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(REVIEW ARTICLE)

Study of constipation activity of *Actinidia deliciosa*, *Ocimum tenuiflorum*, *Piper betle* L., *Adhatoda vasica*

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Abstract

This review examines the anti-constipation properties of four medicinal plants: Actinidia deliciosa (kiwifruit), *Ocimum tenuiflorum* (holy basil), *Piper betle* L. (betel leaf), and *Adhatoda vasica* (Adulsa). Each of these plants has been traditionally used in various cultures to alleviate constipation, and recent studies provide scientific support for their efficacy. The aim of this systematic review is to understand if kiwifruit dietary consumption can effectively improve constipation and intestinal function. When only patients affected by constipation were considered, kiwifruit consumption was likely associated with a short-term significant increase in defecation frequency but not always with significant changes in stool consistency Actinidia deliciosa is rich in dietary fiber and enzymes like actinidin, which enhance gastrointestinal motility. *Ocimum tenuiflorum* exhibits anti-inflammatory and antispasmodic properties, promoting bowel regularity. *Piper betle* L. contains compounds that stimulate digestive enzymes and gut motility. *Adhatoda vasica*, known for its bronchodilator effects, also has laxative properties due to its bioactive constituents. frequency of spontaneous bowel movements (SBM), abdominal painand straining, as well as stool type as determined by the Bristol Stool Scale (BSS). This review consolidates current research findings, highlighting the potential of these plants as natural remedies for constipation and providing a comprehensive evaluation of the effectiveness and mechanisms of these plants in treating constipation. This abstract provides a concise summary of the review's scope, focusing on the plants anti-constipation properties and their scientific validation.

Keywords: Kiwifruit; Actinidia deliciosa; Constipation; Laxative

1. Introduction

Constipation is a common gastrointestinal disorder that significantly affects individuals' quality of life (1). Despite the availability of various pharmacological treatments, there is a growing demand for natural and herbal alternatives due to their perceived safety and holistic benefits. This condition significantly impacts individuals' quality of life, leading to discomfort, pain, and potential complications such as hemorrhoids and anal fissures. Chronic constipation can also contribute to psychological stress and reduce overall well-being, making it a critical health concern that necessitates effective management and treatment strategies.

There is a growing interest in natural and herbal remedies as alternatives to conventional laxatives due to concerns over the long-term use and side effects of pharmaceutical treatments. Conventional laxatives can lead to dependency, electrolyte imbalances, and reduced efficacy over time. In contrast, natural remedies are often perceived as safer and more holistic, addressing not only the symptoms but also contributing to overall digestive health. This interest is driven by an increasing preference for sustainable and integrative health practices, leading researchers and healthcare practitioners to explore and validate traditional herbal treatments for constipation relief. This review focuses on the

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anti-constipation properties of four medicinal plants: Actinidia deliciosa (kiwifruit), *Ocimum tenuiflorum* (holy basil), *Piper betle* L. (betel leaf), and *Adhatoda vasica* (Adulsa), all of which have been traditionally used in different cultures to alleviate constipation.

Actinidia deliciosa is rich in dietary fiber and enzymes like actinidin, which enhance gastrointestinal motility (2) as well as which enhance gastrointestinal motility. *Ocimum tenuiflorum* exhibits anti-inflammatory and antispasmodic properties, promoting bowel regularity. *Piper betle* L. contains compounds that stimulate digestive enzymes and gut motility. *Adhatoda vasica*, known for its bronchodilator effect.

2. Physiology of the digestive system

Digestive system is highly specialized as because the digestive system's role is to break down complex food molecules, absorb nutrients, water, and minerals, and expel indigestible matter. The stomach produces hydrochloric acid and pepsin, an enzyme that breaks down proteins into peptides and amino acids. The small intestine handles digestion and absorption. Bicarbonate, bile, and pancreatic enzymes are released into the proximal small intestine, while enzymes that digest disaccharides are bound to the brush border (3).

