

Research Article

CONSTIPATION-A MAJOR HEALTH DISORDER: ROLE OF HERBAL MEDICINE TREATMENT

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ABSTRACT

This literature review paper highlights the application of herbal medicine in the treatment of constipation health disorder. **Constipation** is a common gastrointestinal tract disorder which can result in the infrequent stools, difficult stool passage with pain and stiffness. Constipation refers to a situation where bowel movements are hard or become infrequent or difficult stool passage leading to **Irritable bowel syndrome (IBS)**. This is essentially a digestive problem and affect people of all the ages. The common cause of constipation might be related to lack of proper diet, lack of adequate fluid, long term use of medications, lack of adequate physical activity, age related, and might due to serious illness. Conventional treatment includes the use of laxatives to remove stools. The regular use of such chemical-based drugs can imbalance body metabolism and affect the digestive system. Natural plant products rich in fiber, melatonin and anthraquinones are important for the prevention and treatment of gastrointestinal disorders. **Ayurveda** recommends a holistic approach to treat constipation. **The Ayurvedic treatment** for constipation requires the use of herbal formulations. Medicinal plants possess a significant laxative potential and support their folklore. In addition to natural laxatives, an Ayurvedic diet, exercise, and massage are key elements of maintaining a healthy digestive system. This literature review paper listed some of the medicinal plants with **laxative properties** in a single platform as a herbal remedy for the constipation problem.

Keywords: Ayurveda, bowl movement, constipation, irritable bowel syndrome (IBS), herbal medicine, laxatives. Rome I, II, III criteria, stool passage.

INTRODUCTION

Constipation is a common functional gastrointestinal disorder that affects patients of all ages (1-10). Constipation could be resulted in the unsatisfying defecation, infrequent stools, difficult stool passage or both with pain and stiffness (1-20). Acute constipation may cause closure of the intestine, which may even requires surgery (10-25). They may need to spend more time in the toilet as passing stools becomes a difficult process. Some people experience a feeling of an incomplete bowel movement and feel a blockage. When the stools are too hard, there is more strain on the muscles in the rectum. Therefore, history of the patient and physical examination can be considered as the main initial approaches for the identification of the constipation (1-33). Chronic constipation is a complicated condition among older individuals, which is characterized by difficult stool passage (1-30). Constipation among older people is far more common than younger people (1-35). Common causes of constipation in the elderly people are linked to several factors including lack of normal bowel movements or aging, lack of proper diet, low-fiber food consumption, lack of adequate fluid intake, lack of adequate physical activity, illness or the use of drugs (1-38). Moreover, severe constipation is markedly seen in elderly women as compared with that of male individuals (1-25). Occasional episodes of constipation can also be occurred due to consumption of food that is difficult to digest. Constipation episodes may even occur as a side effect of taking certain medications. Some people experience constipation when they travel or are away from their homes. Since these happen infrequently, and these episodes do not pose a serious problem. When constipation starts to occur regularly, then it is a matter of concern. Any person constipated for more than three days a

week, then a doctor is likely to diagnose that person is suffering from **chronic constipation**. Constipation causing toxins in the colon should not be taken lightly as purgatives. These toxins can have detrimental effects not just the colon but on a few other organs.

Therefore, diagnostic and therapeutic options are important for the treatment of chronic constipation (1-25). Chronic constipation should be managed according to its etiology and guided by the best evidence-based treatment (1-40). According to the Rome III criteria, a standardized definition of Functional Constipation is presented as follows (44, 49). Functional gastrointestinal (GI) disorders, such as irritable bowel syndrome (IBS), functional dyspepsia, chronic constipation, pose an extensive healthcare burden and negatively affect the quality of life (44, 49).

Current treatments for the constipation include pharmacologic agents such as laxatives (Osmotic laxative- **Polyethylene glycol (PEG)**; Stimulant laxative - Bisacodyl - polyphenolic), Direct or Indirect Chloride Channel Activators (**Lubiprostone and Linaclotide**), and non-pharmacologic therapies such as biofeedback, Sacral nerve stimulation, and surgery (1-40). Newly developed Serotonergic agents (**Tegaserod and Prucalopride**) have overcome limitations, and have shown superior clinical results (1-25). In addition, a guanylate cyclase-C agonist has been reported to improve the symptoms of constipation, and its high efficacy has been verified (1-40). Other new agents under evaluation include the bile acid transporter inhibitors, antibiotics, and probiotics (1-40). Non-pharmacologic therapies have been attempted for treating defecatory disorders and intractable constipation (1-30).

Constipation might be related to drug. The long term use of certain medications can also resulted in the constipation. Diabetic older patients (60 to 70 age group) with long term medication of higher dose (1000mg) of Metformin suffers from constipation. Both metformin and **JANUVIA** (Sitagliptin phosphate tablets) medication combinations were used for the treatment of type-2 diabetes. However, **JANUVIA** (Sitagliptin phosphate tablets) can cause

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serious side effects, such as constipation including pancreatitis, which may be severe and lead to death. Another medication combination **Acetaminophen** and **codeine** may also cause side effects such as constipation. The combination of acetaminophen and codeine is used to relieve mild to moderate pain. Acetaminophen is in a class of medications called analgesics (pain relievers) and antipyretics (fever reducers). **Ketorolac**, sold under the brand names **Toradol**, and **Biorolac** among others, is a nonsteroidal anti-inflammatory drug used to treat pain. Specifically it is recommended for moderate to severe pain. However, **Ketorolac** medication also causes constipation, stomach ache, and stomach upset.

Constipation leading to **three bowel movements** a week, stools are dry, hard and/or lumpy, stools are difficult or painful to pass, stomach ache or cramps, and feel bloated and nauseous (1-30). Constipation happens because colon absorbs too much of water from waste (stool/poop), which dries out the stool making it hard in consistency and difficult to push out of the body (20-40). Food normally moves through the digestive tract, nutrients are absorbed (1-27). The partially digested food (waste) that remains moves from the small intestine to the large intestine, also called the colon. The colon absorbs water from this waste, which creates a solid matter called stool (1-22). In case of diabetic patients with constipation, food may move too slowly through the digestive tract. This gives the colon more time to absorb water from the waste. The stool becomes dry, hard, and difficult to push out (1-40).

Constipation health problem in India

According to the Indian health experts, people in India often shy about talking about their bowel movement (22-40). For instance, an issue as serious as constipation is never talked about openly, people are mostly embarrassed to discuss it in open or make jokes about it (22-30). Constipation is a common digestive issue in which people suffer with infrequent bowel movement or face tremendous difficulty in passing stool (22-40). According to a latest Indian survey, nearly 22 per cent of India's adult population suffers from constipation and Kolkata tops the charts with 28 per cent respondents suffering from it (22-40). Constipation is a problem faced by people across ages, from elders to youth to middle-aged population. These findings suggested that 22 per cent of the adult Indian population is suffering from the condition, with 13 per cent complaining of severe constipation. Furthermore, 6 per cent of the Indian population suffers from constipation associated with certain comorbidities, healthcare firm Abbott said in its Gut Health Survey (22-40). One population based study from India in only 505 people found the prevalence of constipation by the Rome II criteria to be 16.8% and self-reported constipation to be reported is 24.8% (24). Another study gives some estimate about constipation predominant Irritable Bowel Syndrome (IBS-C) (22-40). However, the true prevalence of constipation in the larger Indian population is not known due to lack of a uniform definition of constipation (24). Normal stool frequency and form is also determined by geographic and ethnic factors and so varies between population (22-40).

Chronic constipation significantly impacts people's quality of life due to lack of sleep, and mental and physical stress, compared to those who do not have constipation, according to the "Gut-Health Survey" (22-40). According to the Indian health experts, 14% of India's urban population suffered from chronic constipation, an inability to pass stool for more than three times a week and for more than three months at a stretch (22-40). These findings showed that 60% of people with chronic constipation opted for home herbal remedies as the most preferred treatment option for relief (22-40). The Indian Motility and Functional Diseases Association and the Indian Society of Gastroenterology developed this evidence based practice guideline for management of chronic constipation (22-40).

Most Indians with chronic constipation (80 per cent) looked for a solution only after facing issues multiple times and the average time taken to visit a doctor was 80 days from the time they first started suffering from the symptoms (22-40). This is due to the fact that 60 per cent of the patients opted for home herbal remedies for some relief. "Many of the patients would try popular home herbal remedies but they will provide relief only in the case of mild constipation (22-40). For moderate to severe constipation, one needs to approach a physician for treatment. While there is no definite treatment for constipation, treatment includes laxatives and a drug known as Polyethylene glycol (PEG), which is prescribed twice every night and every morning for complete evacuation of the bowels or stool (22-40).

Symptoms of Constipation

1. Passing fewer than three stools a week. or Three bowel movements a week.
2. Having lumpy or dry and hard stools.
3. Straining to have bowel movements.
4. Feeling as though there's a blockage in rectum that prevents bowel movements.
5. Feeling as though cannot completely empty the stool from rectum.
6. Needing help to empty the rectum, such as using hands to press on patients abdomen and using a finger to remove stool from the rectum.
7. Stomach ache or cramps.
8. Feel bloated and nauseous.
9. Loose stools are rarely present without the use of laxatives.
10. There are insufficient criteria for diagnosis of irritable bowel syndrome.
11. Person releases smelly farts (Smelly flatulence). Passing gas, especially very smelly gas, can be an embarrassing problem.
12. Constipation can also cause smelly gas, along with bloating and abdominal discomfort. **It happens when stool builds up in the colon, unable to exit, and bacteria continues creating gas.** Dehydration, diet, and certain medications can lead to constipation resulting in smelly gases to occur alongside. This extra smelly gas may cause bloating and discomfort.
13. High-fiber foods are difficult to digest. These slow-digesting foods break down or ferment in the digestive tract. The fermentation process produces odorous gas. High-fiber foods often also contain more sulphur than other types. This can cause the makeup of a person's fart to change to include more sulphur, which has a distinct odour and will cause the person to produce smellier gas.
14. The digestive tract is responsible for breaking down foods into usable nutrients, which are absorbed into the blood. It also produces waste, which is passed through the colon. The digestive tract relies on its resident good bacteria. At times, the levels of bacteria in the digestive tract may become imbalanced, potentially leading to an infection. The infection will often cause smelly, excessive gas.

