Phytochemical and Pharmacological Activities of Andrographis Paniculata Nees. : A Review

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Abstract: Andrographis paniculata is well known as king of bitters and has wide range of medicinal pharmacological application, which has been use either single or in combination with other drugs in various Indian traditional systems of medicine like Unani, Ayurveda and Sidda. It exhibits anti-inflammatory, anti-HIV, anti-bacterial, anti-oxidant, nematocidal etc. Apart from having several active chemical constituents, andrographolide, neoandrographolide and dehydro-andrographolide are most important bioprotectants with wide range of therapeutic applications. The extract of Andrographis paniculata its wide range of applications in various fields, an attempt has been made in this review paper to explore various phytochemical and pharmacological studies carried out on this drug.

Keywords: Andrographis paniculata, Kalmegh, anti-inflammatory activity, andrographolides, biological activities, Toxicity.

1. Introduction

Andrographis paniculata belongs to the family Acanthaceae. It is distributed in tropical Asian countries, often in isolated patches. This species can be found in a variety of habitats, like plains, hill slopes, wastelands, farms, dry or wet lands, sea shores and even road sides. South India and Sri Lanka which are considered as centre of origin and diversity of the species for native populations. The herb is also available in northern parts of India, Java, Malaysia, Indonesia, West Indies and whereas in America where it is probably an introduced species. (Abhishek et.al.2010) The species also occurs in Hong Kong, Thailand, Brunei, and Singapore, etc. However, precise data are lacking on the introduction and naturalization of the species in these countries (Chopra et.al.1956; Prajapati et.al.2003)

The genus Andrographis Wall. Consists of 28 species among which Andrographis paniculata is the most popular as medicinal plant. It has been used as medicinal herb for centuries in several traditional systems of medicine all over the world. It is extensively used in Ayurveda, Unani and Siddha medicines as home remedy for various diseases in Indian traditional system as well as in tribal medicine in India and some other countries for multiple clinical applications. The therapeutic value of Kalmegh is due to its mechanism of action by enzyme induction. It is an important cold property herb, used fevers and to dispel toxins from the body. It is used to treat gastrointestinal tract and upper respiratory infections, fever, herpes, sore throat, hepatitis and a variety of other chronic and infectious diseases (Chopra et.al.1956) It exhibits antibacterial, antimalarial, lacticidal, anti diarrhoeal, cardiovascular activities, fertility effects and protection of liver and gallbladder. The herb and its isolates like andrographolide, neoandrographolide, dehydroandrographolide, isoandrographolide, etc. (Abhisek et.al.2010) are reported to possess anti-inflammatory, hepatoprotective, astringent, anodyne, tonic, alexipharmic and anti-pyretic properties and helps in arresting dysentery, cholera, diabetes, influenza, bronchitis, swellings and itches, piles and gonorrhoea (Prajapati et.al.2003) of the aqueous extract was clinically proved.

Therapeutic Actions: The therapeutic value of kalmegh is due to its mechanism of action by enzyme induction. Kalmegh possess a number of therapeutic actions which mainly include anti-inflammatory, anti-pyretic hepatoprotective, astringent, anodyne, tonic, alexipharmic and helps in arresting dysentery, cholera, diabetes, influenza, bronchitis, swellings and itches, piles and gonorrhoea (Prajapati, et.al.2003) of the aqueous extract was clinically proved.

Therapeutic Uses: Andrographis paniculata recommended for prominent 26 Ayurvedic formulations treatment of various ailments include immunostimulant (Puri et.al. 1993) asthma, gonorrhoea, piles (Rao 1914) dysentery and dyspepsis (Bhalla et.al.1982) blood purification (Vohora, 1985) influenza (Dey, 1986) gastric complaints, diarrhea (Gupta et.al. 1990) pharyngitis and allisitis (Thamlikitkal, et.al...
Phytochemical Studies

