwezi THPs, Tabora region, Tanzania	120
354	*Teucrium polium* L.	Aerial part	Powder	Gastralgia	Setifian High Plateau, Algeria	117
355	*Thespesia garckeana* F.Hoffm.	Leaves	Decoction Drunk	Dysentery, Diarrhoea	Nyamwezi THPs, Tabora region, Tanzania	120
356	*Thunbergia laurifolia* Lindl.	Stem and Leaves	Decoction (Potion, Bath)	Gastric Ulcer Diarrhoea	Karen people of northern Thailand	115
357	*Thymus kotschyanus* Boiss. & Hohen.	Floral Branch	Infusion	Diarrhoea, Bloating, Indigestion	Urmia, Iran	157
358	*Thymus linearis* Benth.	Plant		Anorexia, Diarrhoea, Digestive, Gastritis, Indigestion, Stomachache	Nepal	112

(continued)

Table 1. *(continued)*

S. N.	Plants	Part used	Preparation	Traditional use/properties	Used in country	References
359	*Thymus vulgaris* L.	Plant	Tea, Essential Oil	Bloating, Diarrhoea, Constipation, Irritable Bowel Syndrome Symptoms, Gastric Infection, Gastric Acidity	Mexican Traditional Medicine	82,126
360	*Tordylium nodosum* L. (syn. of *Torilis nodosa* (L.) Gaertn.)	Whole plant		Intestinal Worms	Bannu, Khyber Pakhtunkhwa province of Pakistan	110
361	*Trachyspermum ammi* (L.) Sprague	Plant		Flatulence, Cholera, Colic, Diarrhoea, Dyspepsia, Gastritis, Indigestion, Intestinal worms, Stomachache	Nepal	112
362	*Tragopogon caricifolius* Boiss.	Leaves	Decoction	Constipation	Urmia, Iran	116
363	*Trifolium pratense* L.	Floral Branches	Decoction	Constipation	Urmia, Iran	116
364	*Trigonella foenum-graecum* L.	Seeds		Anorexia, Diarrhoea, Constipation, Dyspepsia, Gastric infection, Acidity, Peptic ulcer	North Africa	105,110,129
365	*Typha capensis* (Rohrb.) N.E.Br	Rhizomes	Decoction	Diarrhoea, Dysentery	Eastern Cape Province, South Africa	108
366	*Urtica dioica* L.	Leaves	Decoction	Diarrhoea	Setifian High Plateau, Algeria	117
367	Vaccaria oxyodonta Boiss. (syn. of *Gypsophila vaccaria* (L.) Sm.)	Flowers	Decoction	Constipation	Urmia, Iran	116
368	*Valeriana jatamansi* Jones ex Roxb.	Plant		Flatulence, Cholera, Diarrhoea, Dysentery, Gastrospasms, Indigestion, Stomachache	Nepal	112
369	*Viscum album* L	Leaves and Fruit	Decoction	Diarrhoea	Izmir province, Turkey	124,129
370	*Vitex mombassae* Vatke (*Vitex mombassae* L.)	Leaves	Decoction Drunk	Dysentery	Nyamwezi THPs, Tabora region, Tanzania	120
371	*Vitis vinifera* L.	Leaves, Fruit and Seeds		Peptic Ulcer	North Africa	81,105
372	*Withania coagulans* (Stocks) Dunal	Fruit and Leaves	Fruits Are Crushed, Mix With Salt, Extract	Gastric and Abdominal pain	Karak, Kohat, D. I. Khan, Lakki Marwat, Bannu, Khyber Pakhtunkhwa province of Pakistan	107
373	*Woodfordia fruticosa* (L.) Kurz	Flowers		Diarrhoea, Dysentery, Ulcers,	Kohat, Khyber Pakhtunkhwa province of Pakistan	107
374	*Xeroderris stuhlmannii* Dunn ex Baker f. (or *Xeroderris stuhlmannii* (Taub.) Mendonça & E.P.Sousa syn. of *Aganope stuhlmannii* (Taub.) Adema	Roots	Powder Mixed With Hot Water Or Tea And Drunk	Stomachache	Nyamwezi THPs, Tabora region, Tanzania	120

(continued)

Table 1. *(continued)*

S. N.	Plants	Part used	Preparation	Traditional use/properties	Used in country	References
375	*Ximenia americana* L.	Roots	Infusion Drunk	Diarrhoea	Nyamwezi THPs, Tabora region, Tanzania	120
376	*Xylopia antunensii* L. (or *Xylopia antunesii* Engl. & Diels syn. of *Xylopia odoratissima* Welw. ex Oliv.)	Leaves	Decoction	Gastric Ulcer, Diarrhoea	Nyamwezi THPs, Tabora region, Tanzania	120
377	*Zanthoxylum armatum* DC.	Plant		Abdominal Pain, Anthelmintic, Anorexia, Flatulence, Cholera, Constipation, Diarrhoea, Dysentery, Dyspepsia, Flatulence, Gastritis, Indigestion,	Nepal	112
378	*Zanthoxylum chalybeum* Engl.	Roots	Decoction Drunk	Constipation, Gastric ulcer, Diarrhoea	Nyamwezi THPs, Tabora region, Tanzania	120
379	*Zingiber montanum* (J.Koenig) Link ex A.Dietr.	Rhizome	Decoction	Flatulence, Gastric ulcer	Karen people of northern Thailand	114,115
380	*Zingiber officinale* Roscoe	Rhizome	Tea, Capsule, Powder	Diarrhoea, Dyspepsia, Nausea, Vomiting, Flatulence, Peptic ulcer	Asian medicine, Mexican Traditional Medicine and Nyamwezi THPs, Tabora region, Tanzania and North African regions	82,97,105,110,115, 120,126,158–160
381	*Zingiber ottensii* Valeton	Rhizome	Decoction	Flatulence, Flatulence	Karen people of northern Thailand	114,115
382	*Ziziphora tenuior* L.	Inflorescence	Decoction	Diarrhoea, Bloating, Gastritis	Urmia, Iran	161
383	*Ziziphus cambodiana* Pierre	Bark	Decoction	Gastric ulcers	Karen people of northern Thailand	114,115
384	*Ziziphus jujuba* Mill.	Fruit	Roast the fruit and eat for the treatment of stomach problems. Take 5 gm of roots powder and 7 pieces of black pepper grind and mix	Diarrhoea and Abdominal pain	Bannu, LakkiMarwat, Khyber Pakhtunkhwa province of Pakistan	107
385	*Ziziphus lotus* (L.) Lam.	Bark, Leaves, Fruits and Seeds	Decoction	Gastralgia, Peptic ulcer	Setifian High Plateau, Algeria and other North African regions	117,105
386	*Ziziphus mauritiana* Lam.	Plant		Abdominal pain, Constipation, Diarrhoea, Dysentery, Dyspepsia, Indigestion, Peptic ulcer, Stomach disorders, Vomiting	Nepal	112
387	*Ziziphus mucronata* Willd.	Roots, Bark and Leaves	Decoction of the roots; concoction of bark and leaves	Diarrhoea, Dysentery	Eastern Cape Province, South Africa	108
388	*Ziziphus nummularia* (Burm.f.) Wight & Arn.	Bark, Fruit and Leaves	Decoction	Dysentery	Bannu, D. I. Khan, Kohat, Khyber Pakhtunkhwa province of Pakistan	107

THPs, traditional health practitioners.

thereby upregulating CYP3A4 and P-glycoprotein—key elements in detoxification and mucosal barrier maintenance, thus offering a dual anti-inflammatory and barrier-protective effect.[164]

Likewise, triptolide, an active diterpenoid triepoxide from *Tripterygium wilfordii*, demonstrated significant downregulation of IL-1, IL-6, TNF-α, and ornithine decarboxylase 1 expression in a chronic stress-induced IBS model. Its administration resulted in improved behavioral scores, reduced visceral hypersensitivity, and decreased intestinal inflammation, suggesting that triptolide modulates the gut-brain axis and inflammation in tandem.[165]