Causes of Constipation

Constipation most commonly occurs when waste or stool moves too slowly through the digestive tract or cannot be eliminated effectively from the rectum, which may cause the stool to become hard and dry. Chronic constipation has many possible causes (1-40). Following are the few causes of constipation.

1. **Lack of fiber food or** Low-fiber food consumption (Inadequate consumption of fruits, vegetables, and other foods containing fibers). No sufficient drinking water or liquids (dehydration). In

- these cases, constipation is usually not a serious problem and can be controlled (1-40). This is called as diet related constipation.
- Studies have indicated that a **High-fiber diet** can increase stool weight, resulting in a decreased colon transit time, while poor fiber diet induces constipation (1-25).
 - Diseases and conditions as secondary cause of constipation:** Patients suffering from diabetes, cancer, neurological disorders, psychological conditions such as depression, anxiety and eating disease, myopathic disorders, and anorectal disorders may cause constipation (1-40).
 - Medications:** Several constipation-causing medications are indicated as causative agents of constipation including, diabetes drugs metformin, **JANUVIA** (Sitagliptin phosphate tablets), antipyretic drugs (e.g., morphine and codeine), **Acetaminophen** and **codeine**, **Ketorolac (Toradol)**, and **Biorolac**, anticholinergic drugs (Hyoscine), antidepressants (Imipramine and fluoxetine), antiepileptic drugs (e.g., phenytoin and carbamazepine), antipsychotics (haloperidol and clozapine), food supplements containing iron and calcium (1-40).
 - On the other hand, some blood pressure-lowering drugs, lipid lowering drugs, muscle relaxant drugs, anti-ulcer drugs, antihistamines, and antioxidants (i.e., drugs containing aluminum and calcium) are commonly associated with constipation (1-40). Continuous consumption of opioids leads to chronic constipation in addicts. Hence prolonging the duration of excretion in the intestine, causing constipation (1-40).
 - Socioeconomic status:** The impacts of socioeconomic status and educational level on the prevalence of constipation have been reported in most studies (10-30). Low-income people are more likely to suffer from constipation than their richer counterparts (12, 13, 20-40). On the other hand, a reverse correlation between parental education and the incidence of constipation has been demonstrated in a number of investigations (12, 13). The socioeconomic status and educational level seem to be associated with these conditions in many developing countries (1-22, 12, 13).
 - Economic impact and the health-related quality of life:** Diagnosis and treatment of constipation impose a significant cost to the individual and the healthcare system, while constipation prevention programs will lead to cost savings (1-22, 12, 13).
 - Causes of chronic constipation:** Blockages in the colon or rectum may slow or stop stool movement. Causes include: A) Tiny tears in the skin around the anus (anal fissure). B. A blockage in the intestines (bowel obstruction). C. Colon cancer. D. Narrowing of the colon (bowel stricture), E. Other abdominal cancer that presses on the colon. E. Rectal cancer. F. Rectum bulge through the back wall of the vagina (rectocele). G. Colorectal cancer (blood in the stool) (1-40).
 - Stool that can't be expelled (Fecal impaction):** Chronic constipation may cause an accumulation of hardened stool that gets stuck in intestines (1-40).
 - Eating large amounts of milk or cheese related food (1-40).

Prevention of constipation

The following can help to avoid developing chronic constipation.

- Consumption of high-fiber foods** in diet, including beans, vegetables, fruits, whole grain cereals and bran. Consumption of a well-balanced diet with plenty of fiber is one of the best home based remedy for the constipation. Good sources of fiber are fruits, vegetables, legumes, and whole-grain breads and cereals. Fiber and water can help the colon to pass the stool. Most of the fiber in fruits is found in the skins, such as in apples, and orange. Fruits with seeds like strawberries, have the most fiber. Bran is a great source of fiber. Eat bran cereal or add bran cereal to other foods, like soup and yogurt. People with constipation should eat between 18 and 30 grams of fiber every day (1-40).
- Eat fewer foods with low amounts of fiber such as processed foods, and dairy and meat products. **Ayurveda** recommends the use of warm and cooked foods to be consumed. Cold drinks and cold food should be strictly avoided.
- Drink plenty of fluids. Drink 10-15 glasses of water a day. (Note: Milk can cause constipation in some people.) Liquids that contain caffeine, such as coffee and soft drinks, alcohols can dehydrate the patient. Therefore, stop drinking these products until bowel habits return to normal.
- Stay as active as possible and try to get regular exercise. Physical activity is important to improve body metabolism. Avoid sitting in one place for a long time. **Exercise** regularly and take a short walk after a heavy meal. Yoga can be very helpful in the treatment of constipation. It provides relief from gas and bloating. It can also help in correcting imbalances and allowing smooth passage of stools.
- Try to manage stress.
- Don't ignore the urge to pass stool.
- Try to create a regular schedule for bowel movements, especially after a meal.
- Make sure children who begin to eat solid foods get plenty of fiber in their diets.
- Sleep is very important to treat any disease since sleep **rejuvenates** the body. A good night's sleep for six to eight hours is recommended to feel refreshed and stimulate body metabolism.
- Try to follow a regular routine for waking up, sleeping, eating food, and passing stools. This can be helpful in solving the problem of constipation.
- Warm water should be taken frequently. It is very important to drink a lot of water so that the stools turn soft and can be easily passed out.
- Food prepared should be warm and freshly cooked. The use of spices like garlic, turmeric, cumin, and asafoetida is recommended. It is suggested to use ghee or organic oils while cooking. Fried food, processed food, spicy food, and non-vegetarian food must be avoided.
- Wheat, green gram, fruits and vegetables rich in fiber content, and green leafy vegetables should be consumed. Apples, bananas, guavas, figs, oranges, and spinach should be a part of the diet to treat constipation

Drugs used for the treatment of Constipation

- The dietary modifications and lifestyle, bulking agents, stool softeners, osmotic laxatives (Lactulose and Polyethylene glycol - PEG), stimulant laxatives (bisacodyl, Senna, Cascara and sodium picosulfate -SPS; Senna and Cascara can frequently be found in herbal remedies or tea). Prucalopride and probiotics were used in the management of chronic constipation (1-40).
- Several studies reported that fiber supplements could improve bowel symptoms in patients with chronic constipation. Supplements and/or an inexpensive osmotic agent have been introduced for constipation (e.g., milk of magnesia 1 or twice daily, or polyethylene Glycol (PEG) 17g daily).
- A new agent is required when the laxatives are not effective in reducing symptoms; therefore, Lbiprostone and Lnaclotide can be considered 2 favourable drugs. Prucalopride has been described as a selective high affinity 5-HT₄ receptor agonist, which works

as a stimulator of gut motility. It is suitable for removing the main symptoms of chronic constipation (1-40).

- Colchicine is an alkaloid substance, which is used as an anti-inflammatory agent. It can increase the frequency of bowel movements, where it may be prescribed as a remedy for the treatment of chronic constipation. Alvimopan and methylnaltrexone have been recently suggested as new agents for the treatment of constipation caused by opioid. However, trials of alvimopan in the confirmed use of methylnaltrexone in opioid-induced constipation represent seriously dangerous cardiovascular causes with opposite results in terms of efficacy. FDA has already warned about the drugs Alvimopan and methylnaltrexone (1-25).

Constipation: Diagnosis

- Clinical exact history is sufficient to identify the disease or medications that may be involved in constipation. Clinical evaluation should be taken into consideration to identify specific symptoms of constipation (alarming symptoms), medical history, and organic causes, as well as medications.
- Colon cancer** screening should be conducted at the early stage.
- Patient medications can be adjusted to prevent those with constipating effects. Fiber and/or over-the-counter laxatives (polyethylene glycol, sodium picosulfate, or bisacodyl) may be initiated.
- Diagnostic colonoscopy is only necessary in individuals with alarm symptoms (i.e., blood in stools, anemia, rectal bleeding, inflammatory bowel disease, rectal prolapse, obstructive symptoms, weight loss, etc.) or in patients who have to undergo colorectal cancer screening.
- Anorectal manometry (or ARM) is a diagnostic procedure.
- The balloon expulsion test (BET).
- A barium Enemas is a colon X-ray procedure to define changes or anatomic abnormalities of colon used in clinical evaluation and diagnosis of organic disease.
- Defecography and magnetic resonance defecography (MRD) test.
- Colonic transit study: In this procedure, patients may swallow a capsule that contains either a radiopaque marker or a wireless recording device. The progress of the capsule through colon will be recorded over several days and be visible on X-rays.
- Surgical treatment.

