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Bioactivities of *Plantago ovata* (Psyllium): A short review

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Abstract

Plantago ovata (Psyllium) is a plant from the family Plantaginaceae. About 10 species of this plant are found in India. It has many of applications in the pharmaceutical industries. It can be used to extract a polymeric base which can be used as a matrix for drug release agents. This is due to its high water-retentive property. It is also traditionally used as a gastrointestinal cleanser as it has the tendency to absorb water and thereby provide a brush-like action in the intestines. It has also proven to be effective in lowering cholesterol levels and diabetes to an extent which are discussed in detail below. It has also proven to be effective in controlling colon cancer in certain cases. It is also shown to be effective in slowing down the effects of Lactose Intolerance.

Keywords: *Plantago ovata*, plants, bioactivities.

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1. Introduction

Plantago is from Plantaginaceae family which has about 200 species, of which ten species occur in India [1]. *Plantago ovata* is a plant from West Asian origin, it was introduced in India during the Mughal settlement in the middle ages. *Plantago ovata* is an annual herb cultivated as a medicinal plant in recent times. Medicinal plants are rich in secondary metabolites and their biosynthesis is controlled genetically and is affected intensely by environmental factors [1]. Plantago seed, psyllium seed or plantain seed which is cleaned, dried, ripe seed of *Plantago psyllium* or *Plantago indica*, belongs to family Plantaginaceae. The genus Plantago has over 200 species. *P. ovata* and *P. psyllium* and *P. indica* are 3 important species. These are produced commercially in several European countries, the former Soviet Union, Pakistan, and India. Isabgul, the common name in India for *P. ovata*, comes from the Persian words ìisapî and ìgholî that mean horse ear, which describes the shape of the seed. India dominates the world market in the production and export of psyllium [2]. Plantago seeds contain 10ñ30% of hydrocolloid in the outer seed coat which can be separated into acidic and neutral polysaccharides and upon hydrolysis L-arabinose, D-galactose, D-galacturonic acid, L-rhamnose and D-xylose are obtained. Solution of Plantago gum is thixotropic where as its mucilage has super disintegrant property. The husk is the rosy-white membranous covering of the seed, which constitutes the drug, mainly given as a safe laxative, particularly beneficial in habitual constipation, chronic diarrhea and dysentery. It is a 100% natural product, a soluble fiber and forms gel in water. [3,4]. This short review gave different bioactivities from *Plantago ovate*.

2. Therapeutic benefits of (*Plantago ovate*) psyllium

Psyllium has been reported for the treatment of constipation, diarrhea, and irritable bowel syndrome, inflammatory bowel disease-ulcerative colitis, colon cancer, diabetes and hypercholesterolemia.

2.1 Constipation and hemorrhoids

Psyllium has been shown to have the paradoxical property of both improving constipation by increasing stool weight and ameliorating chronic diarrhea. Several studies suggest that psyllium may provide benefits for treating

constipation. There is a scientific basis for psyllium working as a mild laxative. Water absorbed by psyllium husk is not absorbed by the intestine resulti.ng in making stools softer and bulkier leading to a smooth defecation process. In hemorrhoids veins in the walls of the anus or rectum are dilated, which is usually caused by untreated constipation but sometimes associated with chronic diarrhea. Adequate fiber supplement combined with the TONE method can stop the progression of hemorrhoids and bleeding, and preventing surgery in most patients with advanced hemorrhoids [5, 6].

2.2 Hypertension

Psyllium, soluble fiber is part of a healthy diet and exerts a protective effect in normalizing the blood pressure. Observational studies show that when fiber is increased in diet (by 7–15 g/day above the usual levels) is significantly associated with reduced blood pressure and hypertension risk compared to the low fiber intake in Western diets. Consumption of soluble fiber is proved to reduce overall Systolic Blood Pressure (SBP) and diastolic blood pressure (DBP) in all populations, and especially psyllium fiber helps to reduce overall SBP [7].

2.3 Diabetes

Psyllium has been proposed as a possible treatment for high blood sugar levels. It is a soluble fiber which forms gel in the intestine which leads to slowing the rate of nutrient absorption and results in lowering postprandial blood glucose level. Studies in humans suggest moderate reductions in blood sugar levels after a single dose of psyllium, with unclear long-term effects. Water-soluble dietary fibers decrease postprandial glucose concentrations and decrease serum cholesterol concentrations to men with type 2 diabetes. Early or uncontrolled studies suggested that psyllium improved glycemic and lipid control in individuals with type-2 diabetes. The ability of soluble fibers to reduce the postprandial glucose response to meals eaten several hours after fiber ingestion (second meal effect) was shown previously in non-diabetic individuals [8].