Atractylenolide I, a bioactive component of *Atractylodes macrocephala*, also showed suppression of intestinal inflammation via inhibition of the JNK/iNOS signaling pathway. In PI-IBS models, this compound significantly decreased the expression of pro-inflammatory cytokines interferon-γ and TNF-α while restoring intestinal architecture and enhancing expression of tight junction proteins such as occludin and claudin-1.[166]

Sakuranetin (SKN), a flavonoid compound, demonstrated anti-inflammatory and mucosal healing effects in GI inflammatory conditions. It significantly reduced colonic expression of iNOS and COX-2 while increasing the levels of endothelial nitric oxide synthase and peroxisome proliferator-activated receptor alpha, which are associated with vascular protection and anti-inflammatory responses. Histologically, SKN improved epithelial integrity and lowered inflammation scores, affirming its regulatory effect on inflammation signaling.[167]

In another important study, galangin, a naturally occurring flavonoid, was shown to protect against ethanol-induced gastric mucosal injury. It significantly decreased levels of malondialdehyde (MDA), a marker of oxidative damage, while downregulating the expression of transient receptor potential vanilloid 1 (TRPV1), NF-κB, COX-2, and the pro-apoptotic protein Bax. Concurrently, galangin upregulated the expression of heat shock protein 70 (HSP70), B-cell lymphoma-2 (Bcl-2), and tight junction proteins such as claudin-1 and occludin, resulting in reduced mucosal inflammation and improved structural integrity.[168]

Canolol, a phenolic compound derived from rapeseed oil, provided significant protection against ethanol-induced gastric damage by enhancing antioxidant defenses (elevating glutathione, catalase (CAT), and superoxide dismutase (SOD)) and inhibiting the activation of pro-inflammatory pathways, especially p38 MAPK and NF-κB. It also reduced pro-apoptotic protein Bax and increased Bcl-2 levels, thereby limiting mucosal cell apoptosis and improving overall tissue regeneration.[169]

Finally, engeletin, a flavonoid isolated from *Smilax glabra*, was demonstrated to alleviate ulcerative colitis via inhibition of Toll-like receptor 4/NF-κB signaling. It significantly suppressed TNF-α, IL-1β, and IL-6 expression and inhibited polarization of macrophages to the M1 phenotype. Engeletin also promoted tight junction protein expression, such as occludin and claudin-1, which contributes to barrier restoration in colonic tissue.[170]

These studies collectively illustrate that a wide range of phytochemicals, including terpenoids (oridonin, triptolide, atractylenolide I), flavonoids (SKN, galangin, engeletin), and phenolics (canolol), act through common and well-conserved inflammatory pathways. By suppressing NF-κB and COX-2 activity, reducing cytokine production, and restoring mucosal defense mechanisms, these compounds demonstrate promising therapeutic potential in the management of inflammation-associated GI disorders.

Antioxidant effects

Oxidative stress is a major contributor to the pathogenesis and progression of several GI disorders, such as peptic ulcers, gastritis, IBD, and functional dyspepsia. Excessive production of reactive oxygen species can damage the GI mucosa by promoting lipid peroxidation, altering cellular proteins and DNA, impairing mitochondrial function, and triggering apoptosis. These oxidative changes are often accompanied by inflammation, immune activation, and barrier dysfunction. Accordingly, natural products that possess antioxidant activity play a significant role in mitigating GI damage and promoting mucosal healing.

One such compound is galangin, a naturally occurring flavonoid that exhibited strong antioxidant and gastroprotective properties in an ethanol-induced gastric mucosal injury model. Galangin significantly decreased MDA, a marker of lipid peroxidation, and increased the activities of key antioxidant enzymes, including SOD and CAT. Histologically, galangin reversed mucosal damage and increased the expression of cytoprotective proteins, such as HSP70 and Bcl-2, while decreasing the expression of the pro-apoptotic protein Bax. It also downregulated pro-inflammatory signaling through inhibition of NF-κB, COX-2, and TRPV1, suggesting a dual antioxidant and anti-inflammatory action that supported both mucosal integrity and epithelial regeneration.[168]

Canolol, a phenolic compound derived from rapeseed oil, has also demonstrated potent antioxidant activity in experimental models of ethanol-induced gastric ulceration. Canolol treatment restored gastric mucosal antioxidant defenses by significantly increasing the levels of glutathione, CAT, and SOD. Moreover, it downregulated oxidative stress-related pro-inflammatory proteins, such as p38 MAPK and NF-κB, and decreased the Bax/Bcl-2 ratio, thus reducing apoptosis and enhancing mucosal cell survival. Canolol's multi-targeted antioxidant response contributed to the repair of mucosal lesions and the prevention of further oxidative damage.[169]

SKN, a flavonoid with anti-inflammatory and antioxidant properties, was shown to significantly improve antioxidant enzyme activity in the colon. In particular, SKN increased nitric oxide production through upregulation of endothelial nitric oxide synthase and proliferator-activated receptor alpha expression, while simultaneously decreasing iNOS, COX-2, and other oxidative markers. The antioxidant protection provided by SKN was associated with reduced mucosal inflammation and improved histological scores in GI inflammatory models.[167]

Triptolide, a diterpenoid compound discussed for its anti-inflammatory potential, also exhibited secondary antioxidant effects. In a chronic stress-induced IBS model, triptolide reduced levels of MDA and supported the endogenous antioxidant defense system, which included elevated levels of SOD and CAT. These changes were closely linked to reduced colonic inflammation and restored mucosal structure, indicating that the antioxidant action of triptolide contributed significantly to its protective effects in stress-related GI dysfunction.[165]

Finally, chlorogenic acid (CGA), known for its antioxidant capacity, showed an indirect antioxidative role by modulating gut microbiota and improving mucosal integrity. Although its primary mechanism was microbiota modulation, the resulting decrease in gut inflammation and oxidative stress was partly attributed to its reactive oxygen species-scavenging action and maintenance of mitochondrial function in epithelial cells.[171]

Taken together, these findings illustrate that phytochemicals, such as flavonoids (galangin, SKN), terpenoids (triptolide), phenolic acids (canolol, CGA), and polyphenols, act as potent antioxidants in the GI tract. By reducing oxidative stress, restoring redox balance, preventing apoptosis, and enhancing epithelial repair mechanisms,

these compounds offer a robust therapeutic approach in the treatment and prevention of oxidative stress-mediated GI disorders.

Gut microbiota modulation

The GI tract hosts a dense and diverse community of microorganisms that play a critical role in maintaining digestive health, regulating immunity, synthesizing vitamins, metabolizing indigestible substrates, and maintaining the mucosal barrier. Disruptions in the composition and function of gut microbiota, termed dysbiosis, have been implicated in the pathogenesis of various GI disorders, including IBS, IBD, PI-IBS, and colorectal inflammation. An emerging area of research highlights the capacity of plant-based natural products to modulate the gut microbiota, leading to significant therapeutic effects.

A key study demonstrated the microbiota-modulating effects of CGA in a PI-IBS rat model. CGA not only reduced clinical markers of inflammation and hypersensitivity but also shifted microbial composition by significantly increasing the abundance of *Bacteroides acidifaciens*. This bacterial strain, in turn, produced extracellular vesicles enriched in glycine. These extracellular vesicles exerted anti-inflammatory effects on colonic epithelial cells by suppressing the NF-κB signaling pathway, ultimately reducing TNF-α and IL-6 expression and restoring intestinal barrier integrity.[171] This study provided a unique mechanism linking polyphenol intake, microbiota composition, and microbial metabolite-driven immunomodulation.