Constipation: Role of Herbal medicine treatment

Ayurveda is a holistic approach to health and wellness that emphasizes balance between body, mind, and spirit. It's one of the oldest and the most respected medicinal traditions in the world. Today, *Ayurveda* is practiced widely, both in India where it originated and around the world (41-83). *Ayurveda* focuses on preventing disease, so its approach to treating constipation encompasses a whole range of healthy choices, rather than focusing solely on laxatives and immediate relief (41-83). In addition to natural laxatives, an *Ayurvedic* diet, exercise, and massage are key elements of maintaining a healthy digestive system. Some *Ayurveda* practitioners confirmed that constipation is related to an excess of cold and dry elements in the body remedied by adding warmth, hydration, and oils (41-83). Some of the *Ayurvedic* laxatives described below can be made into warm, soothing teas or taken in tablet form with water. Some are available in liquid form, too (41-48, 51-83). *Ayurveda* recommends a holistic approach to treat constipation (42-70). While conventional medical systems prescribe laxatives, *Ayurveda* recommends a host of measures to treat constipation. The best *Ayurvedic* treatment for constipation recommends lifestyle changes to improve body metabolism (42-81). This not only treats constipation

but leads to a general improvement in health. The constipation remedies *Ayurveda* recommends are made from herbs (42-81). They are safe and gentle on the body. They correct the Vata imbalance allowing the digestive system to function normally and this ensures normal bowel movement (42-81). The *Ayurvedic* treatment of constipation suggested the use of **herbal formulations**. These herbs have been sourced from nature and have been used for thousands of years (44-83).

Ayurveda looks at diseases from the viewpoint of Doshas (bio-energies in the body). According to *Ayurveda*, there are three doshas – Vata, Pitta, and Kapha. The Vata Dosha is essentially cold and dry in nature and it governs movement and elimination. When it is imbalanced, it causes constipation. It is referred to as Vibandha. According to *Ayurveda*, constipation can occur due to: 1) Consumption of dry and cold food that imbalances Vata dosha. 2) Not drinking sufficient water. 3) Spending a lot of time under sunlight. 4) Being physically inactive and sitting in the same place for a long time (44-75).

The *Ayurvedic* treatment for constipation in adults requires the use of herbal formulations. These herbal formulations have a combination of herbs that help to correct Vata imbalance, improve digestion, and make the colon work normally. This can be helpful in treating the symptoms of constipation and allow normal bowel movement. Excessive consumption of tea and coffee is not good for digestion and should be minimized. Warm water and soup are a good substitute to be sipped on through the day. An active lifestyle with adequate exercise keeps the bowels moving normally (45-76). There are certain Yoga poses or Asanas that are particularly good for digestion. Regular sleep and meal routines are also conducive to and helpful for optimal digestion and good health (45-80). Warm water is helpful for digestion and to help relieve constipation. It is good to maintain a good water intake throughout the day and start the day with a warm lemon water drink. Adequate hydration is essential for proper bowel movements.

Ayurveda does not address the individual symptoms of a problem. As per *Ayurveda*, the imbalance of the Doshas from the person's normal state causes health issues. So, the causes of the imbalance are addressed to help restore the body's natural balance. The person is advised to make lifestyle changes and take *Ayurvedic* medicine for constipation that supports good digestion.

An increase in the popularity of alternative medicine and natural products has renewed interest in plant compounds and their derivatives as potential natural medicines. Complementary and alternative therapies are frequently used for constipation. Constipation, as an ancient disease, has been treated with many kinds of herbal medicines in the human history (41-48, 51-83). According to quantity of herbal medicines, it can be divided into two types: single herb and multiple herbs. According to active ingredient of single herb, it also can be divided into two types: bulk laxative and stimulant laxative (41-48, 51-81). The Japanese herbal medicines (JHMs), were also used to treat constipation and compared the pharmacological actions of Kampo medicine (KM) with those of Western drugs (41). **Kampo medicine** is another term for traditional Japanese herbal medicine based on traditional Chinese medicine (41).

The application of **herbal medicine** for the treatment of constipation is as old as mankind. Today, plants have been utilized worldwide as a source of medicine by people from all cultures and traditional medicine is an important part of the health care system in India. Medicinal plants were used as pharmaceuticals (41-80). Different plant parts such as, flowers, leaves, and roots are processed into different food products as a herbal medicine (42-83). It is often marketed as a health food due to its history as a medicinal plant used to alleviate symptoms having diuretic, choleric and laxative (44-83).

Constipation may be caused by various factors such as lifestyle, particular food habits, pregnancy and even due to some medication (1-22). Chronic constipation is responsible for different health issues. Pharmacological and non-pharmacological paradigms are applied for the treatment or management of constipation (1-59). In the pharmacological way of treatment, medicinal plants have a key role because of their fibrous nature. Numerous plants such as *Prunus persica* (*Rosaceae*), *Cyamopsis tetragonolobus* (*Leguminosae*), *Citrus sinensis* (*Rutaceae*), *Planta goovata* (*Plantaginaceae*), *Rheum emodi* (*Polygonaceae*), *Cassia auriculata* (*Caesalpinaceae*), *Ricinus communis* (*Euphorbiaceae*), *Croton tiglium* (*Euphorbiaceae*), *Aloe barbadensis* (*Liliaceae*), *Mareya micrantha* (*Euphorbiaceae*), *Euphorbia thymifolia* (*Euphorbiaceae*), *Cascara sagrada* (*Rhamnaceae*), *Cassia angustifolia* (*Fabaceae*) have laxative activity (22-83). A teaspoon of roasted fennel (*Foeniculum vulgare*) belongs to family *Apiaceae* taken at bedtime with a glass of warm water may act as a mild laxative. The volatile oils found in fennel seeds can help kick start digestion by promoting the production of gastric enzymes (41-83). Further, Ginger (*Zingiber officinale*) belongs to *Zingiberaceae*, known for its stomach-soothing properties. It can help with nausea and an upset stomach. Because ginger speeds the movement of food through the intestines, it may also relieve gas and bloating (42-83).

Medicinal plants possess a significant laxative potential and support their folklore; therefore, further, well-designed clinical-based studies are required to prove and improve the efficacy of herbal medicine for constipation (41-83). Diets including fruits, fluids, and probiotics are good for constipation. Fruits contain water, melatonin, sorbitol, fructose, fiber, and phytochemicals (69, 70-83). Fruits thought to be useful for treating constipation are pear, oranges, berries, grape, plump, and apple with peel, which are rich in fiber (22-69, 71-83). Fruits juices are generally helpful for constipation, particularly in young children, whose intestinal function has not fully matured. Apple, prune, and pear juices are usually recommended for constipation (69). Berries are rich in fiber and melatonin. Raspberries provide 8 grams of fiber in one cup, and can have them topped over oatmeal for breakfast or even with a bowl of yogurt which has a soothing effect on patient stomach (23-83). Some of the **Indian berries** like mulberries, strawberries, **jamunans** cape gooseberries are also good options for constipation (41-83).

Common fiber and melatonin rich foods include cereals (rice, corn), bread, vegetables, fruits, potatoes (with peel), and whole grains (69, 84). The mechanism of action of fiber on constipation includes: 1) Fiber increases stool bulk and accelerates colon transit; 2) fermenting fiber produces short-chain fatty acids (butyrate, propionate, acetate, etc.), which increase osmotic load and accelerate colon transit; 3) short-chain fatty acids change the intraluminal microbiome (mass) directly or indirectly by decreasing luminal pH, which accelerates colon transit; and 4) fiber contains water. All these improve stool consistency and amount (23-69, 70-81). Milk and Ghee- According to the book, 'The Complete Book of *Ayurvedic* Home Remedies,' "taking one or two teaspoons of ghee in a cup of hot milk at bedtime is an effective and gentle means of relieving constipation. This is especially good for vata and pitta constitutions." (41-83).

Laxatives are agents that add bulk to intestinal contents by retaining water within the bowel lumen by virtue of their osmotic effects, or that stimulate intestinal secretion or motility thereby increasing the frequency and ease of defecation (24-81). Plants contains natural laxatives (41-83). **A tea** made from the leaves is laxative. Therefore, the continuous search for a more natural, effective, affordable and readily available laxative of plant origin is very much needed for controlling constipation (41-62, 63-84).

Following is the list of herbal medicine with laxative properties used for the treatment of constipation (41-84).

1. Prunes (*Prunus domestica*): Prune is an European plum, a flowering deciduous tree species belongs to family *Rosaceae*. Prunes includes many varieties of the fruit trees known as plums in English, and not all plums belong to this species (46-48). **Prune juice** is a fruit juice derived from prunes (dried plums) that have been rehydrated. Prune juice is used throughout the world as a dietary supplement to act as a laxative and to alleviate constipation (46-48). Prunes contain dietary fiber (about 7% of weight; table) which may provide laxative effects and sorbitol content may also be responsible for this (46-48). Prunes and prune juice contain phytochemicals, including phenolic compounds (mainly as neochlorogenic acids and chlorogenic acids) and sorbitol. According to the health care reports, patients suffering from constipation can consume warm prune juice (100-300ml) in one week depending on the patient condition in the management of constipation (46-48).

2. Indian Senna (Swarnapatri): *Cassia angustifolia* belongs to the family *Leguminosae* is a plant best known for its laxative property (51-57). Indian Senna (*Cassia angustifolia*) is often used to clear the bowel before diagnostic tests such as colonoscopies. Cleansing the colon is believed to enhance nutrient uptake and support overall colon health (51-57). It is also known as Swarnapatri in Sanskrit (51-57). It is mainly used as a blood purifier, laxative for relieving constipation and to treat skin diseases. It contains a powerful natural laxative called anthraquinone and is approved by the world health organization (WHO) (51-57). It is an FDA approved nonprescription laxative (51-57). Senna is an anthranoid type stimulating laxative (51-57).

