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Review Article

Efficacy Of Wood Apple in Relieving Constipation: A Comprehensive Review

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ABSTRACT

Constipation, a common gastrointestinal disorder, is often managed through dietary and lifestyle modifications. This review explores the potential of wood apple (*Limonia acidissima*) as a natural remedy for constipation. A traditional Ayurvedic remedy, wood apple is a rich source of dietary fiber, with a notable concentration of soluble fiber that contributes to increased stool bulk and promotes healthy bowel function. The fruit's mild laxative properties and acidic nature aid in softening and lubricating the stool, potentially easing constipation. Although anecdotal evidence and traditional usage suggest its benefits, there is limited scientific research supporting its efficacy. More rigorous clinical studies are required to confirm its role in treating constipation. Nevertheless, wood apple remains a promising natural option, with a good safety profile when consumed in moderation.

INTRODUCTION

• Constipation (Costiveness):

Constipation is a prevalent gastrointestinal disorder characterized by infrequent, difficult, or incomplete bowel movements and is often accompanied by symptoms like hard, dry stools and abdominal discomfort. It affects millions of individuals worldwide, impacting quality of life and overall health.^[1,2] The complexity of constipation's underlying mechanisms ranging from reduced colonic motility and extended stool

transit time to impaired coordination of pelvic floor muscles adds to the challenge of effective treatment.^[3,4] While conventional anti-constipation medications can provide relief, they often come with undesirable side effects such as cramping, diarrhoea, and bloating, and may disrupt the natural bacterial balance in the intestines. Given the limitations of synthetic treatments, there has been growing interest in natural remedies for constipation.^[5,6, 7]

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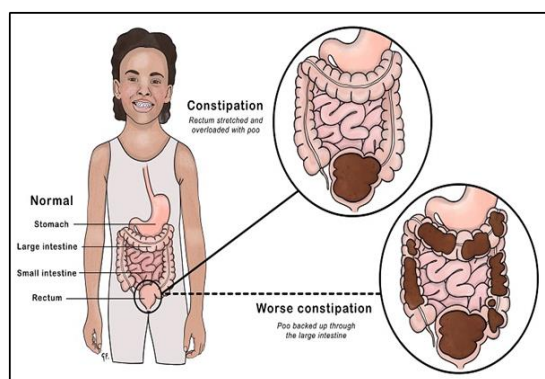


Fig. No.1: Costiveness: GIT

❖ **Objective:**

• **Overview of Constipation:**

A widespread gastrointestinal condition affecting millions worldwide. Characterized by infrequent bowel movements, difficulty passing stools, and

hard or dry stools. Particularly challenging for paediatric and geriatric populations. Prevalence varies significantly across different populations [8,9].

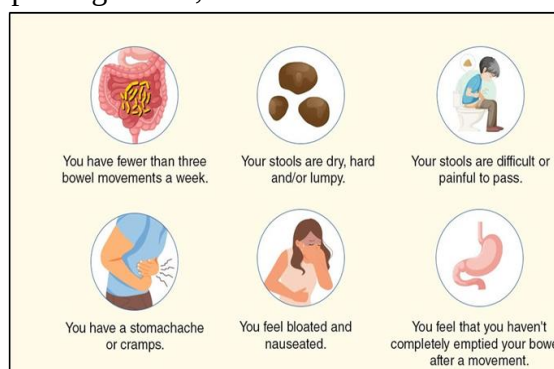


Fig. No.2: Symptoms of Constipation

❖ **Types Of Constipation:**

1. **Functional Constipation:** Common in adults and children (29.6% globally). Occurs without structural or organic abnormalities.

Associated factors: diet, psychological stress, toilet training issues, and family history. Complications include fecal incontinence (up to 84% of cases) and behavioural disturbances.

2. **Chronic Idiopathic Constipation:** Involves persistent, unexplained difficulties with defecation. Significantly impacts quality of life.

3. **Secondary Constipation:** Results from identifiable causes such as medications, systemic diseases, or structural abnormalities.

