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Nutritional and Health Consequences of *Bauhinia variegata*[#]

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ABSTRACT

Public health around the globe is still under the major threats and of some serious infectious diseases though a marvelous progress carried out in the field of human medicines. Therefore, use of products from natural sources as medicinal agent probably antecede in human history. The advancement and knowledge of various useful plants and their properties, functions and its use over synthetic drugs has increased in recent years. *Bauhinia variegata* L. (Kachnar) is an ornamental flowering plant within the Leguminosae family. Hairy branches of the plant are widely used in various traditional remedies to cure vast range of disease infections. Several plant portions, like roots, stem and stem bark, leaves, buds and flowers, are not only popular in different disease treatment but also useful in the manufacture of fibers, gum and to conserve the nature. The phytochemical screening exposed that *B. variegata* consist of various important secondary metabolites like flavonoids, terpenoids, cardiac glycosides and steroids, saponins and tannins compounds that are appropriate to be used in the treatment of various biological activities, such as antibacterial, antidiabetic, antitumor, antimicrobial, anticancer, antiulcer, anticarcinogenic effects, anti-inflammatory, nephro and hepatoprotective effects and wound healing effect. The current review is to demonstrate the medicinal, nutritional and biological importance of *B. variegata* as multidimensional effects on various diseases.

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Introduction

The most basic and important requirements for human beings to survive are food, clothes and good health. Since timeworn humans are totally dependent on plants and their products for their necessities. Nature has provided us a complete stock house of various remedies to maintain good health. Since ancient time various human health problems and disorders has been cured constantly with the help of herbs. An herbal remedy plays a major role in traditional medicinal structures that was used for thousands of years in medical practice and made a great contribution in maintaining good human health A major portion of population is still depends on herbal remedies in order to get its quality health needs in developing countries. Conferring to a world health organization (WHO) almost 80 percent of the entire world residents remains largely on folk medicines for its better health (WHO., 1998). From last few decades' traditional medicines paid high attention and consideration mainly because of a well-known alternative of other medicines and upon on its easy excess in both less and more developed areas (Gurib-Fakim., 2006).

Most people had shown a keen interest in plant natural products instead of synthetic drugs and medicines (Gunalan et al., 2012). Recently, modern remedies also based on traditional structure just only after clinical and chemical examination. About 56 percent of active constituents for various remedies in British National Formulary are from universal materials (Kamboja and Saluja., 2011). It is important to standardize and formulate plant natural products in order to explain and know about its identification, qualification and isolation of active constituents in plant (Qaisar et al., 2012). Therefore, these trees are valuable source of appreciated bioactive secondary metabolites which shows a great performance for quality health (Uddin et al., 2011, Rauf et al., 2012.)

Bauhinia variegata L. is an average size ornamental plant with a maximum height of about 10-15 meters and belongs to family *Fabaceae* and sub-family *Caesalpinioideae*. It is usually called mountain ebony in English, Kachnar in Urdu. It is a deciduous tree, starts leaf fall in November to December and tree remain leafless from January to April. It has almost smooth and dark

brownish bark with branches gray puberulent when three is young. It is native of Asia (Pakistan, China, India and Nepal). Its foliage is wider, tightly sub classes, severely heart shape per two leaflets that are oviform and 10-15cm long. Flowers occur in various color, lateral, stalk less, 5 stamens, flat fruit, hard glabrous dehiscent pods with 10-15 seeds (Patil et al., 2012). They are propagated by seeds. Constituents like fiber, oil, tannins and gum are mostly procured from its species which are able to play an important role in industries. These plants also contain beautiful colorful flowers which bear fragrant and used in perfumes. *B. variegata* also grown as ornamental plants are broadly used in local and various traditional medicines (Mali et al., 2009).

Major Phytochemical Compounds in Various Plant Parts

B. variegata is mainly divided into seed, bud, root, flower, bark, leaf and stem which contain various valuable chemical constituents in different ratios.

Seed: The seed portion of *B. variegata* consist of important building block units like histidine, alkaloids, carbohydrates, ascorbic acid, aspartic acid, proteins, flavonoids, lysine, threonine, serine, glycine, alanine, glutamic acid, tyrosine, proline, phenylalanine, methionine and phenylalanine (Reddy et al., 2003). The fatty oil extracted from *B. variegata* consists of mainly myristic acid, linolenic and oleic acid, palmitic and steric (Deswal et al., 2015).