Phytochemical studies reveal the presence of various chemical constituents in the aerial parts of the Andrographis paniculata which includes flavonoids, triterpenoids, etc. The aqueous extract was found to be safe and efficacious for the relief of symptoms of uncomplicated upper respiratory tract infection. Poolsup et al. (2003) in ethanolic extract alone or in combination may be more effective than placebo and may be an appropriate alternative treatment of uncomplicated acute respiratory tract infection. Poolsup et al. and Gabrielian et al. in their double-blind clinical study also proved that A. paniculata extract alone or in combination may be more effective than placebo and may be an appropriate alternative treatment of uncomplicated acute upper respiratory tract infection (Coon et al. 2004). Immunological and biochemical studies were carried out in 2006 by Sheeja et al. to investigate protective effects of ethanolic extract of A. paniculata against cyclophosphamide-induced neutropenia in rats. It was also found to inhibit the tumor-specific angiogenesis by regulating the production of various pro-inflammatory factors and antiangiogenic factors byin vivo and in vitro studies (Sheeja et al. 2007). In a study by Wang et al. (1994) A. paniculata was found to alleviate atherosclerotic artery stenosis induced by both atherothrombosis and high cholesterol diet as well as lower restenosis rate after experimental angioplasty. Further in a research by Coon et al. in 2004 it was also found to be safe and efficacious for the relief of symptoms of uncomplicated upper respiratory tract infection. Poolsup et al. and Gabrielian et al. in their double-blind clinical study also proved that A. paniculata extract alone or in combination may be more effective than placebo and may be an appropriate alternative treatment of uncomplicated acute upper respiratory tract infection (Coon et al. 2004). Immunological and biochemical studies were carried out in 2006 by Sheeja et al. to investigate protective effects of ethanolic extract of A. paniculata against cyclophosphamide-induced neutropenia in rats. A. paniculata shows presence of flavonoids, triterpenoids, etc. Further, it was concluded by Yu BC et al. in 2003 that the andrographolide was responsible for the antihyperglycemic activity. Finally in 2006, the antidiabetic potential of A. paniculata was found to restore impaired estrous cycle in alloxa-induced diabetic rats (Reyes et al. 2006).

Antidiabetic property of A. paniculata was confirmed by Borhanuddin et al. (1994) and Husen et al. (2004) in aqueous extract and by Zhang et al .(2000) in ethanolic extract. Along with antihyperglycemic property, the ethanolic extract may also reduce oxidative stress in diabetic rats as studied by Zhang et al. (2000). It was also found to inhibit the tumor-specific angiogenesis by regulating the production of various pro-inflammatory factors and antiangiogenic factors byin vivo and in vitro studies (Sheeja et al. 2007). In a study by Wang et al. (1994) A. paniculata was found to allevi...
Andrographolide, neoandrographolide, and 14-deoxy-11,14-epidioxyandrographolide were found in the methanol extract of *A. paniculata*. The activities of antioxidant enzymes such as superoxide dismutase, catalase, glutathione peroxidase, and the levels of glutathione were decreased following the BHC effect.

**Hepatoprotective activity:**

Sheeja *et al.* (2006) concluded that the methanolic extract of *A. paniculata* was found to inhibit the formation of oxygen derived free radicals such as superoxide (32%) hydroxyl radicals (80%), lipid peroxidation (80%), and nitric oxide (42.8%) in vitro. Trivedi *et al.* studied the effect of the *A. paniculata* on antioxidant activity in mice by using the enzymes y-Glutamyl transpeptidase, glutathione-S-transferase, and lipid peroxidation compared to Benzenehexa Chloride (BHC). The activities of antioxidant enzymes like superoxide dismutase, catalase, glutathione peroxidase, and the levels of glutathione were decreased following the BHC effect.

**Immunomodulatory activity**

In 1993, Visen *et al.* found that andrographolide has a significant dose-dependent protective activity against paracetamol-induced toxicity on ex vivo preparation of isolated rat hepatocytes. Kapil *et al.* (1993) proved effects of *A. paniculata* on hepatotoxicity induced in mice by carbon tetrachloride.

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