Requires targeted treatment to address underlying issues. [9, 10,11]

❖ **Side Effects of Anti-Constipation Medications:**

- **Abdominal Cramping:** Caused by stimulation of intestinal contractions. Leads to pain and discomfort.
- **Diarrhoea:** Medications designed to alleviate constipation can sometimes result in loose stools. May exacerbate existing gastrointestinal conditions.

Bloating and Gas: Disruption of the gut's natural bacterial balance. Results in overgrowth of gas-producing bacteria, causing bloating and discomfort.



Fig. No.3: Abdominal Discomfort

❖ A Natural Approach to Constipation: Wood Apple (Beal Fruit):

One promising alternative is *Limonia acidissima*, commonly known as wood apple, a fruit used in traditional South Asian medicine. Wood apple offers a natural, Fiber-rich approach that promotes healthy digestion without the adverse effects associated with synthetic laxatives. Studies have shown that wood apple can improve stool consistency, enhance bowel motility, and support

gut health, positioning it as a potentially valuable tool in managing constipation. This review aims to explore the mechanisms, efficacy, and potential benefits of wood apple as a natural remedy for constipation, drawing comparisons with conventional treatments and examining existing research to assess its therapeutic value.^[15, 16,17]

Synonyms: - *Feronia Ele phantum* Correa, *Feronia limonia* (L.) Swingle, *Schinus limonia* L.



Fig. No 4. Wood Apple (*Limonia acidissima*)

Steel research has confirmed the effectiveness of wood apple to promote constipation. Studies published in Journal 'Journal of Ethnopharmacology' show that apple wood extract improves stool consistency and increases intestinal movements in rats. Another study published in the Journal of Ayurvedic and Integrative Medicine found that wood apple pulp helped relieve constipation in people by promoting bowel regularity and reducing straining during bowel movements disrupting the natural bacterial balance in the gut. ^[18, 19]

• Scientific Classification of Wood Apple:

Table No. 1: Taxonomy

Taxonomy	
Kingdom	Tracheobionta
Sub-kingdom	Tracheobionta
Super division	Spermatophyta
Division	Magnoliophyta
Class	Magnoliopsida
Sub-class	Rosidae
Order	Sapindales
Family	Rutaceae
Genus	<i>Limonia</i> L.

• Historical Significance:

Wood apple has been an integral part of traditional medicine systems like Ayurveda, Siddha, and Unani for many centuries, valued not only for its ability to alleviate constipation but also for its overall digestive health benefits. Its therapeutic properties, including its high fiber content, natural sugars, and ability to balance digestive fire (Agni) in Ayurvedic practice, form the basis of its use. Beyond constipation, wood apple was also used to treat other gastrointestinal issues such as indigestion, bloating, and gas. Its antimicrobial and anti-inflammatory properties were recognized in the treatment of various other health problems^[18, 19]

Table No. 2: Vernacular names of Wood apple

Vernacular names	
English	Wood Apple, Elephant Apple, Monkey Fruit or Curd Fruit
Hindi	Kaitha, Kath Bel , bel ka fal
Sanskrit	Kapittha or Dadhistha
Tamil	Vilam Palam
Bengali	Koth Bel
Oriya	Kaitha
Telugu	Vellaga Pandu
Malayalam	Vilam Kai
Gujarati	Kothu

❖ Phytochemicals And Nutrients Composition:

• Nutritional Composition:

Wood apple fruit is very nutritious and provides valuable moisture, fiber, fatty acids and minerals that are beneficial to human health. Its pulp, which contains 58.89% moisture, promotes quality and longevity. Rich in dietary fiber and low in fat (0.99% crude fat), wild apple pulp oil is rich in polyunsaturated fatty acids (PUFA), including 16.55% β -linolenic acid and 10.02% linoleic acid. These AGIs contribute to flavor production and heart health by reducing LDL cholesterol. The composition of pulp oil includes monounsaturated (23.89%) and unsaturated fatty acids, with obvious health benefits. In addition, the wood apple is a

good source of minerals and vitamins, including vitamin C (up to 900 mg in fresh pulp), riboflavin (170 mg), calcium (up to 130 mg), phosphorus and iron. These nutrients make the wood apple beneficial for a variety of health conditions, offering potential as a food source in fresh or processed form.^[20, 21, 22]

Table No 3. Nutritional composition of Wood apple fruit.