The colon is responsible for reabsorbing water(4).The enteric nervous system (ENS) is the primary driver of gastrointestinal motility(5) and is responsible for mechanically propelling digesta through the gastrointestinal tract. This motility includes the low-amplitude motor complex, which mixes contents, and the high-amplitude migrating motor complex (MMC), which is propulsive in nature. Motility is regulated by the release of neurotransmitters. For instance, cholecystokinin (CCK) signals satiation, while gastrin enhances secretion and gastric peristalsis. CCK, released in response to nutrients in the small intestine lumen, also slows gastric emptying and reduces pancreatic secretion. Pressure-sensitive enterochromaffin cells (EC-cells) secrete serotonin, a key regulator of gastrointestinal motility, pancreatic secretion, and visceral sensation(6,7).All four mediators also enhance small intestine motility, with propulsion mainly induced by serotonin. Another neurotransmitter, peptide YY, decreases motility and secretion while regulating the absorption of electrolytes and water in the colon (8, 9).

2.1. Characterization of constipation and IBS

Chronic functional constipation, as defined by the Rome IV criteria, involves having at least two of the following symptoms: hard and lumpy stools, sensation of incomplete evacuation and anorectal blockage, fewer than three bowel movements per week, straining during bowel movements, and the need for manual maneuvers to aid evacuation for more than 25% of the time. It also includes the absence of loose stools without the use of laxatives and the absence of irritable bowel syndrome (IBS) (10).IBS is a chronic functional disorder characterized by recurrent abdominal pain occurring at least once a week in relation to bowel movements. It is accompanied by changes in bowel habits, including alterations in frequency and consistency of stools. Complex pathophysiological mechanisms are involved in functional gastrointestinal disorders like IBS-C and constipation (11, 12).As constipation and IBS-C are considered to be part of the same spectrum, many of these mechanisms are also implicated in constipation. However, due to the intricate interplay of the immune system, gut microbiota, and enteric nervous system (ENS), the pathophysiological mechanisms are interconnected and mutually influence each other.

3. Causes of constipation

The pathogenesis involves multiple factors, emphasizing diet type, genetic predisposition, colonic motility, and absorption, along with behavioral, biological, and pharmaceutical elements(13).Constipation results from various factors, encompassing lower socioeconomic status, parental education, physical activity, medication usage, depression, instances of physical and sexual abuse, and everyday life occurrences(14,15).

Certain medications and physiological states (such as pregnancy and aging) have been shown to elevate the risk of constipation. Additionally, several illnesses are linked with decreased mobility, such as spinal cord injury or musculoskeletal disorders like muscular dystrophy, which are prevalent causes of this ailment. Moreover, certain conditions affecting the large intestine, such as IBS, pelvic floor dysfunction, and depressive disorders, have been observed to disrupt colon movements. It's important to note that the subsequent sections delineate the causes of constipation and related factors.

3.1. Kiwi Fruit

Figure 1 Kiwi Fruit

- Scientific name: Actinidia
- Family: Actinidiaceae
- Chemical Constituents: - epicatechin, quercitrin, rutin, catechin, chlorogenic acid, ferulic acid, and vanillic acid, Actinidin.
- **Description**
  - The kiwifruit, also known as Chinese gooseberry, is the edible berry from various species of woody vines belonging to the genus Actinidia. The predominant cultivar group (Actinidia deliciosa 'Hayward') typically has an oval shape, resembling a large hen's egg, measuring 5–8 centimeters (2–3 inches) in length and 4.5–5.5 centimeters (1+3/4–2+1/4 inches) in diameter. It features a thin, fuzzy, fibrous, tart yet consumable light brown skin and light green or golden flesh containing rows of tiny, black, edible seeds (16).
  - Featuring a soft texture and a distinct sweet flavor, kiwifruit originates from central and eastern China. Its earliest documented description dates back to the 12th century, during the Song dynasty. By the early 20th century, kiwifruit cultivation expanded from China to New Zealand, where the first commercial plantings took place. The fruit gained popularity among British and American servicemen stationed in New Zealand during World War II and subsequently became a common export, initially to Great Britain and later to California in the 1960s.
- **Anti-Constipation Activity of Kiwi Fruit**

Kiwi fruit contains fiber and actinidin, an enzyme that may aid digestion. Eating kiwi fruit can potentially help relieve constipation by promoting regular bowel movements. Additionally, its high water content can contribute to hydration, which is important for bowel function.