Similarly, berberine, an isoquinoline alkaloid, has shown profound regulatory effects on gut microbiota in multiple experimental models of GI inflammation. In a PI-IBS model, berberine treatment resulted in the downregulation of *Proteobacteria* and pathogenic *Escherichia/Shigella* strains, while promoting beneficial genera such as *Lactobacillus*, *Clostridium IV*, and *Ruminococcus*. This microbiota-reshaping effect was associated with restored intestinal permeability, increased short-chain fatty acid (SCFA) production, and reduced levels of pro-inflammatory cytokines.[172,173] Furthermore, berberine enhanced the expression of tight junction proteins such as occludin and claudin-1, highlighting its combined microbiota- and barrier-restoring function.

Another microbiota-targeted compound is ganoderic acid, derived from *Ganoderma lucidum*. In a Dextran Sulfate Sodium-induced colitis model, oral administration of ganoderic acid enriched beneficial microbial taxa, including *Lactobacillus* and *Oscillospira*, while reducing the abundance of pathogenic bacteria. This modulation was paralleled by improved mucosal morphology, increased expression of tight junction proteins (occludin, claudin-1, ZO-1), and reduced colonic inflammation. Ganoderic acid's dual impact on microbial ecology and barrier function supports its role as a biotherapeutic agent in microbiota-linked gut disorders.[174]

Additionally, costunolide, a sesquiterpene lactone, improved microbial diversity and intestinal permeability in IBS models. It increased the relative abundance of *Bacteroides* while reducing *Escherichia* and *Shigella* spp., alongside upregulating occludin and downregulating claudin-2. Costunolide also improved central nervous system parameters, such as serotonin and norepinephrine levels in the hippocampus, indicating its bidirectional effects on the gut-brain axis.[175]

Piperine, the active alkaloid in *Piper nigrum*, has been shown to not only exert anti-inflammatory and antioxidant effects but also positively influence microbiota composition. In a DSS-induced colitis model, piperine administration increased the levels of *Lactobacillus* and *Bifidobacterium*, decreased *Enterobacteriaceae*, and improved colonic histopathology. Its ability to restore microbial balance was closely associated with its anti-colitic effects.[176]

Cardamonin, a chalcone found in *Alpinia katsumadai*, similarly demonstrated beneficial effects on gut microbiota in IBD models. It improved colonic inflammation, suppressed the NOD-like receptor protein 3 (NLRP3) inflammasome, and increased short-chain fatty acid-producing bacterial genera, which collectively contributed to mucosal healing and immune regulation.[177]

In another study, morroniside, an iridoid glycoside from *Cornus officinalis*, alleviated 5-HT-induced diarrhea and gastric ulcers while modulating hypothalamic-pituitary-adrenal axis activity. Though its primary effect was hormonal, the reduction in colonic inflammation and diarrhea suggests indirect effects on microbiota–gut interactions through neuroimmune modulation.[178]

Taken together, these studies underscore the multifaceted ability of plant-derived compounds to positively modulate the gut microbiota. Phytochemicals such as CGA, berberine, ganoderic acid, costunolide, piperine, and cardamonin not only reshape microbial communities but also influence their metabolites, gut barrier function, mucosal immunity, and even central nervous system signaling. These microbiota-mediated effects represent a critical pharmacological axis in the therapeutic potential of natural products for GI diseases.

Other mechanisms of action

Beyond the primary mechanisms of anti-inflammatory activity, antioxidant defense, microbiota modulation, enzyme inhibition, and mucosal protection, natural products also exert therapeutic effects in GI disorders through several additional pathways. These include modulation of the gut-brain axis, immunomodulatory effects, anti-apoptotic signaling, regulation of GI motility, antimicrobial activity, and nociceptive modulation.

A prominent mechanism in functional GI disorders such as IBS is the modulation of the gut-brain axis. Costunolide, a sesquiterpene lactone, demonstrated gut-brain regulatory effects in a chronic stress-induced IBS model by increasing levels of serotonin (5-HT), brain-derived neurotrophic factor, GluN2A, p-ERK1/2, and p-CREB in the hippocampus. These changes were accompanied by improved colonic architecture and reduced visceral hypersensitivity.[175] Similarly, morroniside, an iridoid glycoside from *Cornus officinalis*, normalized gut-brain communication by reducing the secretion of hypothalamic-pituitary-adrenal axis hormones including corticotropin-releasing factor, adrenocorticotropic hormone, and corticosterone. This modulation helped restore gut motility and reduce stress-induced diarrhea and ulceration.[178] Triptolide also demonstrated multiple beneficial effects in IBS models, including reduction of colonic inflammation and modulation of gut microbiota composition. In a post-inflammatory IBS model, triptolide alleviated visceral hypersensitivity but did not significantly improve anxiety- or depression-like behaviors.[165] However, studies in animal models reported that triptolide improved behavioral test scores,[179] suggesting gut–brain axis modulation through regulation of serotonergic and dopaminergic neurotransmission. Phlorizin, a flavonoid glycoside, alleviated visceral hypersensitivity by inhibiting sodium/glucose cotransporter 1 (SGLT1) expression and blocking corticotropin-releasing factor- and lipopolysaccharide (LPS)-induced epithelial permeability, indirectly supporting gut-brain homeostasis.[180]

Natural products also exhibit significant immunomodulatory effects, helping to balance the immune response and prevent mucosal overactivation. Engeletin, a flavonoid from *Smilax glabra*, suppressed Toll-like receptor 4-NF-κB signaling, reduced the expression of IL-1β, IL-6, and TNF-α, and inhibited macrophage polarization from the pro-inflammatory M1 phenotype. These effects led to a decrease in colonic inflammation in ulcerative colitis models.[170] Berberine promoted immune homeostasis by modulat-

ing the Wnt/β-catenin signaling pathway and restoring gut microbiota balance, leading to reductions in epithelial permeability and inflammatory cytokines in PI-IBS.[173]

Juglone, a bioactive naphthoquinone, demonstrated protective effects in DSS-induced colitis by downregulating NF-κB signaling and mitochondrial stress responses. It increased levels of IL-10 and reduced TNF-α, supporting both anti-inflammatory and immune-regulatory functions.[181] Similarly, sclareol significantly decreased levels of IL-1β, TNF-α, and IL-6 in Crohn's disease models while upregulating tight junction proteins and preserving mucosal structure, indicating immunomodulatory and barrier-stabilizing roles.[182]

Another important mechanism is the anti-apoptotic and epithelial proliferative action of several compounds. Galangin upregulated cytoprotective proteins Bcl-2 and HSP70 while downregulating Bax and caspase-3, reducing cell death and promoting mucosal regeneration in gastric injury models.[168] Canolol similarly reduced apoptosis via inhibition of p38 MAPK, lowering Bax levels and enhancing Bcl-2 expression in gastric mucosal cells.[169] SKN reduced colonic caspase-3 expression and enhanced epithelial survival, likely contributing to its mucosal protective effects.[167] Additionally, Russelioside B upregulated epidermal growth factor and restored HSP70 levels in the gastric mucosa, aiding in epithelial repair and regeneration.[183]

Several natural compounds also play key roles in the regulation of GI motility and secretion. Morroniside accelerated gastric emptying and improved intestinal transit by modulating serotonin signaling, while simultaneously reducing stress-induced diarrhea.[178] Costunolide improved motility in IBS models, possibly via modulation of the enteric nervous system and neurotransmitters.[175] Traditional agents like ginger and peppermint, though not elaborated in the primary dataset, have been widely cited (e.g., Brierley & Kelber, 2011) for their ability to regulate motility through TRP channel modulation and calcium channel blockade.[37]

In terms of antimicrobial activity, berberine demonstrated strong effects against dysbiotic bacteria in IBS models, reducing the abundance of *Escherichia/Shigella* and *Proteobacteria* while enriching beneficial taxa such as *Lactobacillus* and *Ruminococcus*.[172] In a similar vein, 2,3,5,4′-Tetrahydroxystilbene-2-O-β-D-glucoside reshaped the gut microbiota in ulcerative colitis models by lowering the abundance of *Bacteroides* and *Lachnoclostridium*, thereby improving immune parameters and intestinal histology.[184]

Finally, many phytochemicals exert anti-nociceptive effects by modulating sensory neuron activity and inflammatory pain pathways. For instance, galangin downregulated TRPV1, CGRP, and substance P—key nociceptive markers involved in visceral hypersensitivity and gastric pain in models of ethanol-induced mucosal injury.[168] As reviewed by Brierley & Kelber, compounds like gingerol, menthol, and eugenol target TRP channels (e.g., TRPA1, TRPM8), which are responsible for pain and motility regulation in the GI tract.[37] These mechanisms are particularly relevant in IBS, where sensory neuron hypersensitivity contributes to abdominal pain and bloating.