2.4 Influence on autonomic gastrointestinal disorder

Psyllium husk can be used in Parkinson disease associated with autonomic GI dysfunction induced by anticholinergic drugs. Levodopa was extracted from collected and centrifuged plasma samples of rabbits and characterized by HPLC. 50% higher AUC values, higher C_{max} values are observed after oral administration of levodopa and carbidopa (20:5 mg/kg), biperiden (100 µg/kg), ispaghula husk at 2 different doses 100 and 400 mg/kg in rabbits in 7-14 days treatment period. Hence, Plantago ovate husk improve the pharmacokinetics of levodopa when given in combination with levodopa/car-bidopa and results in more stable plasma concentration, thus, circumventing the ëwearing offí phenomenon and delaying the onset of dyskinesia [9].

2.5Anti-inflammatory activity

Psyllium has been found to decrease the inflammatory intermediaries involved in intestinal inflammatory process for example NO, leukotriene B4 and TNF when evaluated in HLA-B27 transgenic rats, supporting its use as an intestinal anti-inflammatory agent [10].

2.6 Hypocholestrolemic activity

Rosendaal *et al* searched out that the use of Ispaghula husk (psyllium) as an adjunct to diet in patients with hypercholesterolemia is effectual [11]. Likewise, a placebo controlled double blind test involving 340 patients of 18-65 years age with mild to moderate hypercholesterolemia corroborated that ispaghula (7 g/day for 6 months) when given with diet caused 8.7% reduction in LDL cholesterol level (4.1-0.42 mM/L). The total cholesterol level was reduced by 7.7-8.9%. In another appraisal it was reported that psyllium binds with the bile acids in the intestinal lumen and lowers the serum cholesterol level [12]. Plantago ovata has revealed a considerable reduction in total cholesterol and LDL cholesterol in animals [13-15] and in humans as well. Furthermore, an additional scrutiny has divulged that consumption of 5.1 g of psyllium husk twice daily for the duration of eight weeks causes a 3.5% reduction in total cholesterol and a 5.1% reduction in LDL levels [12].

2.7 Suspending agent

Different studies have been conducted to evaluate use of Plantago ovata as a suspending agent, due to its mucilage forming property. According to Rajamanickam *et al* (2010) mucilages of different plants can be used to suspend particles in thermodynamically unstable systems, which aid in preventing sedimentation of particles and promote easy dispersion of settled particles due to their viscous and colloidal nature [13]. Moreover, they evaluated ispaghula mucilage powder as suspending agent by formulating suspension with standard drug, nimsulide and compared suspending properties of mucilage powder with one of the marketed product. Different formulations were formed and were observed for 7 days to monitor sedimentation and settling rate of particles. All formulations exhibited good shear thinning properties of suspension and particles were uniformly dispersed without formation of any deposits, therefore, confirming the property of Ispaghula mucilage powder as an effective suspending agent in different oral preparations. Similarly, Rao *et al* (2007) also investigated rheological properties of psyllium seed husk as suspending agent [14].

2.8 Wound healing activity

Singh *et al* conducted a study to investigate the wound healing activity of ethanolic extract of Plantago ovata seeds [15]. The extract was used as an ointment (10% w/w in petroleum jelly base) to cure the wound in shortest possible time with mini mal pain, discomfort and scaring to the patients in comparison to standard Aloe vera ointment (10%w/w). In this trial Albino rats were selected and surgical intervention was carried out to generate wound under sterile conditions. Acute dermal toxicity was performed and effective dose was selected for wound healing afterward. Healing of a lesion is accompanied by wound contraction characterized by organizing healthy skin adjacent the wound to cover the bare area. The results showed that ethanolic extract had significantly increased the percent wound contraction leading to enhanced wound healing

3. Conclusion

The present review work showed bioactivities of *Plantago ovate*. It has remarkable pharmaceutical properties like superdisintegrant, binder, gelling agent, suspending agent and can be widely used in the preparation of FDTs, suspensions, oral gels and it also possesses excellent pharmacological properties like wound healing, anti-diarrheal, anti-constipation, hypocholestrolemic and hypoglycemic activity.

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