Bud: B. variegata buds are the rich source of compounds like phosphonyl pyruvic acid, alanine, ketoglutaric acid, aspartic acid, oxaloacetic acid, glycine, glutamic acid and serine (Bansal et al., 2014). These buds especially dried buds are more important in the cure of stomach diseases like worms, piles, diarrhea and dysentery (Gautam., 2012).

Flower: As the mountain ebony (*B. variegata)* produces two types of flower colors; the white flowers where main constituents are kaempferol-3-galactoside and rhamnoglucoside, while the pale violet color flowers have mainly consist of peonidin-3-diglucoside, peonidin-3-glucoside, cynidin-3- glucoside, malvidin-3-glucoside and malvidin-3-diglucoside (Deswal et al., 2015).

Root: Analysis of *B. variegata* root showed novel flavonol glycosides, flavanone (2S)-5, 7-dimethoxy-3',4'-methylenedioxyflavanone, phenanthraquinone, 5-hydroxy7,3',4',5'-tetra-methoxyflavone5-O-beta-Dxylopyranosyl-(1-2)-alpha-Lrhamnopyranoside.
Phenolic compounds, carbohydrates, proteins, glycosides, gums and tannins were also found in the chemical analysis of root powder (Deswal et al., 2015; Patil et al., 2010). Root and root powder of *B. variegata* is mainly used as an antitoxin in snake poison and also helpful in the treatment of abdominal illness like dyspepsia (Shilpa Gautam., 2012).

Bark: Chemical test of bark produces various flavonoids like kaempferol-3-o-β-D-glucopyranoside, hesperidin, isorhamnetin-3-o-β-D-glucopyranoside, kaempferol, myricetol glycoside, lupeol, betasitosterol and isoquercitroside. (Yadava and Reddy., 2002, Sharma et al 1988., Gupta et al., 1980). The bark of *B. variegata* is used as an alternative and tonic to various disorders like skin treatment, ulcer. Its bark extracts show scavenging activity and also helpful to reduce oxidative stress (Bhatia et al., 2011). Result from the study carried out by Koti et al., 2009 shows that the ethanolic extracts from bark of *B. variegata* reveals significant role against anti diabetic activities.

Leaf: compounds isolated from *B. variegata* leaves mainly involved of dotetracont-15-en-9-ol and heptatriacontan-12,13-diol. The phyto-constituents of its leaves are also alkaloids, tannins, cardiac-glycosides and flavonoids containing apigenin, rutin, quercetin, and apigenin 7-O-glucoside (Deswal et al., 2015). The fresh juice obtained from *B. variegata* leaves is mostly useful in chest pain treatment (Prashar et al., 2010). The dried leaves ash can be used against cough (Pant and Sharma, 2010). *B. variegata* foliage's also valuable source of ascorbic acid (146 mg) and contain abundant amount of reducing sugar as well (Kirtikar and Basu., 1991).

Medicinal Capability

B. variegata is a rich source of series of important secondary metabolites which plays an important role in maintaining good health. Its leaves contain insulin like protein which helps them to be used as an antidiabetic (Azevedo et al., 2006). The plant also was shown to have anti-inflammatory action as consist of various flavonol glycoside and helpful in anti-tumor activity (Patil et al., 2010). *B. variegata* is also beneficial in making of traditional remedies aimed at various kinds of health disorders such as diarrhea, worm infestation, dysentery, rectal prolapse, antimicrobial, goiter anti-obesity and also act as blood cleanser (Manoj et al., 2013). It also improves detoxifying task of our liver. The upper parts of *B. variegata* is helpful in treatment of gallbladders and also helpful in kidney pain and piles as well (Singh et al., 2013).

Pharmacological Functions

Anti-Inflammatory

B. variegata flower buds are able to be used in the cure of complaints like cough, piles, liver and eye problems, and also act as an astringent in hematuria and catamenia (Mali et al., 2009). A research was carried out to study the anti-inflammatory actions of mountain ebony shows that the plant extract has the adequate source of anti-inflammatory actions (Bansal et al., 2014). Another study conducted by Gunalan et al., 2014 with the help of GCMS analysis also proved that it has significant anti-inflammatory activity.