Taken together, these additional mechanisms reinforce the multifaceted pharmacological nature of natural products. By influencing not just inflammation and oxidation but also immune function, neuronal signaling, epithelial regeneration, and microbial ecosystems, plant-derived compounds serve as holistic and promising therapeutic agents in the treatment of GI disorders. Key natural products, their phytoconstituents, and pharmacological activities relevant to GI disorders are summarized in Table 2,[37,164–194] while their integrative therapeutic mechanisms are illustrated in Figure 3.

Clinical evidence and human trials

Recent scientific evaluations have increasingly explored the clinical efficacy of natural products and traditional herbs in treating GI disorders such as IBS, functional dyspepsia, constipation, peptic ulcer, and other functional GI conditions. Multiple RCTs, observational studies, and meta-analyses provide a growing evidence base for their use in routine practice. *Cassia alata* Linn., known for its anthraquinone-rich laxative leaves, was tested in a RCT involving 80 patients with constipation. The study found that 83% of those in the *Cassia alata* group had bowel movements within 24 h, compared to 86% in the Mist. alba group and only 18% in the placebo group, with results being statistically and clinically significant ($p < 0.001$). Mild, self-limiting adverse effects were reported in 16–25% of patients.[195] In IBS management, a notable randomized, double-blind, placebo-controlled trial with 116 patients showed that both standardized and individualized Chinese herbal medicine (CHM) significantly improved symptoms and quality of life versus placebo ($p < 0.05$). Notably, only the individualized CHM group sustained improvements 14 weeks post-treatment.[196]

Further, an Ayurvedic formulation combining *Aegle marmelos* and *Bacopa monnieri* demonstrated 64.9% effectiveness in a six-week double-blind trial with 169 IBS patients, compared to 78.3% with standard therapy and 32.7% with placebo. The Ayurvedic remedy was particularly effective in diarrhea-predominant IBS, although long-term relapse prevention was not observed.[197] The Tibetan herbal formulation Padma-179 also showed promising results in a placebo-controlled trial involving 72 patients with constipation-predominant IBS. It significantly improved abdominal pain, stool frequency, bloating, and overall well-being compared to placebo.[198] In functional dyspepsia, *Curcuma domestica* Val. (turmeric) was tested in a multicenter, double-blind trial with 116 patients. The turmeric group showed an 87% treatment response, outperforming the flatulence remedy group (83%) and placebo (53%). Though mild adverse effects were evenly distributed, patient satisfaction hovered around 50% across all groups.[199] For ulcer management, mastic gum (*Pistacia lentiscus*) demonstrated potent therapeutic effects in a double-blind trial with 38 duodenal ulcer patients. A daily dose of 1 g led to 80% symptom relief and 70% ulcer healing, significantly outperforming placebo outcomes (50% and 22%, respectively; $p < 0.01$). Mastic gum was well tolerated, reinforcing its potential in peptic ulcer treatment.[200]

Moreover, one of the most promising agents is curcumin (turmeric). In a pilot RCT by Bundy *et al*.[201] involving 207 patients, curcumin supplementation (72–144 mg/day for eight weeks) resulted in a ~60% reduction in IBS prevalence and improved quality of life, although pain reduction narrowly missed statistical significance ($p = 0.071$). Similarly, a meta-analysis by Ng *et al*.[202] reviewed five RCTs (three included in the final analysis with 326 patients) and found curcumin safe and potentially beneficial, though not statistically significant, highlighting the need for larger trials. Peppermint oil remains one of the most well-studied natural agents for IBS. Meta-analyses by Ford *et al*.[193] and trials like Cappello *et al*.[203] confirm its effectiveness in reducing abdominal pain, bloating, and global IBS symptoms. The number needed to treat was as low as 2.5, with a favorable safety profile when used in enteric-coated formulations. The poly-herbal formulation STW 5 (Iberogast), composed of nine medicinal plant extracts, has shown efficacy in both IBS and functional dyspepsia. Studies by Madisch *et al*.[204] and Melzer *et al*.[205] reported significant symptom improvement, particularly in pain and bloating. A supporting meta-analysis confirmed STW 5's efficacy, showing it to be comparable or even superior to conventional prokinetics, with good

Table 2. Bioactive natural compounds, their mechanisms, and gastrointestinal applications

S. No.	Compound/source	Bioactive class	Mechanism(s) of action	GI application(s)	Dose/HED*	References
1	Oridonin (*Rabdosia rubescens*)	Diterpenoid	Inhibits NF-κB/iNOS/COX-2/IL-1β/IL-6; activates PXR-CYP3A4	Post-infectious IBS	(20 mg/kg mouse) HED ≈1.6 mg/kg	164
2	Triptolide (*Tripterygium wilfordii*)	Diterpenoid	↓ IL-1, IL-6, TNF-α, ODC1; reduces MDA; improves behavioral symptoms	Stress-induced IBS	100 µg/kg (Clinical caution consensus; toxicity data)	165,179
3	Atractylenolide I	Sesquiterpene lactone	Inhibits JNK/iNOS; ↓ IFN-γ, TNF-α; ↑ occludin, claudin-1	PI-IBS	(10 mg/kg mouse) HED ≈ 0.81mg/kg	166
4	Sakuranetin (SKN)	Flavonoid	↓ COX-2, iNOS; ↑ eNOS, PAX; ↓ caspase-3, NOx; improves survival markers	Colonic inflammation	20 & 40 mg/kg mouse) HED ≈ 1.6–3.2 mg/kg	167
5	Galangin	Flavonoid	↓ MDA, TRPV1, COX-2, Bax; ↑ HSP70, Bcl-2, TJ proteins; ↓ CGRP, SP	Gastric mucosal injury, nociception	(25–50 mg/kg mouse) HED ≈ 2.03–4.05 mg/kg	168
6	Canolol	Phenolic compound	↑ GSH, SOD, CAT; ↓ Bax, p38 MAPK, NF-κB; ↑ Bcl-2	Gastric ulcers	–	169
7	Engeletin (*Smilax glabra*)	Flavonoid	Inhibits TLR4/NF-κB; ↓ IL-1β, TNF-α, IL-6; ↑ occludin, claudin-1	Ulcerative colitis	(10 & 20 mg/kg mouse) HED ≈ 0.81–1.6 mg/kg	170
8	Chlorogenic acid (CGA)	Phenolic acid	↑ *B. acidifaciens*; glycine-EVs ↓ NF-κB; improves barrier	PI-IBS	50 mg/kg mouse) HED ≈ 4.05 mg/kg	171
9	Berberine	Alkaloid	Modifies microbiota; ↓ *Shigella*, ↑ *Lactobacillus*; ↑ TJ proteins; immunomodulatory	IBS, IBD	(900–1,500 mg/day)(commonly adopted clinical dose)	172,173, 185
10	Ganoderic acid (*G. lucidum*)	Triterpenoid	↑ *Lactobacillus*, ↑ occludin, claudin-1, ZO-1; restores mucosa	DSS-induced colitis	1.5–3 g/day standardized extract (human)	174,186
11	Costunolide	Sesquiterpene lactone	↑ occludin, ↓ claudin-2; modulates 5-HT, NE, BDNF, p-CREB (gut-brain axis)	IBS, diarrhea	(5–20 mg/kg mouse) HED ≈ 0.4–1.6 mg/kg	175
12	Piperine (*Piper nigrum*)	Alkaloid	↑ *Lactobacillus*, ↓ *Enterobacteriaceae*; improves colitis histology	DSS-induced colitis	5–20 mg/day (as bioenhancer with curcumin)	176,187
13	Cardamonin (*Alpinia katsumadai*)	Chalcone	Inhibits NLRP3 inflammasome; ↑ SCFA-producing microbiota	IBD	(15–60 mg/kg mouse)	177
14	Morroniside (*Cornus officinalis*)	Iridoid glycoside	↓ CRF, ACTH, corticosterone; improves HPA axis & motility	Stress-induced ulcers, diarrhea	(20–50 mg/kg mouse) HED ≈ 1.6–4.1 mg/kg	178
15	Phlorizin	Flavonoid glycoside	Inhibits SGLT1; ↓ CRF-induced colonic permeability, visceral hypersensitivity	IBS, LPS-induced inflammation	(30–80 mg/kg mouse); HED ≈ 2.4–6.5 mg/kg (oral clinical use limited	180
16	Quercetin	Flavonoid	Inhibits H^+/K^+ ATPase, COX-2, iNOS; ↑ SOD, GSH, CAT; ↓ histamine	GERD	500–1,000 mg/day (human)	188,189
17	*Euphorbia hirta* flavonoids	Flavonoids	Inhibit H^+/K^+ ATPase, COX-2, TNF-α; ↑ catalase	GERD	100 mg/kg mouse) HED ≈ 16.2 mg/kg	190
18	Gallic acid	Phenolic acid	Antioxidant; ↑ mucin	Gastric ulcers	150–300 mg/day (human supplements)	191
19	Russelioside B	Glycosidic saponin	↑ EGF, HSP70; anti-apoptotic	Gastric injury	(20 mg/kg mouse) HED ≈ 1.6 mg/kg	183