Indian Senna (*Cassia angustifolia*) comprises of dianthrone glycosides (compounds consisting of sugar molecules bound to other molecules), as well as mucilage (a thick, gluey substance), tannins and flavonoids. In addition to its use as a safe and effective laxative (51-57). Indian Senna (*Cassia angustifolia*) is an annual leguminous herb which is cultivated extensively in the southern parts of the India. Its pods and leaves are used in *Ayurveda* as well as in modern system of medicines. One of the glycosides present in Senna, Emodin has many herapeutic benefits including as an anti-inflammatory, antispasmodic, and the ability to inhibit or destroy viruses (51-57). These compounds have also shown to be effective in stimulating cellular regeneration, and detoxifying and cleansing. Indian Senna (*Cassia angustifolia*) is the active ingredient in many commercial laxatives (51-57). It was reported that the first variety of Senna was found along the Nile River in Egypt and Sudan (51-57). Swarnapatri consists of dried leaves of *Cassia angustifolia* Vahl (*Leguminosae*), a little shrub, 60-75 cm high, found throughout the year, cultivated largely in Southern India, especially in Karnataka, Andhra Pradesh, Kerala, Tamil Nadu state, India (51-57). Its commercial cultivation has recently come up in Kutch (Gujrat) and Jodhpur (Rajasthan), India

Indian Senna (*Cassia angustifolia*) contains dianthrone glycosides (1.5% to 3%) (51-57). Two crystalline glucosides sennoside A & B have been reported from the leaves and pods. Sennosides A and B (rhein dianthrone), and sennosides C and D (rhein aloe-emodin heterodianthrone) (51-57). Numerous minor sennosides are identified, and every one appears to contribute to the laxative effect (51-57). The leaves and pods of the Indian Senna (*Cassia angustifolia*) plant are important ingredients of laxatives sold in most pharmacies (51-57). It is a well-known and accepted cure for constipation which begins to work 10-12 hours after ingestion. It detoxes the body and cleanses the colon (51-57).

The maximum **daily dose to treat constipation** is 15 to 30 mg Sennosides. The dried leaf of Indian Senna (*Cassia angustifolia*) is used as a purgative. The powder of the leaf is taken in a dosage of

1-2 g with hot water in conditions of constipation, abdominal distention. However, the correct individual dose is the smallest required producing a comfortable soft-formed motion. The dosage for Indian Senna is about 500 mg to 2 gm of the powder of leaf or pod. Indian Senna is used for irritable bowel syndrome, hemorrhoids and weight loss (51-57). The laxative effect is due to the action of sennosides and their active metabolite, rhein-anthrone, in the colon (51-57).

Warning: Indian Senna (*Cassia angustifolia*) is not recommended for use in children under 12 years of age.

3. Triphala: One of the best known *Ayurvedic* laxatives is Triphala (46-48, 50). Triphala (Sanskrit; Tri = three and Phala = fruits) is defined as a well known tri-herbal Indian *Ayurvedic* formulation consisting of dried fruits of the three plant species, *Embolica officinalis* (Amalaki or the Indian Gooseberry) (Family-*Euphorbiaceae*), *Terminalia bellirica* (Bibhitaki or Karitaki) (Family-*Combretaceae*), and *Terminalia chebula* (Haritaki) (Family-*Combretaceae*) that are native to the Indian subcontinent (46-48, 50). **Triphala in *Ayurvedic* Rasayana** formulation is used as a rejuvenative herbs, for the treatment of gastrointestinal tract disorders, prevents constipation, diarrhea, hypolipidemic effect, and reduces stress related problems, reducing the total cholesterol levels, and low-density lipoprotein (46-48, 50). The major constituents of the Triphala formulations are the tannins, gallic acid, ellagic acid, and chebulinic acid, chebulagic acid which are potent antioxidants and therefore, resulted in the immunomodulatory activity without any side effects (46-48, 50). Triphala also contains other bioactive compounds such as flavonoids (e.g., quercetin and luteolin), saponins, anthraquinones, amino acids, fatty acids, and various carbohydrates (50). Triphala-derived polyphenols such as chebulinic acid are also transformed by the human gut microbiota into bioactive metabolites to prevent oxidative damage (46-48, 50). According to the Indian health experts, Triphala should be consumed daily for one to two weeks in the management of constipation. Fresh fruits can be dried and powdered and mixed (2 spoon of powdered Triphala) with warm water or milk in the management of constipation. Triphala juice is also available in the Indian market and one glass of warm juice is also used as a home herbal remedy for the constipation.

4. Arabic Senna: *Senna alexandrina* (Senna), an herb used in *Ayurvedic* and Persian medicine for centuries, as an over-the-counter laxative (51-57). Compounds in the herb (Sennosides) stimulate the lining of the bowel, usually bringing constipation relief in 6 to 12 hours. *Senna alexandrina* belongs to the family *Fabaceae*, native of upper Egypt and also found in Sudan (51-57). It is also cultivated in India and Somalia has also been widely used for the treatment of constipation, even though there is no clinical controlled trial to support for its use in the management of chronic constipation. Senna (*Senna alexandrina*) can be found in several herbal remedies (eg, Black draught, Chatolicoon, Daffy's Elixir, Diasenna, Swedish bitters and many diet teas). *Senna alexandrina* was used in the form of senna pods, or as herbal tea made from the leaves, as a laxative (51-57). Senna is considered to be safe for adults and children when taken at the right dose and for less than 1 week to control constipation (51-57). Longer periods of use of senna are not recommended. Some people may experience stomach cramps and diarrhea when taking senna. Children in diapers may develop blisters if their diapers are not changed often when they are taking senna laxatives (46-48). It is also important to know that taking senna in combination with other herbal laxatives such as horsetail, Licorice, Aloe, buckthorn, and others could cause a big drop in potassium levels. The strength of Senna is due to pungency, bitter with unpleasant smell and some time it is sweet in taste which is very much effective. It is easy to chew, during chewing and after digestion it produce unpleasant smell and pungency in taste, its performance is just like laxative (51-57).

Arabic Senna tea (*Senna alexandrina*) is an herbal blend made of flowers from plants in the legume family (51-57). Senna (*Senna alexandrina*) plants are grown all over the world, but a particular type of Senna is cultivated in India for its health properties (51-57). Senna leaves contain compounds called Sennosides, which can irritate digestive tract just enough to stimulate a bowel movement. According to health experts, 1-2 dosage powder of dry leaf of Senna (*Senna alexandrina*) with hot water is very effective and beneficial for constipation and abdominal discomforts (51-57).

Warning: Senna is not recommended for use in children under 12 years of age.

5. Cascara sagrada: The active ingredients of *Cascara sagrada* (*Rhamnus purshiana*, also known as sacred bark or California buckthorn) are hydroxyanthraquinone glycosides found in the dried bark of the plant. *Cascara sagrada* belongs to the family *Rhamnaceae*. The fresh bark, however, causes nausea, vomiting and gripping abdominal pain (58-59). *Cascara sagrada* is a herbal medication used for short term treatment of constipation, generally well tolerated but is known to cause liver injury when used in higher doses than recommended (58-59). Anthraquinone derivatives are the active laxative components; promoting peristalsis and inhibiting reabsorption of water and electrolytes (58-59). *Cascara* is slightly absorbed, and typical recommended courses are for less than 7 days. The mechanism of liver injury is not well understood but it has been hypothesized that it is mediated by the direct toxicity of anthraquinone derivatives (58-59). Nevertheless, injury is usually self-limited and typically reversible upon discontinuation (58-59).

It is native to western North America from southern British Columbia south to central California, and eastward to Northwestern Montana (58-59). It is a shrub native to western North America whose bark is processed for medicinal purposes. *Cascara sagrada* contains organic plant compounds called anthraquinones that have the powerful laxative effects. *Cascara sagrada* is primarily used to treat constipation (58-59). The anthraquinones contained in the bark slow down the absorption of water and electrolytes in the intestines. Because of this, stool volume increases as it absorbs the excess water, which increases pressure within the intestine (58-59). This stimulates muscle contractions in the colon (peristalsis), speeding the clearance of the bowel (58-59).

Cascara sagrada is considered as a stimulant laxative, causing intestinal muscle contractions (58-59). However, the effect of *Cascara sagrada* tends to be gentler, resulting in fewer loose or watery stools (58-59). *Cascara sagrada* is a dietary supplement made from the bark of a shrub in North America. It is used for its laxative effects to treat constipation. It does this by slowing down the water and electrolytes absorbed in the intestines. However, *Cascara sagrada* has possible side effects especially if taken long-term. It can cause dehydration and loss of electrolytes (minerals), which can lead to serious side effects and complications of liver injury (58-59).

6. Flax seeds (*Linum usitatissimum*): Flax, is also known as common flax or Linseed, is a flowering plant, *Linum usitatissimum*, in the family *Linaceae* (60, 61). Flax (*Linum usitatissimum*) is a blue flowering annual herb that produces small flat seeds varying from golden yellow to reddish brown color (60, 61). Being a great source of dietary fibre, omega-3 fatty acids and essential antioxidants, flaxseed can allow stool to pass easily through the digestive tract, making it a powerful natural remedy for constipation (60, 61). To use flaxseed for constipation, just take about 1 tablespoon of these super seeds and boil it in a cup of water for 2-3 minutes, allow it to cool slightly, and then drink the water. Flax seeds are also consumed with food for two to three times a day (60, 61). Flaxseed is considered as a functional food owing to the presence of three main bioactive components—alpha-linolenic acid, lignans and dietary fiber (60, 61).

7. Bael fruit pulp (*Aegle marmelos*): *Aegle marmelos* belongs to the family Rutaceae, is an important medicinal tree in India and Sri Lanka (48). Pulp of Bael (wood apple) fruit is an excellent *Ayurvedic* remedy for constipation (48). ***Aegle marmelos***, commonly known as Bael, also known as Bengal quince, golden apple, Japanese bitter orange, stone apple or wood apple, is a rare species of tree native to the Indian subcontinent and Southeast Asia (48). Eating a half cup of bael fruit pulp (*Aegle marmelos*) and a teaspoon of jaggery every day in the evening before dinner may also help relieve constipation (48). Bael fruit pulp along with tamarind water and jaggery mixture is a popular natural juice in India and Sri Lanka used in the management of constipation (48).