Antidiabetic Activity

As *B. variegata* leaf and stem bark contain insulin like protein which is broadly used in as an anti-diabetic agent in various popular medicines (Azevedo et al., 2006). The study conducted by Dewangan et al., 2014 found a bioactive compound called D-pinitol from mountain ebony leaves. This compound is a natural product of cyclic polyol group and was responsible for hypoglycemic activities.

Anti-tumor Activity

A study performed by Panday and Agarwal during 2009 showed that increase in the life span of mice and significantly reduce the tumor size which shows that the *B. variegata* extract is helpful against anti-tumor activity. According to Rajkapoor et al., 2006 ethanolic extracts of

mountain ebony carried out a significant character in chemo preventive and cytotoxic effect and also helpful to reduce human cancer lines and liver tumor.

Wound healing Activity

B. variegata carried a vital part in wound healing that has been used for many years as a healing agent since ancient times. A poly-herbal liniment can be set by using mountain ebony, Rhododendron arboreum, and Myrica esculenta in different ratios according to need (Gyawali et al., 2016).

Antimicrobial Activity

B. variegata extract from stem bark carried an effective anti-microbial action against *Bacillus subtilis, Pseudomonas aeruginosa, Salmonella typhi, Shigella dysenteriae, Staphylococcus aureus and Vibrio cholera* (Pokhrel et al., 2002).

Anti-ulcer Activity

B. variegata contain strong anti-ulcer activity. The leaf, stem and root of the plantare beneficial for handling of diabetes, pain, infections, leprosy and ulcer (Arain et al., 2012). It also reduces the capacity of gastric excretion, total free acidity and ulcer. (Rajkapoor et al., 2003).

Antibacterial Actions

Various extracts of *B. variegata* displays strong anti-bacterial activity contrary to five various bacterial strains *S. aureus, B. cereus, P. pseudoalcaligenes, Klebsiella pneumoniae and Escherichia coli*. Antibacterial activity in methanolic extract is extra effective than aqueous extracts (Parekh et al., 2006).

Haemagglutinating Activity

B. variegata seeds are the rich source of protein shows hemagglutinating actions (Wassel et al., 1989).

Besides a vital role in traditional medicines, *B. variegata* are directly and indirectly associated with other products also:

- *Ornamental Source:* These plants contain purple, pink and white flower makes environment gorgeous for decorative purpose and also used street plantings. They are also using in various perfumes.
- *Fodder: B. variegata* are also good source fodder for sheep and goats. The normal annual fodder production per tree is 15-20 kg of dry matter.
- *Food:* Flowers and flower buds are cooked as vegetables in different countries (Pakistan, India and Nepal).
- *Fiber:* Fiber is extracted from weak stems and is used for making ropes.
- *Timber:* Its wood plays an important role in the preparation of agricultural equipment because colour is brown and is reasonably hard.
- *Gum or resin:* The tree produces a gum, which is used as adhesive agent and also as an industrial product.
- *Lipids:* The *B. variegata* seeds are made up of 20% endocarp and 80% kernel. They yield 16.5% of pale yellow, fatty oil on extraction with petroleum ether but only 6.1% in a hydraulicm press.
- *Medicine:* It is used for cough cure, diarrhea, bleeding hemorrhoids, dysentery, heartburn, skin illnesses, sore throat, TB, dyspepsia, bronchitis, leprosy, hematuria, indigestion, malaria, menorrhagia ulcer, obesity and worms (Gautam., 2012).

Conclusion

B. variegata is known as an ornamental and fodder tree with colorful flowers; it draws attention by researchers and increase in demands because with potential to cure various diseases. It has been used in many folk medicines and in traditional systems of medicine but it lasts few decades many experiments proved its ability and effectiveness in various disorders like antidiabetic, anti-oxidant, anti-ulcer, anti-microbial and anti-bacterial agent. Mountain ebony also helpful in making of several modern remedies because of its major phytochemical constituents.

Further research and investigations on *B. variegata* are needed to utilize the phytochemicals present in this plant on molecular medicinal level.

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