(continued)

Table 2. *(continued)*

S. No.	Compound/source	Bioactive class	Mechanism(s) of action	GI application(s)	Dose/HED*	Refer-ences
20	Sclareol (SCL)	Diterpene	↓ IL-6, IL-1β, TNF-α; ↑ claudin-1, occludin; preserves barrier	Crohn's disease	(5 mg/kg mouse) HED ≈ 0.4 mg/kg	182
21	Juglone	Naphtho-quinone	↓ NF-κB, ↑ IL-10, ↓ TNF-α; ↓ apoptosis; modulates microbiota	DSS-induced colitis	(150 mg/kg mouse) HED-toxicity cautions	181
22	TSG (Tetrahydroxystilbene glucoside)	Stilbene	Alters microbiota; ↓ *Bacteroides*, ↑ TJ proteins; modulates IL-6, TNF-α	Ulcerative colitis	(25 & 100 mg/kg mouse) HED ≈ 2.03–8.1 mg/kg	184
23	Gingerol/Menthol/Eugenol	Terpenoid/ Phenolics	Modulate TRP channels (TRPA1, TRPM8); reduce pain and motility disturbances	IBS, visceral pain	Ginger: 1–2 g/day; Peppermint oil (EC): 180–225 mg/day; Eugenol: not used orally as stand-alone due to safety	

*HED estimates derive from commonly used mouse doses unless otherwise noted: HED (mg/kg) = animal dose × (3/37) for mouse → human. Where only human clinical/traditional doses are established (e.g., berberine, quercetin, ginger, peppermint oil), those are shown directly.[194] Safety note: Actual clinical dosing depends on formulation, standardization, bioavailability, and safety. Compounds such as triptolide and juglone are toxic with narrow therapeutic windows; no over-the-counter human dosing is recommended. Use only within controlled research/clinical settings. ↑, increase; ↓, decrease. ACTH, adrenocorticotropic hormone; Bcl-2, B-cell lymphoma 2; BDNF, brain-derived neurotrophic factor; CAT, catalase; CGRP, calcitonin gene-related peptide; COX-2, cyclooxygenase-2; CRF, corticotropin-releasing factor; CYP3A4, cytochrome P450 3A4; DSS, dextran sulfate sodium; EC, epithelial cells; eNOS, endothelial nitric oxide synthase; EVs, extracellular vesicles; GI, gastrointestinal; GSH, glutathione; HPA, hypothalamic–pituitary–adrenal; HSP70, heat shock protein 70; IBS, irritable bowel syndrome; IFN-γ, interferon-gamma; IL, interleukin; iNOS, inducible nitric oxide synthase; JNK, c-Jun N-terminal kinase; LPS, lipopolysaccharide; MAPK, mitogen-activated protein kinase; MDA, malondialdehyde; NE, norepinephrine; NF-κB, nuclear factor kappa-light-chain-enhancer of activated B cells; ODC1, ornithine decarboxylase 1; PAX, paired box protein; p-CREB, phosphorylated cAMP response element-binding protein; PI-IBS, post-infectious irritable bowel syndrome; PXR, pregnane X receptor; SCFA, Short-Chain Fatty Acids; SGLT1, sodium-glucose transporter 1; SOD, superoxide dismutase; SP, substance P; TJ, tight junction; TLR4, Toll-like receptor 4; TNF-α, tumor necrosis factor-alpha; TRPV1, transient receptor potential vanilloid 1; ZO-1, zonula occludens-1.

tolerability.

In an Ayurvedic herbal RCT involving *Murraya koenigii*, *Punica granatum*, and *Curcuma longa*, Lauche *et al*.[206] found no significant difference compared to placebo in managing diarrhea-predominant IBS. However, the preparation was considered safe, with good compliance despite minor adverse events reported in about one-third of participants. CHM was evaluated through a comprehensive meta-analysis and trial sequential analysis involving 10 RCTs and 2,501 participants. CHM significantly improved global IBS symptoms (RR 1.76) and abdominal pain (RR 1.85) but was also linked to a higher rate of adverse events (RR 1.51). The findings were supported by a sufficient sample size and indicate potential efficacy with a need for caution.[59] Probiotics, particularly *Saccharomyces boulardii*, also show promise. In a trial by Choi *et al*.,[207] daily supplementation with nine billion CFU over four weeks significantly reduced stool frequency and improved symptoms in 87.5% of IBS patients compared to placebo. Further, an observational study in Belgium assessed the combined use of berberine and curcumin (Enterofytol® PLUS) in 146 IBS patients. After two months, significant reductions were observed in the IBS severity index (−47.5%), abdominal discomfort, bloating, and transit issues (all $p < 0.0001$). Use of antispasmodics and antidiarrheals declined by over 64%, and 93.1% reported symptom improvement.[208] A broader systematic review by Rahimi & Abdollahi analyzed over 20 clinical studies,[209] concluding that herbal remedies like peppermint oil, STW 5, and CHM are generally effective and well-tolerated for managing functional gastrointestinal disorders. Clinical evidence supports the efficacy and safety of several traditional herbal therapies in managing GI disorders. These findings highlight their potential role as complementary therapies alongside conventional care. However, despite the wide ethnomedicinal use of plants for GI conditions, only a fraction has been evaluated through *in vitro* and *in vivo* studies, and an even smaller number has progressed to clinical validation. This gap is clearly represented in the evidence pyramid (Fig. 4), underscoring the urgent need for systematic scientific evaluation and standardized clinical trials to strengthen their integration into mainstream care.