8. Psyllium husk (*Plantago ovata*): *Plantago ovata* belongs to the family *Plantaginaceae* is used as a natural laxative. The common name of Psyllium husk – Blond plantain, Blond Plantago, Indian Plantago, Desert Indian wheat, Dietary fiber, Blond psyllium, Sand Plantain, and Isabel or ispagol etc. In India, *Plantago ovata* cultivated as a cash crop in Gujarat, Rajasthan, Punjab and Haryana states (63). The consumption of **Psyllium husk** may be effective in alleviating chronic constipation in patients without slow colonic transit or disordered constipation (63). On the other hand, fiber with lactulose may improve the stool consistency in patients with Irritable Bowel Syndrome (IBS) with constipation (63). The seed husk of *Plantago ovata* (Psyllium husk), known locally as Isabel, is well known for its effectiveness in chronic constipation (63). About the efficacy of Psyllium for constipation, a general understanding is that its high fiber and mucilaginous content contribute to a laxative action (63).

9. Fig (*Ficus carica*) Anjeer ; *Ficus carica* belongs to the *Moraceae* family is frequently used as bulk laxative. *Ficus carica* increased stool frequency and improved stool consistency but was not effective on colon transit or anorectal motility (64). The common fig (*Ficus carica* L) is a deciduous broadleaf shrub and is widely known for the medicinal value of edible fruits (64). The feeding of fig paste increased fecal weight, which had been decreased by diet-induced constipation (64). Therefore, fig paste may be suitable for human patients suffering from diet induced constipation (64). Anjeer, or figs, soaked in warm water also helps treat constipation, especially in kids (64).

10. Castor (*Ricinus communis*): *Ricinus communis* is also known as the castor bean or castor oil plant, is a species of perennial flowering plant in the spurge family, *Euphorbiaceae* (65). Castor oil is a popular natural remedy that acts as a stimulant laxative, relieving constipation and promoting regular bowel movements (65). For constipation, it is recommended to take 1-2 tablespoons of castor oil on an empty stomach, preferably at bedtime until patient get relief. Castor oil is well-known for numerous health properties being the most important medicinal oil as a **cleansing laxative and purgative** (65). The ricinoleic acid, the main fatty acid found in castor oil, causes the muscles of your intestinal walls to contract and push out stool (65).

Castor oil is extracted from the castor beans by pressing ripe seeds. The outer covering (hull) of the seeds contains a **deadly poison called Ricin**. So, only castor seeds without the hull are used for producing oil. Besides treating constipation, castor oil is also used to start labour in pregnancy, and to start the flow of breast milk (65).

Warning: Castor oil is **not recommended** for everyone, especially children, pregnant women and people with certain health conditions. Higher doses of oral consumption of castor oil is toxic leading to death.

11. Licorice Root (*Glycyrrhiza glabra*) (Mulethi) : Licorice or Mulethi (*Glycyrrhiza glabra*) belongs to the family *Fabaceae* (66-68). In India it is also called as Yasthimadhu in *Ayurveda*, is often

prescribed as a demulcent, mild laxative, and anti-inflammatory. Licorice is a rasayana and used to treat mucosal inflammation, dryness, and ulcerations. Licorice is a medicinal plant known for the root of which a sweet, aromatic flavouring can be extracted. The major active component of licorice root is the triterpenoid saponin glycyrrhizin (also known as glycyrrhizic acid or glycyrrhizic acid), which is usually found in the concentrations ranging from 6% to 10% (66-68). *Ayurveda* has a long held herbs like Mulethi or licorice root in high regards for its health-boosting qualities. Consumption of a teaspoon of powdered licorice root is used in the management of constipation (66-68). Add a teaspoon of jaggery and drink it with a cup of warm water. **Licorice or mulethi is known to promote bowel activity** (66-68). However, it is advised to consult an *Ayurvedic* expert before taking it regularly. It is a versatile medicine in India and China, for gastrointestinal health. It is a mild laxative, soothes and tones the mucous membranes, and relieves muscle spasms (66-68).

12. Lemon (*Citrus limon*) water: *Citrus limon* belongs to family *Rutaceae*. Lemon (and other citrus fruits) contain high doses of vitamin C, as well as water-soluble fiber. Citrus can also sometimes stimulate colon. That is probably why some people use warm lemon water as a way to get things moving when constipation becomes a problem.

13. Black tea, green tea, or coffee

Stimulating teas and coffee also have a **laxative effect**. Black tea, green tea, and coffee naturally contain caffeine, a stimulant that speeds up bowel movements in many people. People often drink these beverages in the morning to wake themselves up and encourage a bowel movement. Caffeine can have negative side effects in people who are sensitive to it.

14. Wheat bran (*Triticum aestivum*)

Wheat (*Triticum aestivum*) belongs to family *Poaceae* and studies have shown that wheat bran can relieve constipation and improve digestion. The outer layer of the wheat kernel comprises of a lot of fiber force. Sprinkle it over oatmeal, whip up a batch of bran muffins, or eat a bowl of all-bran cereal which will improve the bowel movement. Gluten is a protein found in grains like wheat, barley, rye, spelt, kamut, and triticale. **Some people may experience constipation when they eat foods that contain gluten**. Also, some people are intolerant to gluten. This is a condition known as gluten intolerance or **Celiac disease**. Wheatgrass juice is prepared from the freshly sprouted leaves of the common wheat plant, *Triticum aestivum*. In India, people often drink freshly prepared wheat grass juice in order to relive in- digestion problems, and constipation. Wheatgrass is an excellent source of many different vitamins and minerals. It is especially high in vitamins A, C and E, as well as iron, magnesium, calcium and amino acids.

15. Almonds (*Prunus dulcis*): Almonds belongs to family *Rosaceae*. Almonds contain vitamins, minerals, protein, oil, and fiber, and so they may offer a number of health benefits particularly relive the constipation problem. The high magnesium content gets intestines to work. It neutralizes the stomach acid and moves the stool through intestines.

16. Dandelion (*Taraxacum officinale*): Dandelion belongs to the Aster Family (scientific name **Asteraceae** or **Compositae**). Dandelion tea is a tisane often made from the dandelion root and is an ancient herbal medicine (82, 83). Dandelion tea is often made with the root of the plant but the stem, leaves, and the whole plant can also be brewed. Dandelion tea may help with mild digestive symptoms, such as bloating or occasional constipation (67-83). Dandelion can stimulate the liver to produce bile, which can indirectly help with constipation. Dandelion tea can also act as a diuretic in the

body, adding more water to the digestive system and the stools. This can help to relieve mild constipation. To ease the digestive process, try drinking a cup of dandelion tea after meals (50-83).

17. Banana (*Musa acuminata*)

Banana is an edible fruit and is herbaceous flowering plant belonging to the genus *Musa* and the family *Musaceae*. **Banana** is known to be rich in carbohydrates, dietary fibres, certain vitamins, and minerals, bioactive compounds, such as carotenoids, flavonoids-leucocyanidin, phenolics, amines, vitamin C, A and vitamin E having antioxidant activities to provide many human health benefits (70-73). Banana fruit has been shown to contain a good amount of phytosterols both in the peel and pulp (70-73).

Dietary fiber from vegetables and fruits are very valued for constipation treatment (70-73). Green banana is known for its dietary fiber content, as well as for a solid concentration of **amylase-resistant starch** that is not digested or absorbed in the intestine, stimulating the colonic production of short chain fatty acids and being useful in treating constipation (70-73). The dietary fiber and the high quantity of resistant starch in green banana (approximately 74% of its composition) appear to contribute as a potential therapeutic agent for the functional constipation treatment (70-73). Given the beneficial intestinal effects of dietary fiber in functional constipation treatment and the fact that green banana is a major source of resistant starch, the knowledge of therapeutic properties of resistant starch from green banana should be explored for human dietary applications (70-73).

Before it ripens, a banana is almost **entirely starch**, which accounts for up to 70–80% of its dry weight. A large part of this starch is **resistant starch** (70-73). As banana ripens, the amount of starch and resistant starch decreases and is converted into sugars (70-73). Bananas contain resistant starch which could be beneficial for constipation (70-73). **Resistant starch** is a form of starch which cannot be digested in the small intestine (70-73). The starch is then digested in the large bowel by gut bacteria (70-73). Soluble fiber absorbs water, helping stools stay large and soft (70-73). This may help to improve the movement of stool through digestive tract (70-73). They do contain potassium, however, which helps in moving the bowels and makes it easier to pass the stool to cure constipation (70-73). Bananas also contain an enzyme called **fructooligosaccharide**, which hinders the fermentation of bananas once they are in intestinal tract and acts as a natural mild laxative (70-73). It is better to consume ripe bananas since ripe banana contain a large amount of pectin, which binds to the stools. It pulls out water from the intestinal tract, resulting in dehydrated stools (70-73).