Nutritional Composition	Concentration
Moisture (%)	66.67–72.36
Crude fiber (%)	3.32
Total sugar (%)–	
Saturated fatty acids	32.17
Monosaturated fatty acids	26.20
Polyunsaturated fatty acids	25.78
α -linolenic acid–	16.55
Polysaccharides (%)	
Fructose	16.40
Glucose	14.23
Rhamnose	0.24
Sucrose	0.13
Maltose	0.57
Carbohydrate	5.868–24.74
Minerals (%)	
Phosphorus	46.5–110
Iron	3.5
Amino acids—	
Aspartic acid, alanine, arginine, histidine, isoleucine, glycine, leucine, tyrosine, methionine, glutamic acid, proline, valine, serine, threonine, tryptophan and phenylalanine	----

❖ Phytochemical Composition

It is rich in carbohydrates, dietary fiber, and natural sugars (fructose, glucose), which support energy and regular intestinal transit. It also provides essential vitamins (C, A, B complex) for immune support, vision, and metabolism, as well as minerals (calcium, potassium, iron, magnesium) vital for bone health, fluid regulation, and oxygen transport.



- **Digestive Benefits:** The fruit contains mucilages and organic acids that help soothe the digestive tract, making it effective in improving digestion and relieving constipation
- **Phytochemicals:** The wood apple is rich in bioactive compounds such as tannins, alkaloids, flavonoids, carotenoids, phenols, coumarins, terpenoids, and pectins, which exhibit anti-inflammatory, antioxidant, and antimicrobial properties.
- **Bioactive Compounds:** The fruit and its various parts (roots, stems, leaves, fruits) contain over 100 biologically active compounds like egelin, lupeol, cineol, citral, eugenol, marmelosin, and fagarin. These compounds have medicinal value and contribute to the fruit's health benefits. The wood apple is also used in green synthesis, such as the creation of zinc oxysulfide quantum dots using bael fruit extract, demonstrating its potential in modern scientific applications.^[23, 24, 25]

Table No 4. Phytochemicals composition of wood apple fruit

Phytochemicals composition	Concentration
Alkaloids-Acidisiminin Epoxideepoxide Dihydroxyacidissiminol Acidissiminol N-benzoyltyramine Acidissiminol epoxide Triterpenoid Acidissimin	26.01 µg/mg
Coumarins 6-Methoxy-7-geranyloxy coumarin, Osthenol, Isopimpinellin Xanthotoxin Demethylsuberosin, Psoralen	---

❖ Traditional Use in Constipation Management:

Wood apple, or *Limonia acidissima*, is a tropical fruit indigenous to India, where it has played a vital role in cultural and culinary practices for centuries. Esteemed for its medicinal benefits, culinary flexibility, and spiritual importance, this fruit, commonly known as "Bael," presents a unique combination of sweet, sour, and fragrant flavors. It has long been recognized for its digestive benefits, especially in South Asia, where it is consumed in various forms.^[20, 24, 25]

- **Pulp Consumption:** The wood apple pulp is rich in fiber, which helps regulate bowel movements and promote regular intestinal function. Traditionally, it is eaten raw, added to smoothies, or mixed with water to alleviate constipation.
- **Digestive Health:** The mucilage and organic acids in the fruit are used in traditional remedies to calm the digestive system, reduce inflammation, and ensure the smooth passage of stools, making it beneficial for relieving constipation.
- **Laxative Properties:** In Ayurveda, the wood apple is considered a mild natural laxative. Both its pulp and juice are commonly recommended for constipation, as its fiber content helps bulk up stools and promotes regular bowel movements.

