The Plantain plant with the scientific name *Plantago major* L. belongs to Plantaginaceae family. It is a plant with wide geographic distribution in temperate grasslands of the world. *Plantago* is an important medicinal plant which has different compounds such as phenolic compounds (caffeic acid derivatives), flavonoids, alkaloids, terpenoids, vitamin C, antioxidants, anti-inflammatory agents. The World Health Organization has approved the use of *Plantago* as a laxative agent, to treat hypercholesterolemia and to reduce the blood glucose. *Plantago* consumption can also have side effects, including bloating and allergic reactions. *Plantago* has interactions with the carbamazepine, lithium, warfarin, iron supplements, minerals and vitamin B12 supplements.

**Keywords:** *Plantago* plant, Traditional medicine

**IPC Int. Cl.**: A61K 36/00

**Chemical constituents in the plant**

This forage plant contains 2 - 6.5 % mucilage which is composed of at least four polysaccharide, 6.5% tannin, Anvrtyin, emulsions and a glycoside called Aucubin, Diastase, hetrozeid, coloring materials, pectin, Plantagin, more than 1% salicylic acid, carboxylic phenolics acids, flavonoids, minerals, including zinc, potassium, silicic acid, and saponin. The seeds have a lot of glutinic materials plus Plantenolic acid, Succinic acid, Adenine, Choline, and Aeocoeine.

*Plantago* is an important medicinal plant which has different compounds such as phenolic compounds (caffeic acid derivatives), flavonoids, alkaloids, terpenoids, and vitamin C. *Plantago* plants have high levels of phenol toms and the powerful antioxidant quality of the plant may be due to its phenolic compounds.

Phenolic compounds, especially flavonoids have antioxidant qualities, but they are not able to inhibit all mutations induced by mutagenic agents. Based on the researches, the phenolic compounds of *Plantago* plant is used against UV radiation. The anti-mutation activities of phenolic compounds are associated with its antioxidant activity, because phenolic compounds in the presence of free radicals lead to the inhibition of DNA damage.
Trepeneids isolated from leaf wax contain Ursolic acid and Oleonolic acid, which are both inhibitors of tumor progression\(^5\). Actoside and Plantamajosid are the main derivatives of caffeic acid in *Plantago major* L.\(^9\). *Plantago major* L. has some alcaloids called Plantagonin and Indican\(^5\).

**Plantago from the perspective of traditional medicine**

*Plantago* has a number of unique properties that makes it suitable to be widely used in traditional medicine around the world. This perennial herb has been used as a traditional medicinal plant for centuries to treat several illnesses including colds, hepatitis, skin diseases, infectious diseases, problems related to the digestive organs, respiratory organs, reproduction, circulation, and it is used to reduce fever. Several biological activities have been attributed to *Plantago* leaves including anti-inflammatory, antiviral, analgesic, antioxidant, anti-cancer, anti-tumor, anti-fever, immune modulator, and anti-hypertensive effects and it has also been used to neutralize internal and external toxins\(^10-14\).

Recently, in many countries including Mexico and Argentina a lot of reports on the use of *Plantago* species in traditional medicine against cancer have been presented\(^15\). In addition, in Chile, Venezuela and *Plantago major* has been used to treat cancer\(^16\).

In traditional medicine, *Plantago major* is introduced as a sputum inhibitor, bleeding inhibitor, and a topical analgesic. Boiled leaves and roots are useful for bloody sputum, sore throat, diarrhea and dysentery\(^17\). The species of *Plantago ovata*, *Plantago psyllium*, and *Plantago indica* are used as traditional medicines that are expectorant, anti-tussive, antibacterial, diuretic, and are useful in treating rheumatism and gout pains, bronchitis, and swollen glands\(^18,19\). The herb tea is helpful for sore throat, dry cough and stomach irritation. Also, its topical ointment is used for styte, boils and ulcers\(^17\).