Safety, toxicity, and herb-drug interactions

Herbal medicine continues to be widely used across the globe for managing GI disorders such as indigestion, constipation, IBS, IBD, and dyspepsia. While the traditional use of herbal remedies offers a promising therapeutic approach, the issues of safety, toxicity, and herb-drug interactions remain critical in contemporary clinical practice. Many herbal therapies are generally well tolerated, such as peppermint oil, curcumin, *Glycyrrhiza glabra*, and Triphala, while mild adverse effects like bloating, flatulence, nausea, or heartburn are frequently reported. Notably, non–enteric-coated peppermint oil may induce gastric irritation,[203] and high doses of curcumin (>4 g/day) can lead to GI discomfort.[210]

Serious toxicological concerns arise from herbs like *Aloe vera* latex and *Cassia angustifolia* (senna), both known to cause nephrotoxicity, electrolyte imbalance, or melanosis coli when used excessively.[211] *Glycyrrhiza glabra* (licorice) is used for dyspepsia and ulcers but can cause pseudoaldosteronism, especially with corticosteroids or diuretics, increasing risks of hypokalemia and hypertension.[212,213] Likewise, turmeric and ginger, though safe in culinary doses, may exert hepatotoxic or uterotonic effects when consumed in excess, particularly in sensitive individuals or during pregnancy.[214,215]

The application of natural products and traditional herbals for GI disorders in special populations, such as pregnant women and

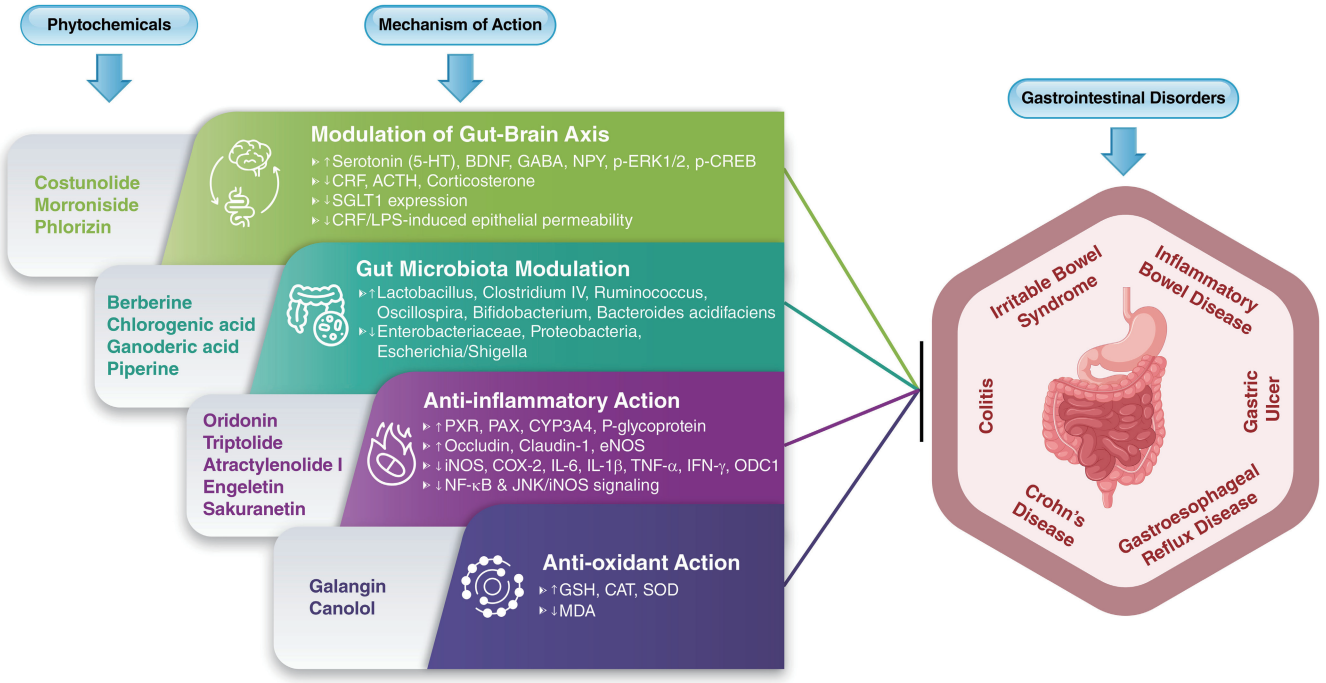

Fig. 3. Mechanisms of key bioactive compounds in modulating signaling pathways involved in gastrointestinal disorders. ↑, increase; ↓, decrease. BDNF, brain-derived neurotrophic Factor; CAT, catalase; COX-2, cyclooxygenase-2; CYP3A4, cytochrome P450 3A4; eNOS, endothelial nitric oxide synthase; ERK1/2, extracellular signal-regulated kinases 1 and 2; GABA, gamma-aminobutyric acid; GSH, glutathione; IFN-γ, interferon-gamma; IL, interleukin; iNOS, inducible nitric oxide synthase; JNK, c-Jun N-terminal kinase; MDA, malondialdehyde; NF-κB, nuclear factor kappa-light-chain-enhancer of activated B Cells; ODC1, ornithine decarboxylase 1; PAX, paired box; p-CREB, phosphorylated cAMP Response element-binding protein; p-NPY, Phosphorylated Neuropeptide Y; PXR, pregnane X receptor; SOD, superoxide dismutase; TNF-α, tumor necrosis factor-alpha.

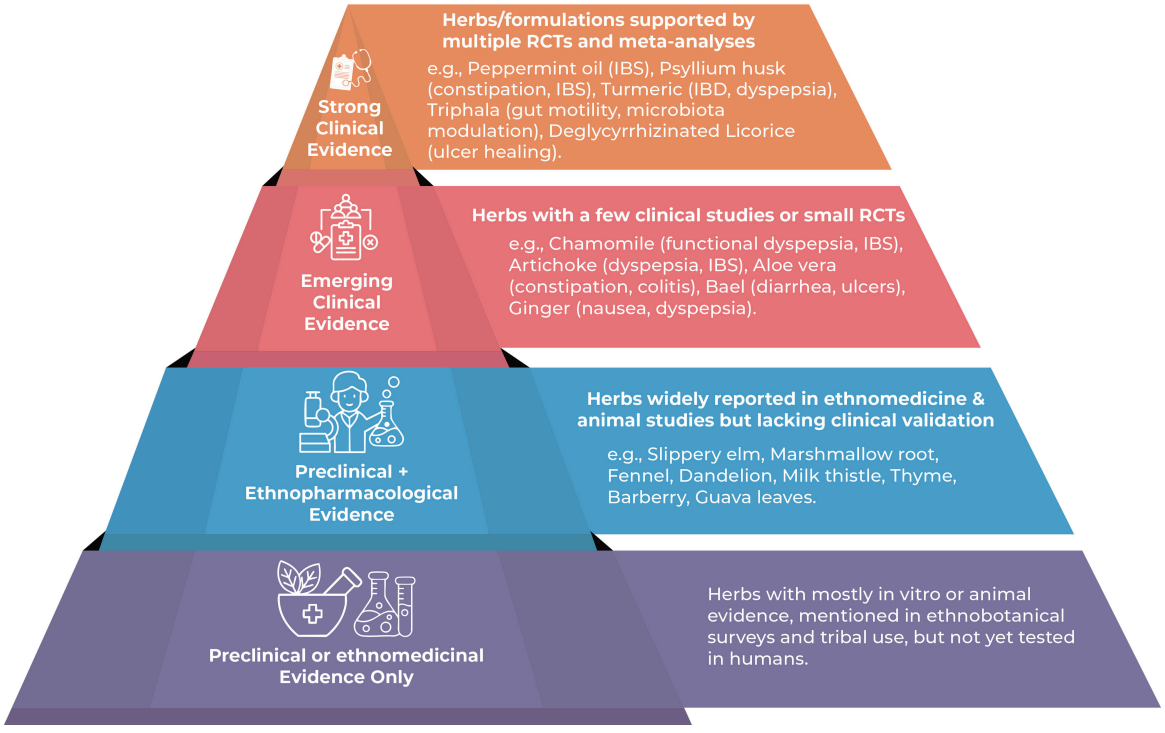

Fig. 4. Evidence pyramid for herbal medicines in gastrointestinal disorders. IBD, inflammatory bowel disease; IBS, irritable bowel syndrome; RCT, randomized controlled trial.

children, requires particular caution due to limited clinical data, potential risks, and substantial data gaps in safety profiles. While many herbal preparations are traditionally prescribed across cultures during pregnancy for digestive complaints such as nausea, constipation, or heartburn, systematic safety data remain scarce.