- Dietary Fiber: Kiwi fruit is rich in dietary fiber, including soluble and insoluble fiber. Fiber adds bulk to the stool, making it easier to pass through the digestive tract.
- Actinidin: Kiwi fruit contains an enzyme called actinidin, which may help break down proteins and aid indigestion. Improved digestion can contribute to regular bowel movements, potentially relieving constipation.
- Water: Kiwi fruit has a high water content, which helps soften the stool and promote hydration. Adequate hydration is essential for maintaining regular bowel movements and preventing constipation.

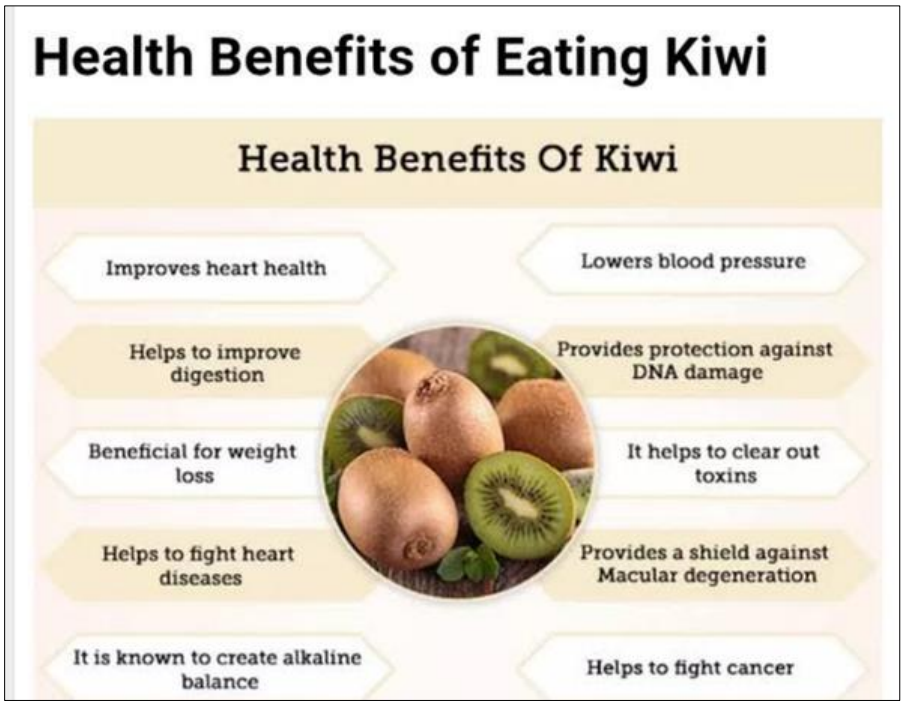

Figure 2 Uses of Kiwi Fruit

3.2. Basil Leaves

Figure 3 Basil Leaves

- **Scientific name**: *Ocimum tenuiflorum*
- **Family:** Lamiaceae
- **Chemical Constituents:** - Eugenol, Estragole, Rosmarinic acid,Ocimene, methyl cinnamate (70.1%), linalool (17.5%), B-elemene(2.6%) and camphor (1.52%).
- **Description:-**
    - Tulsi, grown for religious and traditional medicinal reasons, along with its essential oil, finds extensive utilization. It's a prevalent herbal tea, frequently employed in Ayurveda, and holds significance in the Vaishnava tradition of Hinduism, where adherents engage in worship involving holy basil plants or leaves (17).
    - Holy basil, standing erect as a many-branched subshrub, measures 30–60 cm (12–24 in) in height, boasting hairy stems. Its leaves, either green or purple, exhibit simplicity, featuring petioles and ovate blades up to 5 cm (2 in) long, typically adorned with a mildly toothed margin. Notably aromatic, they adopt a decussate phyllotaxy(18). The purplish blossoms assemble tightly in whorls along elongated racemes. In India and Nepal, three primary morphotypes are cultivated: Ram tulsi (predominant, with broad, vivid green leaves offering a subtle sweetness), the less prevalent purplish-green variety (Krishna or Shyam tulsi), and the ubiquitous wild vana tulsi (e.g., Ocimum gratissimum)(19).