**Other applications** include the following:

- *Plantago* seed acts as laxative which is due to the increased volume of the mucilage within the seed membrane; thereby it increases the volume of stool and softens intestines. Plantain seeds should always be administered with plenty of water. The amount of usage is 7.5 gm\(^21\).

- The mashed balm of the leaves relieve arthritis. The seeds are laxative and seeds balm mixed with alyssum and lemon juice relieve swellings. The food with *Plantago* seeds licorice (and a quarter-weight Pepper) is useful for chest pain and cough when is ingested with milk (boil up to 100 gm of *Plantago* in one liter of water, and drink a cup of its filtered water every morning, noon and night).

- It stops fever and causes relaxation. It is useful for the treatment of colico malaria and for relieving cough and bronchitis asthma. It can effectively remove kidney disorders, bladder disorders, and gonorrhea. It stops bleeding. *Plantago* can be used to treat pulmonary tuberculosis and chest ulcer bleeding.

- If you sweeten the boiled juice with honey drink three cups every day, it will prevent heartburn, pricking sensation, and queasiness. It relieves stomach pain and cures anemia.

- Grind a bunch of new *Plantago* twice a day and use it as a poultice to treat varicose ulcers and various burns; it also cures wounds and injuries and improves inflammations. It can cure rash and swelling of the face which are caused by tooth abscess.

- Extract its fresh juice and use it to wash your mouth several times a day; it cures the mouth sores.

- Boil *Plantago* in water and use it to wash your face three times a day; it will remove the brown stains on the face.

- Mix a spoon of *Plantago* with barberry juice and drink it every morning and evening; it will remove the blood in the urine which is due to the weakness of the liver\(^22\).
Therapeutic effects from the perspective of modern medicine

Plantago has antioxidant, anti-inflammatory, and hematopoiesis effects and protects the liver and is used for the treatment of cancer. It has shown anti-asthma and anti-dyspnea therapeutic effects. Studies have shown a significant reduction in the number of coughs when Plantago is used. The ethanol extract of Plantago can generate antitussive effects comparable to codeine, but more research is needed to prove this.

All vegetative and reproductive parts of the Plantago plant, with the scientific name Plantago major, are used as medicines for treating skin diseases, respiratory, digestive and circulatory disorders, preventing cancer, preventing tumor formation, healing wounds and infections, etc.

Luteolin-7-O-β-glucoside, as the major flavonoid compounds in most species of Plantago, is used as a potent anti-cancer molecule with inhibitory effects on breast adenocarcinoma. The exact mechanism of inhibitory activity of Luteolin-7-O-β-glucoside in Plantago species is not identified in detail, but it seems that inhibiting DNA damages by topoisomerase inhibitors is the major cause of the antitumor effect. The Luteolin-7-O-β-glucoside compound is effective for cancer prevention and control. It has been proved that the methanol extract of aerial parts (leaves and inflorescences) of Plantago major has inhibitory effects on the layers of human adenocarcinoma cancer cells (MCF-7) and the layers of human melanoma cells (UACC-62).

There are various species of plantain plants which are laxative, diuretic, anti-inflammatory, anti-bacterial, anti-diarrhoeic, and anti-cicatrizing.

The seeds are sputum-inducer and strong disinfectants for the respiratory system. Boiled plantain seed is used for orally to eliminate diarrhea and inflammations of the kidneys and bladder. Besides, the seed’s paste is diaphoretic, diuretic and anti-rheumatic and is used to sure dry coughs and fever. Roots, leaves and seeds of this plant have softening effects and are used as blood purifier and can cure and alleviate wet asthma, diarrhea, and swelling of the oral mucosa (Table 1).