In pregnancy, several herbs are traditionally used for managing nausea, vomiting, or constipation, but safety is variable. Peppermint oil has shown efficacy in reducing pregnancy-associated nausea, generally with a favorable safety profile in moderate doses, though excessive intake may risk uterine bleeding or miscarriage.[216,217] Ginger (*Zingiber officinale*) has also shown efficacy in reducing pregnancy-related nausea, but concerns remain about dosage and potential bleeding risk.[218,219] Turmeric (*Curcuma longa*) is considered safe in culinary amounts for digestive support, yet high-dose supplementation may exert uterotonic effects and increase bleeding risk.[220,221] Licorice (Glycyrrhiza glabra) is contraindicated in pregnancy, as glycyrrhizin can elevate cortisol, increasing risks of preterm birth, hypertension, and developmental problems.[219,222] Psyllium (*Plantago ovata*) is regarded as safe for pregnancy-related constipation due to its bulk-forming, non-absorbed nature, with minimal adverse effects.[223,224] In contrast, *Triphala*, though widely used in Ayurveda, lacks adequate safety data and is not recommended in pregnancy because its laxative components (e.g., *Haritaki*) may promote downward flow and raise miscarriage risks.[225,226]

In pediatrics, herbal therapies are also frequently employed but require careful evaluation. Peppermint oil demonstrates evidence for reducing spasms and managing functional abdominal pain or IBS in children, with generally good tolerability, though long-term data remain scarce.[227,228] Psyllium husk is safe and effective for pediatric constipation, abdominal pain with IBS and improving GI regularity, and is recommended as a first-line dietary fiber.[229,230] Similarly, fennel (*Foeniculum vulgare*) is used for infantile colic,[231] yet reports of estrogenic effects and rare hepatotoxicity warrant careful monitoring. In pediatrics, herbs like chamomile and peppermint are often given as teas for colic or dyspepsia, though standardized pediatric dosing guidelines are lacking.[232]

Overall, data gaps persist regarding long-term safety, optimal dosing, herb–drug interactions, and age-specific pharmacokinetics in these vulnerable groups. Healthcare providers should prioritize evidence-based guidelines, avoid unsupervised use, and carefully individualize herbal treatments during pregnancy and in pediatric populations to ensure safety.[232]

Herb-drug interactions further complicate clinical use. *St. John's Wort* induces CYP3A4 and can reduce plasma concentrations of PPIs like omeprazole, while curcumin and berberine can inhibit CYP3A4 and P-glycoprotein, raising toxicity risks with drugs such as warfarin, statins, or immunosuppressants.[233,234] Berberine, while effective in microbial modulation, can disrupt gut flora and interfere with cytochrome activity, intensifying risks of adverse interactions.[234]

Alarmingly, contamination with heavy metals, pesticides, or undisclosed pharmaceuticals like corticosteroids has been reported in various herbal products, amplifying toxicological risks.[235,236] In one study from Saudi Arabia, over 76% of herbal medicine users were unaware of potential herb-drug interactions, highlighting the urgent need for awareness programs and physician inquiry during patient history intake.[126] Mechanistically, most interactions involve modulation of hepatic enzymes and transporters, which can lead to subtherapeutic effects or heightened toxicity depending on whether the herb acts as an enzyme inducer or inhibitor.[237]

To ensure safety, healthcare providers must actively screen for herbal use, particularly in vulnerable populations such as pregnant women, neonates, and patients with hepatic or renal compromise. Regulatory measures, including product standardization, contamination testing, and transparent labelling, are crucial.[238] Recent advancements in toxicity prediction using 3D liver cell models and integrated herbal safety databases are steps toward modernizing herbal pharmacovigilance.[239–241] While herbal medicines offer considerable therapeutic promise for GI disorders, their responsible use demands careful risk-benefit analysis, enhanced regulatory oversight, and increased clinician and patient awareness to optimize therapeutic outcomes and minimize harm.

Regulatory and quality control aspects

As the global interest in herbal therapies for GI disorders continues to grow, ensuring the quality, safety, and efficacy of herbal products has become a major concern. The therapeutic success of natural remedies largely depends on their standardization, adherence to regulatory frameworks, and resolution of formulation-related challenges such as stability, consistency, and labeling.

Standardization of herbal preparations is critical for maintaining therapeutic uniformity and consumer trust. Unlike synthetic drugs, which typically consist of a single active pharmaceutical ingredient, herbal products contain complex mixtures of phytochemicals that can vary based on species, geographic origin, harvest time, storage, and processing methods. Standardization involves identifying and quantifying active constituents (e.g., curcumin in *Curcuma longa*, sennosides in *Cassia angustifolia*) using techniques like high-performance liquid chromatography (HPLC), gas chromatography-mass spectrometry (GC-MS), and liquid chromatography/mass spectrometry (LC-MS/MS). It also includes setting quality benchmarks for parameters such as extract ratios, ash values, moisture content, and microbial load. Pharmacopoeial monographs (e.g., the World Health Organization Monographs on Selected Medicinal Plants, Ayurvedic Pharmacopoeia of India) guide standardization, but in practice, only a fraction of marketed herbal products are rigorously standardized. Poor standardization can result in subtherapeutic or even toxic outcomes, especially in sensitive conditions like ulcerative colitis, GERD, or pediatric GI disorders.[242–244]

Globally, regulatory bodies have implemented guidelines for herbal product registration and quality assurance, although frameworks differ significantly across regions. In the United States, the Food and Drug Administration classifies most herbal products as dietary supplements under the Dietary Supplement Health and Education Act (1994). This allows them to be marketed without pre-approval, although manufacturers are responsible for ensuring product safety and truthful labeling.[245]

In India, the Ministry of AYUSH regulates traditional herbal formulations under the Drugs and Cosmetics Act, 1940. It mandates adherence to Good Manufacturing Practices, scientific validation (via Central Council for Research in Ayurvedic Sciences (CCRAS)/AYUSH Research Portal), and compliance with the Ayurvedic Pharmacopoeia of India for raw materials and finished products. In Europe, the European Medicines Agency supports two main regulatory tracks: "well-established use" and "traditional use registration" under Directive 2004/24/EC, which requires data on safety, efficacy, and pharmacovigilance.[244,246] These systems have helped improve the credibility and accessibility of standardized herbal products across the European Union.

Despite regulatory advances, several challenges persist in the formulation and quality control of herbal drugs, particularly when

used in GI applications. One issue is the chemical instability of active compounds such as curcumin and aloin, which degrade rapidly in gastric conditions unless protected by encapsulation or phytosomal systems. Another concern is batch-to-batch variability, which arises from unregulated sourcing of plant materials and inconsistent processing. Adulteration with synthetic drugs (e.g., corticosteroids in anti-diarrheal preparations) or contamination with heavy metals and pesticides further undermines safety.[247] Additionally, there is a lack of uniform labeling standards, with many products omitting details about exact dosages, plant parts used, extraction solvents, or potential herb-drug interactions.[238]

The absence of universally accepted biomarkers for complex mixtures makes it difficult to validate efficacy claims and mechanistic pathways. Regulatory authorities are now encouraging industry stakeholders to adopt modern analytical tools (e.g., DNA barcoding, nuclear magnetic resonance (NMR) spectroscopy, and chemometrics) and post-market surveillance systems to track adverse events and ensure consumer safety. Furthermore, with the rise of global e-commerce in herbal supplements, there is an urgent need for harmonization of regulatory frameworks and cross-border monitoring mechanisms to prevent the proliferation of substandard or counterfeit products.