Traditional Remedies: Wood apple has been incorporated into medicinal mixtures such as syrups, powders, and herbal formulations to treat digestive issues, including constipation. The dried fruit is often combined with other herbs to increase its effectiveness.



Fig. No 5. Unripe Wood Apple

The pulp of the wood tree is rich in dietary fiber, which adds volume to the stools and promotes regularity, making it useful for the management of constipation. In addition, it contains ingredients with mild laxative properties, facilitating the passage of feces without causing digestive disturbances. Wild apple is also thought to stimulate digestive enzymes, which promotes efficient digestion and reduces the risk of constipation by preventing from getting stuck in the digestive tract. In addition, its hydrating and electrolyte-rich composition helps maintain water balance, essential for softening stools. The traditional Ayurvedic uses of wood apple aim to balance “vata” disorders, usually associated with dry stools and slow digestion. A typical preparation involves mixing wood apple pulp with water, honey or sour cream to create a sweet and natural drink that gently relieves constipation.^[26, 27,28]

❖ Mechanism Of Action In Constipation Relief

- **Laxative Effects of Wood Apple-** Wood apple is a rich source of dietary fiber, which plays a crucial role in promoting regular bowel movements. Here's how fiber contributes to its laxative effects:
- **Increased Stool Bulk:** Dietary fiber adds bulk to the stool, stimulating the muscles in the intestinal walls. This increased bulk triggers peristalsis, the rhythmic contractions that propel food through the digestive tract.



Fig. No 6. Ripe Wood Apple

- **Increase Water Absorption:** Fiber absorbs water in the intestines, softening the stool. This softer stool is easier to pass, reducing straining and discomfort during bowel movements.
- **Gut Microbiome Support:** Fiber acts as a prebiotic, nourishing beneficial bacteria in the gut. A healthy gut microbiome is essential for optimal digestive function, including regular bowel movements. By increasing stool bulk, softening the stool, and supporting a healthy gut microbiome, wood apple's fiber content effectively relieves constipation and promotes regular bowel habits.

Gut Health Impact of wood apple :-(*Limonia acidissima*) serves as a valuable natural remedy for promoting gut health through its various mechanisms. Its rich dietary fiber content enhances gut motility by stimulating peristalsis and increasing stool bulk, which aids in maintaining regular bowel movements and alleviating constipation. Additionally, the prebiotic fibers nourish beneficial gut bacteria, supporting a balanced microbiome and improving overall digestive health. The presence of flavonoids and antioxidants contributes to its anti-inflammatory properties, which can help manage gastrointestinal disorders. Furthermore, wood apple helps regulate gut pH and exhibits dual effects in managing both constipation and diarrhea. Overall, incorporating wood apple into a balanced diet can effectively support digestive function and promote gut health.^[28, 29,20]

❖ Marketed Products



Fig no 7. Bale Swaras



Fig no 8. Bale Fruit Powder

❖ Scientific Studies And Clinical Evidence:

• In- Vitro and In -Vivo Studies:-

While specific studies on wood apple (*Limonia acidissima*) directly related to constipation relief are limited, there are several in vitro and in vivo studies examining its components and their effects on digestive health:

A study published in the **Journal of Pharmacognosy and Phytochemistry** analyzed the phytochemical constituents of wood apple, identifying significant levels of dietary fiber, tannins, and flavonoids. These compounds are known for their potential to improve gut health and may contribute to alleviating constipation through their laxative effects.