Indications approved by the World Health Organization based on clinical data

The World Health Organization has approved the use of Plantago in the following cases:

- Laxative: for treating constipation, temporary constipation due to illness or pregnancy, irritable bowel syndrome, constipation caused by duodenal ulcer or diverticulitis; hemorrhoids stool softener after surgery in patients with anorectal.
- To treat hypercholesterolemia as an adjunct to diet to reduce the risk of coronary heart disease.
- To reduce the blood sugar that is increased after a meal.

Instructions for the use and dosage of the drug and its side effects

Plantago can be administered both orally and topically. It is prepared in the following manners:

A. Oral

Plantago major and Plantago lanceolata species:

- infusion: 1.4 gm herb in 150 ml of boiling water for 15-10 minutes in a closed container; 3-4 times a day.
- Fluid extract (1:1 gm / ml): 1.4 ml; three to four times a day.
- Tincture (5:1 gm / ml): 7 ml; three to four times a day.
- Plantago ovata and Plantago psyllium and Plantago indica Species:

- Seeds: 5-10 gm of seeds, two to three times a day. World Health Organization has recommended an average dose of 7.5 gm of seeds dissolved in 240 ml of water or juice, one to three times a day. For children aged 6-12 yrs the dosage is half the adult’s dosage.
- Seed husk: 4-5 gm, one to four times a day. The seed husk must be soaked in 150 ml of warm water for several hours before consumption.
- Seed husk powder: 4-5 gm, one to four times a day. The powdered seed husk must be stirred in 150 ml water and be drunk immediately; after consumption, a large amount of water should be consumed.
Table 1—Summarized the medical effect of *Plantago*

<table>
<thead>
<tr>
<th>Research</th>
<th>The part of usage of the plant</th>
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<th>Medical uses</th>
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<td>Srivastava <em>et al.</em>(15)</td>
<td></td>
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<td>Cancer</td>
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<td>Kuhn <em>et al.</em> (20)</td>
<td>leaves and roots</td>
<td>Terpenoids, Flavonoids, alkaloids</td>
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<td>Samuelsen (5)</td>
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<tr>
<td>Pourmorad <em>et al.</em>(7)</td>
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<td>Boskabady <em>et al.</em>(21)</td>
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<td>reduction in the number of cough</td>
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<td>Galvez <em>et al.</em>(16)</td>
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<td>methanol</td>
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</tr>
<tr>
<td>Riault M A <em>et al.</em>(8)</td>
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<td>phenolic compounds</td>
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</tr>
<tr>
<td>Kuhn M.A., <em>et al.</em>(17)</td>
<td>leaves and roots</td>
<td></td>
<td>bloody sputum, sore throat, diarrhea and dysentery</td>
</tr>
</tbody>
</table>

(B) Local
- Cold infusion: 1.4 gm of chopped herb in 150 ml of cold water, stirred for 1-2 hrs; use to wash and gargle, three to four times a day.\(^{27}\)

Side effects
*Plantago* consumption can also have side effects, including:
- Bloating, and gas.\(^{18,19}\)
- Allergic reactions including nettle rashes, anaphylactic reactions, and even bronchial obstruction in patients allergic to plant.\(^{18,19}\)

Drug Interactions
*Plantago* has Interactions with the following drugs:
- Carbamazepine, lithium, warfarin: decreased drug absorption.\(^{18,19,29}\)
- Iron supplements: decrease Iron absorption.\(^{29}\)
- Insulin: insulin dependent diabetics may need less insulin in case of using the plant.\(^{18,19,29}\)
- Minerals (calcium, magnesium, copper and zinc), vitamin B12, cardiac glycoside, coumarin derivatives: decreased drug absorption.\(^{18,19,29}\)

Conclusion
Recently, plantago has been studied in the medical field. Plantago has some useful effects in the medical sciences. It has different compounds such as phenolic compounds, flavonoids, alkaloids, terpenoids, and vitamin C. So, plantago has antioxidant, anti-inflammatory and hematopoiesis effects. World health organization has approved using plantago compound for treating constipation, hypercholesterolemia and high blood glucose.

References