18. Parsley (*Petroselinum crispum*):

Parsley, or garden parsley is a species of flowering plant in the family *Apiaceae* that is native to the central and eastern Mediterranean region, but has been naturalized elsewhere in Europe, and is widely cultivated as a herb, and a vegetable (74, 75). Parsley is widely used in European, Middle Eastern, and American cuisine. Parsley is the dried aromatic leaf of a biennial herb with dense foliage and white flowers. The bright green leaves are finely divided and curled (74, 75). There are two main types of horticultural parsleys. **The one cultivated for leaves, which is found in India** and the other grows for its turnip like roots (74, 75). The fragrant herb Parsley, is particularly rich in a class of antioxidants known as flavonoids. The two main flavonoids include myricetin and apigenin. Parsley contains many powerful antioxidants that can benefit health. Parsley is a versatile herb that provides a concentrated source of nutrients. It is particularly rich in vitamins A, C, and K (74, 75). Parsley is a common herb that may help with digestive disorders. **A tea that includes the leaves or seeds of the plant may help to relieve mild constipation** (74, 75). Traditionally, people have chewed the leaves or stems to address issues such as bad breath and flatulence (74,

75). Parsley is a common herb that may help with digestive disorders. A tea that includes the leaves or seeds of the plant may help to relieve mild constipation (74, 75). Parsley has been claimed in folk medicine to possess laxative properties attributed to the presence therein of some volatile oils that are more concentrated in seeds than in stems or leaves (74, 75). The aroma of the herb is characteristic, fragrant and spicy due to volatile oil present. Parsley is commonly used for garnishing and seasoning of foods (74, 75). The herb is possessing diuretic, carminative, anti-pyretic properties. The juice of the fresh leaves is used as an insecticide. Parsley herb oil and parsley seed oil are obtained from steam distillation (74, 75).

19. Chamomile (*Matricaria chamomilla*)

Chamomile (*Matricaria chamomilla* L.) is a well-known medicinal plant species from the family *Asteraceae* (76, 77). It was introduced to India during the Mughal period, now it is grown in Karnataka, Tamilnadu, Kerala, Punjab, Uttar Pradesh, Maharashtra, and Jammu and Kashmir (76, 77). *Matricaria chamomilla* belongs to a major group of cultivated medicinal plants (76, 77). It contains a large group of therapeutically interesting and active compound classes. Sesquiterpenes, flavonoids, coumarins, and polyacetylenes are considered the most important constituents of the chamomile drug (76, 77). Chamomile is a familiar fragrant herb used in teas for its soothing effects on the body (76, 77).

Drinking a cup of chamomile tea after meals or toward the end of the day may help to calm the muscles in the intestines and speed up the time between a meal and a bowel movement (76, 77). **Chamomile tea may help relieve constipation.** Chamomile tea is an herbal tea made from dried chamomile flowers (76, 77). It is also used to control the bowel problems (76, 77). The dried flowers of chamomile contain many terpenoids and flavonoids contributing to its medicinal properties (76, 77). Chamomile preparations are commonly used for many human ailments such as hay fever, inflammation, muscle spasms, menstrual disorders, insomnia, ulcers, wounds, gastrointestinal disorders, rheumatic pain, and hemorrhoids (76, 77). Chamomile has been valued as a digestive relaxant and has been used to treat various gastrointestinal disturbances including constipation, flatulence, indigestion, diarrhea, anorexia, motion sickness, nausea, and vomiting (76, 77). Chamomile is used traditionally for numerous gastrointestinal conditions, including digestive disorders, "spasm" or colic, upset stomach, flatulence (gas), ulcers, and gastrointestinal irritation (76, 77). Chamomile is especially helpful in controlling the constipation, dispelling gas, soothing the stomach, and relaxing the muscles that move food through the intestines and increase the bowl movement (76, 77).

20. Olive oil (*Olea europaea*); The olive (*Olea europaea*) belongs to the family *Oleaceae*. Olive oil may be a safe and healthy way to get stools moving again and relieve constipation (78). The fats in olive oil can help smooth the insides of the bowel, making it easier for stools to pass (78). It can also help the stool hold in more water, keeping it softer (78). One tablespoon of **olive oil**, taken on an empty stomach in the morning, may relieve constipation for many healthy adults (78). Olive oil contains substances that may help to prevent colorectal cancer. Furthermore, antioxidants in olive oil may help to protect the body from inflammation, oxidative damage, and epigenetic changes (78). Olive oil mostly consists of triacylglycerols (98–99%). Triacylglycerols are a diverse group of glycerol esters with different fatty acids (78).

The predominant fatty acid present in olive oil triacylglycerols is monounsaturated oleic acid (up to 83% w/w). There is also palmitic acid, linoleic acid, stearic acid, and palmitoleic acid making up the remainder of olive oil triacylglycerols (78). In olive oil, the content of polyphenols ranges from 50 to 1000 mg/kg (78). The flesh of healthy olives contains about 2–3% of phenolic substances in

the form of glucosides and esters. Virgin olive oil contains about 500 mg/L of polyphenols (78).

21. Marshmallow root (*Althaea officinalis*): *Althaea officinalis* belongs to family *Malvaceae*. Marshmallow root may have a similar soothing effect as licorice, and its laxative properties make it a common ingredient in medicinal teas (79). It may be best to drink a cup of Marshmallow root tea toward the end of the day. **Marshmallow root (*Althaea officinalis*)** is a perennial herb that is native to Europe, Western Asia, and Northern Africa. It is been used as a folk remedy for thousands of years to treat digestive, respiratory, and skin conditions (79). Its healing powers are due in part to the mucilage it contains. It is typically consumed in capsule, tincture, or tea form (79). It is also used in skin products and cough syrups (79). Marshmallow root also has the potential to treat a wide range of digestive conditions, including constipation, heartburn, and intestinal colic (79).

22. Peppermint tea (*Mentha piperita*) also known as *Mentha balsamea*

Peppermint tea (*Mentha piperita*) belongs to the family *Lamiaceae* is a popular natural remedy for digestive issues, and many medicines for digestive issues contain peppermint extract (80-81). The main use of mint leaves is associated with problems of the stomach and digestive system. It improves the digestion, restores appetite and eliminates the intestinal gas, dealing with upset stomach (80-81). The soothing effect of the menthol in peppermint may help to relax an upset stomach while moving stool through the intestines (80-81). Drinking a cup of peppermint tea after each meal may benefit people who experience constipation and an upset stomach (80-81). Peppermint and peppermint tea have long been used to soothe digestive issues including bloating. It is **one of the best teas for bloating because of its high concentration of flavonoids**. In simple terms, flavonoids can help to calm the bacteria in digestive tract which often cause high levels of gas and bloating (80-81).

Peppermint (*Mentha piperita* L.) is one of the most widely consumed single ingredient herbal teas, or tisanes (80-81). Peppermint tea, brewed from the plant leaves, and the essential oil of peppermint are used in traditional medicines (80-81). The phenolic constituents of the leaves include rosmarinic acid and several flavonoids, primarily eriocitrin, luteolin and hesperidin. The main volatile components of the essential oil are menthol and menthone (80-81). Peppermint oil (*Mentha Piperita*) is a naturally-occurring carminative herb containing monoterpene compounds that target the pathophysiology of the irritable bowel syndrome (IBS) (80-81).

Peppermint oil (*Mentha Piperita*) contains L-menthol, which blocks calcium channels in smooth muscle, thus producing antispasmodic effects on the gastrointestinal tract (80-81). Peppermint oil possesses antimicrobial, anti-inflammatory, antioxidant, immunomodulating, and anesthetic activities, all of which may be relevant for the treatment of irritable bowel syndrome (IBS) (80-81). Peppermint oil has intrinsic properties that may benefit patients with irritable bowel syndrome (IBS) symptoms (80-81). In the most comprehensive meta-analysis to date, Peppermint oil was shown to be a safe and effective therapy for pain and global symptoms in adults with irritable bowel syndrome (IBS) (80-81).

Therefore, many **over-the-counter laxatives** contain herbal ingredients. **Most laxative herbs** contain anthraquinones, or substances that have a stimulant effect on the intestines (44-83). These laxatives work by drawing in fluid to the colon and increasing peristalsis. Peristalsis is the contraction of the intestines that helps to move material through the colon to the rectum (44-80). Adding fiber and fluids is essential when constipated. There are many polyherbal natural laxatives are available in the Indian and International market for immediate relief from constipation 1) Baidyanath Kabz-Har *Ayurvedic* Laxative Powder. 2) Dabur Laxirid

syrup and tablets. 3) Himalaya herbal drugs. 4) Patanjali- Divya Churna is a time-tested medicine for constipation and indigestion.

CONCLUSION

Constipation is a common digestive system disorder and also indicates other major issues with the digestive tract. Constipation refers to a situation where bowel movements are hard or become infrequent or difficult to pass leading to irritable bowel syndrome (IBS). If there are problems with bowel movements for more than three days a week then it is categorized as constipation. When someone is constipated, patient start facing problems in passing stools. The stools would be hard, making it difficult to be passed out. They may need to strain to pass out the stools. This can lead to fissures (cuts) in the anus or piles (hemorrhoids). Amore troublesome problem is when it is not possible to pass out stools. This becomes a serious problem when it starts occurring regularly. Even children can be constipated, due to problems with their diet or lack of physical activity.

Conventional treatment includes the **use of laxatives to remove stools**. The regular use of such chemical-based drugs can imbalance body metabolism and affect the digestive system. However, poor people in any society cannot afford to buy expensive laxative drugs and reluctant to see a doctor. Constipation is a problem that should not be ignored and requires proper treatment. Constipation might be due to several reasons for example, diet and drug related. This is primarily due to the drastic shift in lifestyles that has resulted in people consuming excess junk food and not involving themselves in optimal physical activities. Unless elimination from the human body is efficient, it is difficult for individuals to be healthy, fit, and energetic.