- **Animal Studies:** Research on related fruits with similar properties, such as the influence of fiber-rich diets on gastrointestinal motility, provides indirect evidence for wood apple's benefits. For instance, studies have shown that high-fiber diets can enhance gut motility and reduce constipation in rodent models, suggesting that wood apple may offer similar benefits due to its fiber content.^[31]
- **Tannin Effects:** Tannins, which are present in wood apple, have been studied for their astringent properties. A study in the **African Journal of Pharmacy and Pharmacology** indicated that tannins can reduce water absorption in the intestines, potentially leading

to softer stools, which may aid in relieving constipation.^[32]

❖ Clinical Trials

There is a scarcity of direct clinical trials specifically investigating wood apple's effects on constipation in humans. However, some studies on related dietary interventions provide context for its potential benefits:

Dietary Fiber and Constipation: A meta-analysis in **The American Journal of Clinical Nutrition** reviewed the effects of dietary fiber on constipation and found that increased fiber intake significantly improves bowel frequency and stool consistency. Given that wood apple is high in dietary fiber, its consumption may similarly contribute to improved bowel health.

Traditional Medicine Surveys: Research that focuses on the use of traditional medicines, including wood apple, in various cultures suggests its use for digestive issues. A study in **BMC Complementary Medicine and Therapies** documented ethnobotanical uses of wood apple in traditional practices for treating digestive disorders, which supports its historical application in managing constipation.

Clinical Case Reports : Although not large-scale clinical trials, anecdotal evidence from case reports or smaller studies may document individual responses to wood apple in managing constipation. Such reports could offer insights into its efficacy and the mechanisms behind its effects, though more rigorous trials are needed to substantiate these claims.^[33, 34]

❖ ADVANTAGES

1. **High Fiber Content:-** Wood apple is rich in dietary fiber, which adds bulk to the stool, promoting regular bowel movements and easing constipation.
2. **Natural Laxative:-** The fruit possesses natural laxative properties, which can help stimulate peristalsis (the contractions that move food through the intestines), thereby facilitating easier stool passage.
3. **Prebiotic Benefits:** Wood apple acts as a prebiotic, supporting the growth of beneficial gut bacteria. A healthy gut microbiome is essential for optimal digestive health and can improve overall bowel function.
4. **Anti-inflammatory Properties:-** The flavonoids and antioxidants present in wood apple may reduce inflammation in the digestive tract, which can help alleviate discomfort associated with constipation.
5. **Versatile Usage:-** Wood apple can be consumed in various forms, such as fresh fruit, juice, or in culinary dishes, making it easy to incorporate into the diet.
6. **Minimal Side Effects:-** As a natural food source, wood apple is generally well-tolerated, with few side effects when consumed in moderation.^[28, 29]

❖ DISADVANTAGES

1. **Limited Research:** While there is anecdotal evidence supporting the use of wood apple for constipation, there is a lack of extensive clinical studies specifically targeting its efficacy in humans.
2. **Individual Variability:** The effectiveness of wood apple may vary from person to person. Some individuals may not experience significant relief from constipation or may require additional treatment options.
3. **Potential Gastrointestinal Distress:** For some people, consuming high-fiber foods like wood apple may lead to gastrointestinal discomfort, such

as bloating or gas, especially if introduced suddenly into the diet.

4. **Not a Quick Fix:** While wood apple may help relieve constipation, it may not provide immediate results for everyone, especially in cases of severe constipation that might require medical intervention.

5. **Allergic Reactions:** Some individuals may be allergic to wood apple or other fruits in the same family, leading to adverse reactions. It is important to be cautious if trying it for the first time.

6. **Sugar Content:-** Wood apple contains natural sugars, which may be a consideration for individuals monitoring their sugar intake, such as those with diabetes^[35]

❖ CONCLUSION

Anti-constipation drugs, while effective, often come with side effects like cramping, diarrhea, bloating, gas, and potential allergic reactions. These risks make natural remedies like wood apple an appealing alternative. With its high fiber content and natural laxative properties, wood apple offers a safer, gentler solution to constipation. Incorporating wood apple into one's diet can promote digestive health, prevent constipation, and improve overall gastrointestinal function, making it an excellent natural choice for constipation relief. While further research is needed to fully understand the mechanisms and efficacy of wood apple for constipation, the available evidence suggests its potential benefits as a natural remedy. The fruit's high fiber content, acidic properties, and potential laxative effects may contribute to improved bowel function. However, it is essential to use wood apple in moderation and consult with a healthcare professional for personalized advice.

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