In conclusion, while herbal medicines hold significant promise for the treatment of GI disorders, their large-scale clinical acceptance depends on robust standardization protocols, adherence to national and international regulatory guidelines, and overcoming persistent challenges related to formulation stability, labeling, and quality assurance. Regulatory reforms, scientific validation, and technological integration must go hand in hand to ensure that natural product-based interventions achieve their full therapeutic potential in modern gastroenterology.

Challenges, emerging trends, and future directions

The use of natural products and traditional herbal remedies in GI disorders is undergoing a profound transformation due to advances in biomedical sciences, biotechnology, and computational tools. While their historical relevance is well-documented, the future of herbal therapeutics in gastroenterology lies in their integration with modern medicine, enhancement through novel delivery systems, and validation using multi-omics and artificial intelligence (AI)-driven approaches. These innovations are not only strengthening their therapeutic value but also paving the way for personalized herbal interventions.

One of the most promising trends is the integration of herbal products into conventional gastroenterological practice, especially for chronic conditions like IBS, IBD, GERD, and peptic ulcers. Modern clinical protocols are increasingly considering evidence-based phytotherapeutics such as *Iberogast*®, *Triphala*, and *Licorice root extracts* as adjunct therapies, particularly where long-term drug use poses risks of adverse effects. A growing number of hospitals and integrative clinics now offer herbal and dietary interventions alongside allopathic regimens, particularly in Asia, Europe, and parts of North America.[248] Additionally, the World Health Organization's Traditional Medicine Strategy (2025–2034) has encouraged countries to incorporate validated herbal remedies into national healthcare systems.[249]

To overcome limitations such as poor solubility, stability, and bioavailability of plant-based actives, researchers are increasingly turning to nanotechnology and advanced delivery systems. Nano-encapsulation, liposomes, solid lipid nanoparticles, and phytosomes have been developed to enhance the GI absorption and targeted delivery of herbal actives like curcumin, berberine, and andrographolide. For example, curcumin-loaded nanoparticles have shown better mucosal penetration and anti-inflammatory action in colitis models than crude curcumin extract.[250] Similarly, phytosomal formulations of *Triphala* and *Boswellia serrata* have demonstrated improved bioavailability and therapeutic performance in clinical settings.[251,252] These systems can protect the active compounds from gastric degradation and facilitate sustained release, enhancing efficacy while minimizing required doses.

Another major advancement is the application of omics-based technologies such as metabolomics, gut microbiome profiling, and transcriptomics to understand the mechanisms of herbal action and host interaction. These approaches are shedding light on how herbs modulate gut microbiota composition, metabolite production (like SCFAs), and immune responses. For instance, berberine's ability to modulate *Lactobacillus*, *Bacteroides*, and *Clostridium* species has been elucidated using metagenomic sequencing.[253] Metabolomic studies have also revealed how polyphenols like CGA influence gut health through microbial metabolites such as glycine-rich extracellular vesicles, which suppress NF-κB signaling and reduce inflammation.[171]

In parallel, AI and machine learning are being employed to accelerate herbal drug discovery, toxicity prediction, and compound-target mapping.[254] AI platforms are now used to screen phytochemical libraries for bioactive candidates, simulate herb–drug interactions, and optimize formulation strategies. Machine learning models trained on network pharmacology data can predict which herbal combinations are most likely to act synergistically on complex diseases like IBD. Recent advances in deep learning algorithms have further enabled virtual screening of thousands of herbal constituents against GI-relevant targets like COX-2, TNF-α, and H^+/K^+ ATPase with high accuracy.[255] These technologies reduce time, cost, and labor in herbal pharmacology while increasing the precision of candidate selection.

Finally, the emergence of personalized herbal medicine guided by genetic profiling and Ayurgenomics marks a futuristic shift in the field. Ayurgenomics is a cutting-edge approach that integrates Ayurvedic "Prakriti" classification with genomics to personalize treatment.[256,257] Individuals with specific genetic markers or microbiome signatures may respond differently to herbal interventions, which can be predicted using polygenic risk scores and single-nucleotide polymorphism (SNP)-based analyses. For instance, variations in genes related to metabolism (e.g., CYP450 polymorphisms) or inflammation (e.g., TNF-α, IL-6) may affect how a patient responds to herbs like licorice or Triphala. Studies integrating Ayurveda with pharmacogenomics are being piloted in India under the Centre for Ayurgenomics and other national research bodies.[257]

In conclusion, the future of herbal medicine in gastroenterology is multidisciplinary, data-driven, and highly personalized. The convergence of traditional knowledge with modern tools—nanotechnology, omics, AI, and genomics—offers exciting new pathways for enhancing efficacy, safety, and acceptance of natural products in GI healthcare. With growing scientific validation and patient demand for integrative solutions, herbal therapeutics are well-positioned to play a central role in next-generation GI treatment paradigms.

Conclusions

This review highlights the therapeutic promise of natural products and traditional herbal medicines in managing GI disorders such as IBS, IBD, GERD, peptic ulcers, and functional constipation. Evidence from phytochemicals, including flavonoids, alkaloids,

terpenoids, polyphenols, tannins, and glycosides, demonstrates diverse pharmacological actions, particularly anti-inflammatory, antioxidant, antimicrobial, immunomodulatory, and mucosal-protective effects. Several herbs and formulations, including licorice (*Glycyrrhiza glabra*), peppermint (*Mentha piperita*) oil, turmeric (*Curcuma longa*), and Triphala, have shown consistent clinical and experimental efficacy, supporting their relevance in both symptom relief and disease modification.

The global surge in demand for herbal medicine, reflected in significant market growth, underscores the increasing acceptance of natural therapies as complementary or alternative options. Advances in modern analytical and molecular techniques are progressively validating the safety and efficacy of these traditional practices, bridging ancient wisdom with contemporary science. Importantly, traditional medicine systems such as Ayurveda, TCM, and Unani offer holistic approaches that align with current trends toward personalized and integrative healthcare.

Taken together, the evidence suggests that natural products and herbal formulations represent valuable therapeutic resources for GI health. Their multifaceted mechanisms of action, cultural acceptance, and perceived safety position them as strong candidates for integration into modern gastroenterology. This review emphasizes that, while scientific validation is ongoing, herbal therapies already demonstrate substantial potential in addressing unmet clinical needs. By distilling insights from traditional knowledge and modern research, natural products can be positioned not merely as complementary options but as integral components of comprehensive, patient-centered GI care.

Acknowledgments

The authors express their sincere gratitude to revered Swami Ramdev Ji for his invaluable support and guidance. They also acknowledge the assistance and cooperation provided by the Patanjali Herbal Research Department, Patanjali Research Foundation, Haridwar, India. Additionally, the authors are thankful to Mr. Uday Juyal for his contribution in providing graphical assistance for this manuscript.

Funding

None.

Conflict of interest

AB holds leadership and ownership interests in Patanjali Ayurved Ltd., a company engaged in the research, development, and manufacture of Ayurvedic and herbal products. DS, RP, AK, and NS are salaried researchers at Patanjali Research Foundation, an independent research institution within the broader Patanjali group structure. The employed authors hold no personal ownership, consultancy roles, or product-specific financial interests, and no commercial entity funded this review. The authors have no other conflicts of interest related to this publication.

Author contributions

Study concept and design (AB), acquisition of data (RP, AK), analysis and interpretation of data (DS, NS), drafting of the manuscript (RP, AK), critical revision of the manuscript for important intellectual content (DS, NS), study supervision, administrative, technical, and material support (VA). All authors have made significant contributions to this study and have approved the final manuscript.

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