The **Ayurvedic** treatment for constipation focuses on correcting the imbalance in the body's doshas (energies) that have led to this problem. The focus is on improving digestion and body metabolism so that bowel movements can be smooth. According to *Ayurveda* constipation usually grows due to poor dietary habits. Consuming foods that are difficult to break down and digest resulted in the constipation. *Ayurveda* suggested many ways to identify whether the colon is functioning at the optimum. Natural plant products are important for the prevention and treatment of gastrointestinal disorders. The *Ayurvedic* treatment for constipation in adults requires the use of herbal formulations. These herbal formulations have a combination of herbs that help to correct Vata imbalance, improve digestion, and make the colon work normally. This can be helpful in treating the symptoms of constipation and allow normal bowel movement.

REFERENCES

1. Wang X, Yin J. Complementary and Alternative Therapies for Chronic Constipation. Hindawi Publishing Corporation Evidence-Based Complementary and Alternative Medicine. 2015; 1-11. Volume 2015, Article ID 396396, (<http://dx.doi.org/10.1155/2015/396396>).
2. Liu LWC. Chronic constipation – Challenges and remedies; Chronic constipation: Current treatment options. Can J. Gastroenterol. 2011; 25, Suppl B; 22B-28B.
3. Singh S, Rao SS. Pharmacologic management of chronic constipation. Gastroenterol Clin North Am. 2010;39:509-27.
4. Forootan M, Bagheri N, Darvishi M. Chronic constipation- A review of literature. Medicine. 2018; 97 (20):1-9.
5. Sanchez MI, Bercik P. Epidemiology and burden of chronic constipation. Canadian J. Gastroenterol. 2011;25: 11B-L 15B.

6. Mugie SM, Benninga MA, Di Lorenzo C. Epidemiology of constipation in children and adults: A systematic review. *Best Pract Res Clin Gastroenterol.* 2011;25:3–18.
7. Vazquez-Roque M, Bouras EP. Epidemiology and management of chronic constipation in elderly patients. *Clin Interv Aging.* 2015;10:919–30.
8. Basile G, Coletta M. Chronic constipation: A critical review. *Dig Liver Dis.* 2013;45:886–93.
9. Pinto-Sanchez MI, Bercik P. Epidemiology and burden of chronic constipation. *Canadian J. Gastroenterol.* 2011;25:11B–5B.
10. Rao SS, Go JT. Update on the management of constipation in the elderly: New treatment options. *Clin Interv Aging.* 2010;5:163–71.
11. Rao SS, Rattanakit K, Patcharatrakul T. Diagnosis and management of chronic constipation in adults. *Nat Rev Gastroenterol Hepatol.* 2016;13:295–305.
12. Bytzer P, Howell S, Leemon M, et al. Low socioeconomic class is a risk factor for upper and lower gastrointestinal symptoms: A population based study in 15 000 Australian adults. *Gut.* 2001;49:66–72.
13. Howell SC, Quine S, Talley NJ. Low social class is linked to upper gastrointestinal symptoms in an Australian sample of urban adults. *Scand J. Gastroenterol.* 2006;41:657–66.
14. Ip KS, Lee WT, Chan JS, et al. A community-based study of the prevalence of constipation in young children and the role of dietary fibre. *Hong Kong Medical J.* 2005;11:431–6.
15. Dennison C, Prasad M, Lloyd A, et al. The health-related quality of life and economic burden of constipation. *Pharmacoeconomics.* 2005;23:461–76.
16. Wald A. Constipation: Advances in diagnosis and treatment. *JAMA.* 2016;315:185–91.
17. Rao SS, Meduri K. What is necessary to Diagnose Constipation? *Best Pract Res Clin Gastroenterol.* 2011;25:127–40.
18. Rao SS, Welcher KD, Leistikow JS. Obstructive Defecation: A failure of rectoanal coordination. *Am J. Gastroenterol.* 1998;93:1042–50.
19. Rao SSC, Ozturk R, Laine L. Clinical utility of diagnostic tests for constipation in adults: A systematic review. *Am J. Gastroenterol.* 2005;100:1605–15.
20. Brandt LJ, Prather CM, Quigley EM, et al. Systematic review on the management of chronic constipation in North America. *Am J. Gastroenterol.* 2005;100:S5–21.
21. Gray JR. What is chronic constipation? Definition and diagnosis. *Can J. Gastroenterol.* 2011;25(suppl B):7B–10B.
22. NDTV News. 22% Indians Suffer From Constipation: 4 Foods That Can Help Ease Bowel Movement. 2018, January 24.
23. Vishal R, Prasad M, Risabh A, Rana K. Epidemiology, demographic profile and clinical variability of functional constipation: A retrospective study in North Bihar. *International Journal of Contemporary Medical Research.* 2018;5(10):J7-J10.
24. Makharia GK, Verma AK, Amarchand R, Goswami A, Singh P, Agnihotri A, Suhail F, et al. Prevalence of irritable bowel syndrome: A community based study from northern India. *J. Neurogastroenterol Motil.* 2011;17(1):82–87.
25. Ghoshal UC, Abraham P, Bhatt C, Choudhuri G, Bhatia SJ, Shenoy KT, et al. Epidemiological and clinical profile of irritable bowel syndrome in India: Report of the Indian Society of Gastroenterology Task Force. *Indian J. Gastroenterol.* 2008;27(1):22–28.
26. Panigrahi MK, Kar SK, Singh SP, Ghoshal UC. Defecation frequency and stool form in a coastal eastern Indian population. *J. Neurogastroenterol Motil.* 2013;19(3):374–80.
27. Tandon RK, Prasad N, Gupta MC, Tandon BN. Stool weight and transit time in North Indians. *J. Assoc Physicians India.* 1976;24(12):807–10.
28. Ghoshal UC, Abraham P, Bhatia SJ, Misra SP, Choudhuri G, Biswas KD, et al. Comparison of Manning, Rome I, II, and III, and Asian diagnostic criteria: Report of the Multicentric Indian Irritable Bowel Syndrome (MIIBS) study. *Indian J. Gastroenterol.* 2013;32(6):369–75.
29. Shah N, Bajjal R, Kumar P, Gupta D, Kulkarni S, Doshi S, et al. Clinical and investigative assessment of constipation: A study from a referral center in western India. *Indian J. Gastroenterol.* 2014;33(6):530–36.
30. Ray G. Evaluation of the symptom of constipation in Indian Patients. *Journal of Clinical and Diagnostic Research.* 2016; 10(4): OC01-OC03.
31. Ghoshal UC, Sachdeva S, Pratap N et al. Indian consensus on chronic constipation in adults: A joint position statement of the Indian Motility and Functional Diseases Association and the Indian Society of Gastroenterology. *Indian Journal of Gastroenterology.* 2018; 37(6):526–544 (<https://doi.org/10.1007/s12664-018-0894-1>).
32. Ghoshal UC, Abraham P, Bhatt C, et al. Epidemiological and clinical profile of irritable bowel syndrome in India: Report of the Indian Society of Gastroenterology Task Force. *Indian J. Gastroenterol.* 2008;27:22–8.
33. Ghoshal UC, Singh R. Frequency and risk factors of functional gastro-intestinal disorders in a rural Indian population. *J. Gastroenterol Hepatol.* 2017;32:378–87.
34. Rajput M, Saini SK. Prevalence of constipation among the general population: A community-based survey from India. *Gastroenterol Nurs.* 2014;37:425–9.
35. Ray G. Evaluation of the symptom of constipation in Indian patients. *J. Clin Diagn Res.* 2016;10:OC01–3.
36. Rahman MM, Mahadeva S, Ghoshal UC. Epidemiological and clinical perspectives on irritable bowel syndrome in India, Bangladesh and Malaysia: A review. *World J. Gastroenterol.* 2017;23:6788–801.
37. Ghoshal UC, Abraham P, Bhatia SJ, et al. Comparison of Manning, Rome I, II, and III, and Asian diagnostic criteria: Report of the Multicentric Indian Irritable Bowel Syndrome (MIIBS) study. *Indian J. Gastroenterol.* 2013;32:369–75.
38. Ghoshal UC, Verma A, Misra A. Frequency, spectrum, and factors associated with fecal evacuation disorders among patients with chronic constipation referred to a tertiary care center in northern India. *Indian J. Gastroenterol.* 2016;35:83–90.
39. Shah N, Bajjal R, Kumar P, et al. Clinical and investigative assessment of constipation: A study from a referral center in western India. *Indian J. Gastroenterol.* 2014;33:530–6.
40. Sharma A, Misra A, Ghoshal UC. Fecal evacuation disorder among patients with solitary rectal ulcer syndrome: A case control study. *J. Neurogastroenterol Motil.* 2014;20:531–8.
41. Iizuka N, Hamamoto Y. Constipation and herbal medicine. *Front. Pharmacol.* 2015; 6:73. (doi: 10.3389/fphar.2015.00073).
42. Wang X, Yin Y. Complementary and Alternative Therapies for Chronic Constipation. Hindawi Publishing Corporation Evidence-Based Complementary and Alternative Medicine. 2015; Article ID 396396, 11 (<http://dx.doi.org/10.1155/2015/396396>).
43. Ashraf W, Park F, Lof J, Quigley EMM. "Effects of psyllium therapy on stool characteristics, colon transit and anorectal function in chronic idiopathic constipation," *Alimentary Pharmacology and Therapeutics.* 1995; 6:639–647.