- **Anti-Constipatipation activity of Basil Leaves:**

Basil leaves possess several properties that may contribute to preventing constipation and digestive infections:

- Antibacterial Activity: Basil contains essential oils like eugenol, which exhibits antibacterial properties. These compounds can help combat harmful bacteria in the digestive tract, reducing the risk of digestive infections that could contribute to constipation.
- Anti-inflammatory Activity: Compounds found in basil leaves, such as eugenol and rosmarinic acid, have anti-inflammatory properties. Inflammation in the digestive tract can lead to various digestive issues, including constipation. Basil's anti-inflammatory properties may help reduce inflammation and promote healthier digestive function.
- Promotion of Digestive Health: Basil leaves contain dietary fiber, which adds bulk to the stool and supports regular bowel movements, thus aiding in the prevention of constipation. Additionally, basil can stimulate digestion and alleviate gastrointestinal discomfort.

Incorporating basil leaves into your diet, either by adding them to dishes or consuming them as herbal teas, may help support digestive health and reduce the risk of constipation and digestive infections. However, it's essential to maintain a balanced diet and consult a healthcare professional for personalized advice on managing digestive issues.

Figure 4 Uses of Basil leaves

3.3. Betel Leaves

Figure 5 Betel Leaves

- **Scientific Name:** Piper betel
- **Family:** Piperaceae
- **Chemical Constituents: -** Guvacoline,Arecoline,Guvacine,Arecaidine.
- **Description**
  - A perennial dioecious creeper, its stems semi-woody, ascends through short adventitious roots. Leaves, ranging from 10-20 cm in length, assume a broadly ovate shape, slightly cordate, sometimes uneven at the base, and shortly acuminate. They are smooth, exhibiting a glaucous hue on both surfaces, appearing in bright green or yellowish tones, supported by sturdy petioles measuring 2.0-2.5 cm long. Male spikes manifest as dense cylinders, while female spikes, pendulous and measuring 2.5-5.0 cm in length, rarely yield fruits, typically nestled within the fleshy spike, creating nodular formations. Betel leaf stands out as the utmost prized home remedy for common ailments (20).
- **Anti-Constipation Activity of Betel Leaf**
  - Digestive Aid: Betel leaves have been traditionally used as a digestive aid due to their carminative properties. Chewing betel leaves or consuming betel leaf extracts can stimulate digestion, alleviate gastrointestinal discomfort, and promote healthy bowel movements.
  - Anti-inflammatory Effects: Compounds present in betel leaves, such as eugenol and hydroxychavicol, possess anti-inflammatory properties. By reducing inflammation in the digestive tract, betel leaves may help alleviate symptoms of digestive disorders and prevent complications like constipation.
  - Dietary Fiber: Betel leaves contain dietary fiber, which adds bulk to the stool and facilitates bowel movements. Adequate fiber intake is essential for maintaining regularity and preventing constipation.

Figure 6 Uses of Betel leaf

3.4. Adathoda Vasica

Figure 7 *Adathoda Vasica*

- **Scientific Name:-** *Adhatoda vasica*
- **Family:-** Acanthaceae
- **Chemical Constituents**:- pyrroloquinazoline alkaloids, vasicine vasicol, adhatonine, vasicinone, vasicinol, vasicinolone8
- **Description:-**
  - The leaves of *Adhatoda vasica* are light green with a characteristic odor and a bitter taste, measuring 10-13 cm in length. They are ovate-lanceolate in shape with an acuminate apex, a slightly crenate to entire margin, a symmetric base, pinnate venation, and a leathery texture, as shown in the figure.
  - Microscopic examination of the leaf surface of *Adhatoda vasica* reveals polygonal thin-walled epidermal cells and diacytic stomata. The primary characteristics of the leaf powder include 2-4 celled blunt covering trichomes, sessile glandular trichomes, and acicular and prismatic calcium oxalate crystals (21, 22).
- **Phytochemistry**
  - The leaves have been found to activate the digestive enzyme trypsin. An extract from the leaves demonstrated significant antifungal activity against ringworm. This plant contains alkaloids, tannins, flavonoids, terpenes, sugars, and glucosides. The primary constituents of vasaka are its various alkaloids, with vasicine being the most prominent. The leaves contain two major alkaloids, vasicine and vasicinone, and are rich in vitamin C, carotene, and essential oil..
- **Anti-Constipation Activity of vasaka leaves**
  - Stimulation of Intestinal Secretions: Certain constituents in Vasaka leaves might stimulate the secretion of fluids and enzymes in the digestive tract. Increased fluid secretion can soften the stool, making it easier to pass, while enhanced enzyme activity can aid in the breakdown and digestion of food, promoting overall digestive health.
  - Anti-inflammatory Effects: Vasaka leaves contain compounds with anti-inflammatory properties. Inflammation in the digestive tract can contribute to various digestive problems, including constipation. By reducing inflammation, Vasaka leaves may help alleviate symptoms associated with digestive disorders.
  - Antioxidant Activity: Antioxidants present in Vasaka leaves can help protect the cells of the digestive tract from oxidative stress and damage. This protection may promote overall gastrointestinal health and reduce the risk of digestive system problems.
  - Uses:-
  - *Adhatoda vasica* has been used to treat various disorders such as bronchitis, leprosy, blood disorders, heart problems, thirst, asthma, fever, vomiting, memory loss, leucoderma, jaundice, tumors, mouth issues, sore eyes, fever, and gonorrhea. *Adhatoda vasica* Linn. Also possesses anti-inflammatory, analgesic, anti-diarrheal, anti-dysentery, antioxidant, hepatoprotective, sedative, antispasmodic, anthelmintic, antimicrobial, antidiabetic, wound healing, antifertility, anti-ulcer, antibacterial, antihistaminic, moderate hypotensive, thrombopoietic, cardiac depressant, uterotonic, and abortifacient properties (23, 24).

Figure 8 Uses of Vasaka Leaves

4. Conclusion

The constipation activity of Actinidia deliciosa (kiwi fruit), *Ocimum tenuiflorum* (Tulsi), Piper betel L. (betel leaves), and *Adhatoda vasica* (Adulsa) suggests that these natural substances show promising potential in the management of constipation. Actinidia deliciosa is effective due to its high dietary fiber and actinidin enzyme, which enhance bowel movement and digestion. *Ocimum tenuiflorum*, with its anti-inflammatory and digestive properties, aids in promoting gastrointestinal health. Piper betel L. acts as a digestive stimulant and carminative, improving overall gut motility. *Adhatoda vasica* offers mucilage, which helps in stool softening and eases bowel movements. While these findings are promising, further rigorous clinical trials are necessary to confirm their effectiveness and determine the best practices for their use in treating constipation**.**

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

References

[1] Mearin, F., Lacy, B. E., Chang, L., Chey, W. D., Lembo, A. J., Simren, M. and Spiller, R. (2016).Bowel disorders. Gastroenterology 150:1393–1407.

[2] Ferguson, A. R. and Ferguson, L. R. (2003). Are kiwifruit really good for you? Acta Horticulturae. 610:131–138.

[3] Brownlee, I. A. (2011).The physiological roles of dietary fibre.Food Hydrocolloids. 25:238–250.

[4] Andrews, C. N. and Storr, M. (2011).The pathophysiology of chronic con-stipation. Can J Gastroenterol. 25(Suppl B):16B–21B.

[5] Gershon, M. (2008).Functional anatomy of the enteric nervous system. In:Hirschsprung's Disease and Allied Disorders, pp. 21–49. Springer,Berlin Heidelberg, Germany.

[6] Chen, J. X., Pan, H., Rothman, T. P., Wade, P. R. and Gershon, M. D. (1998).Guinea pig 5-HT transporter: cloning, expression, distribution and function in intestinal sensory reception. Am. J. Physiol. 275:G433–448.

[7] Wade, P. R., Chen, J., Jaffe, B., Kassem, I. S., Blakely, R. D. and Gershon, M.D. (1996).Localization and function of a 5-HT transporter in crypt epi-thelia of the gastrointestinal tract. J. Neurosci. 16:2352–2364.