44. Rome Foundation, "Guidelines—Rome III diagnostic criteria for functional gastrointestinal disorders," *Journal of Gastrointestinal and Liver Diseases*. 2006;15(3): 307–312.
45. Singh SK, Rajoria K. Ayurvedic management of chronic constipation in Hirschsprung disease- A case study. *Journal of Ayurveda and Integrative Medicine*. 2018; 9: 131e135.
46. Lever E, Cole J, Scott SM, Emery PW, Whelan K. Systematic review: The effect of prunes on gastrointestinal function. *Aliment Pharmacol Ther*. 2014; 40: 750–758.
47. Tinker LF, Schneeman BO, Davis PA, Gallaher DD, Waggoner CR. Consumption of prunes as a source of dietary fiber in men with mild hypercholesterolemia. *Am J Clin Nutr*. 1991; 53: 1259–65.
48. Pathirana CK, Madhujith T, Eeswara J. Bael (*Aegle marmelos* L.), A Medicinal tree with immense economic potentials. *Advances in Agriculture*. 2020; Volume 2020, Article ID 8814018, 13. <https://doi.org/10.1155/2020/8814018>.
49. Shih DQ, Kwan LY. All Roads Lead to Rome: Update on Rome III Criteria and New Treatment Options. *Gastroenterol Rep*. 2007 ; 1(2): 56–65.
50. Malabadi RB, Kolkar KP, Meti NT, Chalannavar RK. Triphala: An Indian Ayurvedic herbal formulation for coronavirus (SARS-CoV-2) disease (Covid-19). *Int. J. Curr. Res. Biosci. Plant Biol*. 2021; 8(8): 18-30. doi: <https://doi.org/10.20546/ijcrbp.2021.808.003>.
51. Abbas SR, Rani G. Medicinal significance of Alexandrian Senna. *Journal of Natural Sciences*. 2020; V-8; I (1): 24-29.
52. Ramchander J, Jalwal P, Middha A. Recent advances on Senna as a laxative: A comprehensive review. *J. Pharmacognosy Phytochemistry*. 2017; 6(2): 349-353.
53. Khan MSA. A review on Senna: An excellent prophetic herbal medicine. *World Journal of Pharmaceutical and Medical Research*. 2020; 6(7):113-118.
54. Balasankar D, Vanilarasu K, Preetha PS, Rajeswari S, Umadevi M, Bhowmik D. Senna-A medical miracle plant. *J. Med Plants Stud*. 2013; 1(3): 41-7.
55. Agarwal V, Bajpai M. Pharmacognostical and biological studies on senna and its products: An overview. *Int J Pharm Bio Sci*. 2010; 6(2): 1-10
56. Deshpande HA, Bhalsing SR. Recent advances in the phytochemistry of some medicinally important Cassia species: A Review. *International journal of Pharma Medicine and Biological Sciences*. 2013; 2(3): 60-78.
57. Sultana S, Ahmad M, Zafar M, Khan MA, Arshad M. Authentication of herbal drug Senna (*Cassia angustifolia* Vahl.) A village pharmacy for Indo-Pak Subcontinent. *African Journal of Pharmacy and Pharmacology*. 2012; 6(30): 2299-2308.
58. Flores E, Mbachi C, Randhawa T, Vohra I, Agrawal R, Benjamin M. Cascara sagrada: A dangerous herbal stool softener: A case report and literature review. *The American College of Gastroenterology*. 2019; 2258 Abstract.
59. Akram M, Thiruvengadam M, Zainab R, Muhammad M. Management of laxative activity. *Current Pharmaceutical Biotechnology*. 2022; 1-12.
60. Katare C, Saxena S, Agrawal S, Prasad GBKS, Bisen PS. Flax Seed: A potential medicinal food. *J. Nutr Food Sci*. 2012; 2:1 (<http://dx.doi.org/10.4172/2155-9600.100012>).
61. Kajla P, Sharma A, Sood DR. Flaxseed—A potential functional food source. *J. Food Sci Technol*. 2015; 52(4):1857–1871. DOI 10.1007/s13197-014-1293-y.
62. Ashafa AO, Sunmonu TO, Abass AA, Ogbe AA. Laxative potential of the ethanolic leaf extract of *Aloe vera* (L.) Burm. f. in Wistar rats with loperamide-induced constipation. *J. Nat Pharm*. 2011;2:158-62.
63. Madgulkar AR, Rao MRP, Warrie D. Characterization of Psyllium (*Plantago ovata*) polysaccharide and its uses. *Polysaccharides*. 2014; 1-17. DOI 10.1007/978-3-319-03751-6_49-1.
64. Oh HG, Lee HY et al. Effects of *Ficus carica* paste on constipation induced by a high-protein feed and movement restriction in beagle. *Lab Anim Res*. 2011; 27(4), 275-281.
65. Arslan GG, Eşer I. An examination of the effect of castor oil packs on constipation in the elderly. *Complementary Therapies in Clinical Practice*. 2011; 17 (1): 58-62.
66. Murray MT. *Glycyrrhiza glabra* (Licorice). *Textbook of Natural Medicine Pharmacology of Natural Medicines*. Section 4. 2020; 641-647. doi: 10.1016/B978-0-323-43044-9.00085-6.
67. Pandey MM, Rastogi S, Rawa AKS. *Indian Traditional Ayurvedic System of Medicine and Nutritional Supplementation*. Hindawi Publishing Corporation Evidence-Based Complementary and Alternative Medicine. 2013; Volume 2013, Article ID 376327, 12 pages <http://dx.doi.org/10.1155/2013/376327>.
68. Peterson CT, Sharma V, Uchitel S, Denniston K, Chopra D, Mills PJ, Peterson SN. Prebiotic potential of herbal medicines used in digestive health and disease. *The Journal of ALTERNATIVE AND COMPLEMENTARY MEDICINE*. 2018; 24 (7) 656–665. (DOI: 10.1089/acm.2017.0422).
69. Bae SH. Diets for constipation. *Pediatr Gastroenterol Hepatol Nutr*. 2014; 17(4):203-208. (<http://dx.doi.org/10.5223/pghn.2014.17.4.203>).
70. Cassettari VM, Machado NC, Lourencão PL, Carvalho MA, Ortolan EV. Combinations of laxatives and green banana biomass on the treatment of functional constipation in children and adolescents: A randomized study. *J. Pediatr (Rio J)*. 2019;95:27-33.
71. Kandasamy S, Aradhya SM. Polyphenolic profile and antioxidant properties of rhizome of commercial banana cultivars grown in India. *Food Bioscience*. 2014; 8: 22–32.
72. Zhang P, Whistler RL, BeMiller JN, Hamaker BR. Banana starch: Production, physicochemical properties, and digestibility—A review. *Carbohydrate Polymers*. 2005; 59: 443–458.
73. Sidhu JS, Zafar TA. Bioactive compounds in banana fruits and their health benefits. *Food Quality and Safety*. 2018; 2: 183–188 doi:10.1093/fqsafe/fyy019.
74. Kreydiyyeh SI, Usta J, Kaouk I, Al-Sadi R. The mechanism underlying the laxative properties of parsley extract. *Phytomedicine*. 2001 ;8(5):382-8. doi: 10.1078/0944-7113-00058. PMID: 11695882.
75. Farzaei MH, Abbasabadi Z, Ardekani MRS, Rahimi R, Farzaei F. Parsley: A review of ethnopharmacology, phytochemistry and biological activities. *J. Tradit Chin Med*. 2013; 33(6): 815-826 (ISSN 0255-2922).
76. Singh O, Khanam Z, Misra N, Srivastava MK. Chamomile (*Matricaria chamomilla* L.): An overview. *Pharmacognosy Reviews*. 2011; 5(9): 82-95.
77. Srivastava JK, Shankar E, Gupta S. Chamomile: A herbal medicine of the past with bright future. *Mol Med Report*. 2010; 3(6): 895–901. doi:10.3892/mmr.2010.377.
78. Gorzynik-Debicka M, Przychodzen P, Cappello F. et al. Potential health benefits of Olive oil and plant polyphenols. *Int. J. Mol. Sci*. 2018; 19: 547; doi:10.3390/ijms1903068.
79. Bonaterra GA, Bronischewski K, Hunold P, Schwarzbach H, Heinrich EU, Fink C, Aziz-Kalbhenn H, Müller J, Kinscherf. Anti-inflammatory and anti-oxidative effects of *PhytohustilR* and root extract of *Althaea officinalis* L. on macrophages in vitro. *Front. Pharmacol*. 2020; 11:290. doi: 10.3389/fphar.2020.00290.

80. Alammam N, Wang L, Saberi B, Nanavati J, Holtmann G, Shinohara RT, Mullin GE. The impact of peppermint oil on the irritable bowel syndrome: A meta-analysis of the pooled clinical data. *BMC Complementary and Alternative Medicine*. 2019; 19:21 <https://doi.org/10.1186/s12906-018-2409-0>.
81. McKay DL, Blumberg JB. A review of the bioactivity and potential health benefits of peppermint tea (*Mentha piperita* L.). *Phytother Res*. 2006;20(8):619-33. doi: 10.1002/ptr.1936. PMID: 16767798.
82. Wirngo FE, Lambert MN, Jeppesen PB. The Physiological Effects of Dandelion (*Taraxacum Officinale*) in Type 2 Diabetes. *Rev Diabet Stud*. 2016;13(2-3):113-131. doi:10.1900/RDS.2016.13.113.
83. Faria TC, Nascimento CCHC, Vasconcelos SDDDe, Stephens PRS, Saranraj P, Barreto AS, Diré GF. Literature review on the biological effects of *Taraxacum Officinale* plant in therapy. *Asian Journal of Pharmaceutical Research and Development*. 2019; 7(3):94-99. DOI: <http://dx.doi.org/10.22270/ajprd.v7i3.502>.
84. Malabadi RB, Kolkar KP, Meti NT, Chalannavar RK. Melatonin: One molecule one-medicine for many diseases, Coronavirus (SARS-CoV-2) disease (Covid-19); Function in plants. *International Journal of Research and Scientific Innovations*. 2021; 8(3): 155- 181