[8] Spiller, R. C., Trotman, I. F., Adrian, T. E., Bloom, S. R., Misiewicz, J. J. andSilk, D. B. (1988). Further characterization of the 'ileal brake' reflex inman–effect of ileal infusion of partial digests of fat, protein, and starch on jejunal motility and release of neurotensin, enteroglucagon, and peptide YY. Gut. 29:1042–1051.

[9] Okuno, M., Nakanishi, T., Shinomura, Y., Kiyohara, T., Ishikawa, H. andTarui, S. (1992). Peptide YY enhances NaCl and water absorption in the rat colon in vivo. Experientia. 48:47–50.

[10] Barbara, G., Feinle-Bisset, C., Ghoshal, U. C., Quigley, E. M., Santos, J.,Vanner, S., Vergnolle, N.and Zoetendal, E. G. (2016).The Intestinal Microenvironment and Functional Gastrointestinal Disorders.Gastroenterology. 150:1305–1318.e8.

[11] Boeckxstaens, G., Camilleri, M., Sifrim, D., Houghton, L. A., Elsenbruch, S.,Lindberg, G., Azpiroz, F. and Parkman, H. P. (2016).Fundamentals of neurogastroenterology: physiology/motility - sensation. Gastroenterology.

[12] Vanner, S., Greenwood-Van Meerveld, B., Mawe, G., Shea-Donohue, T.,Verdu, E. F., Wood, J. and Grundy, D. (2016). Fundamentals of neuro-gastroenterology: basic science. Gastroenterology 150:1280–1291.

[13] Tack J, Müller-Lissner S, Stanghellini V, et al. Diagnosis and treatment of chronic constipation—a European perspective. NeurogastroenterolMotil 2011; 23:697–710.

[14] Dukas L, Willett WC, Giovannucci EL. Association between physicalactivity, fiber intake, and other lifestyle variables and constipation in astudy of women. Am J Gastroenterol 2003;98:1790–6.

[15] Haug TT, Mykletun A, Dahl AA. Are anxiety and depression related to gastrointestinal symptoms in the general population? Scand J Gastroenterol 2002; 37:294–8.

[16] Guroo I, Wani SA, Wani SM, Ahmad M, and Masodi FA.A Review of production andprocessing of kiwifruit. Journal of food processing and technology, 2017; 8(10): 2.

[17] Bhateja S, Arora G. Therapeutic benefits of holy Basil in general and oral medicine. A Review of International Journal of Research in Ayurveda and pharmacy, 2012; 3(6): 762

[18] Guha, P. "Paan Theke Kutir Silpa Sambhabana" (In Bengali). "Exploring Betel Leaves for Cottage Industry", In: Krishi, Khadya-O- Gramin Bikash Mela –A Booklet published by the Agricultural and Food Engineering Department, IIT, Kharagpur, India 1997; 15-19.

[19] rabind Kumar., Vipin K Garg., Ratendra Kumar., Lubhan Singh., Shivani Chauhan. and Sweety., Pharmacognostic study and establishment of quality parameters of leaves of *Adhatoda vasica*. Linn, Journal of medicinal plants study.1 (3), 35-40(2013).

[20] Sheeba B. J. and Mohan T.S., Antimicrobial activity of *Adhatoda vasica* against clinical pathogens, Asian J. Plant Sci Res.2 (2), 83-88(2012)

[21] Vinothapooshan G. and Sundar K., Wound healing effect of various extracts of Adhatodavasica, IJPB.1 (4), 530-536(2010).

[22] Vinothapooshan G. and Sundar K., Anti-ulcer activity of *Adhatoda vasica* leaves against gastric ulcer in rats, JGPT. 3(2), 7-13(2011)

[23] Kokate C.K., Purohit A.P. and Gokhale S.B., Pharmacognosy, 39th edition, Nirali Prakashan, 2007, ch. 13, pp. 536-537.

[24] Khandelwal K.R.,Practical Pharmacognosy techniques and experiments, Nirali Prakashan, 2010, pp.12.30-12.32.