PHYTOCHEMICAL AND PHARMACOLOGICAL REVIEW ON ANDROGRAPHIS SERPYLLIFOLIA: POTENTIAL HERBAL CURE-ALL

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ABSTRACT

From last few decades plant based research is focused all over the world. Plant belongs to family Acanthaceae, Andrographis serpyllifolia is widely grown in India and commonly called as Round leaf Kariyat, Aaku chandrika, Hasiru chedi, Hasiru havina gida, Kaasina sara, Kirta kuram aku, Nela ber. The plant is very rich in Flavonoids, responsible for its wide therapeutic actions. A. serpyllifolia has been recommended for treatment of digestive problems, fever, cancer, inflammation, wound, hypoplipidemia, diabetes, disease caused by microbes, and widely used in snake bite in this review the information of A. serpyllifolia on pharmacology, mechanism of action, and several preclinical and clinical studies.

Key words: Andrographis serpyllifolia, chemical constituents, pharmacology, preclinical study.

INTRODUCTION

A large body of evidence has been accumulated to highlight the immense potential of medicinal plants used in various traditional systems of medicine[1]. World health organization (WHO) reported that about 80% population of developing countries is dependent on medicines which are plant based [2]. India is the largest producer of medicinal herbs; hence it is called as botanical garden of the world [3]. On the basis of international plant name index (IPNI), Genus Andrographis comprises of 40 species out of them Andrographis serpyllifolia (Syn. Eriathera serpyllifolia, Andrographis oribiculata) is one of most important plant[4][5]. It’s common names are Round leaf Kariyat, Aaku chandrika, Hasiru chedi, Hasiru havina gida, Kaasina sara, Kirta kuram aku, Nela ber. This edible, railing and rooting herb is known for its traditional medicinal properties. The herb is widely distributed throughout China, Deccan and Carnatic region of south India [6]. Only a very few studies are reported in A. serpyllifolia for the presence of chemical constituents like serpyllin, apigenin 7,4’-dimethyl ether and tectochrysin compounds [7][8]. Although their utility on bioactivity is not very clearly known, Andrographolide (AG) has been reported as one of the potential active component and is found to be responsible for several pharmacological and clinical activities [9-11]. A. serpyllifolia is a prostrate growing herb whose plant extract inhibits the growth of Bacillus subtilis, Staphylococcus aureus, Pseudomonas aeruginosa, Escherichia coli, Shigella boydii, Shigella flexneri, Salmonella typhimurium, and Salmonella typhi [12-17] and it is used in treatment of jaundice, digestive problems, snake bites, fever, cancer, inflammation, wound [18], hypoplipidemia [19], malaria [20], diabetes [21].

Description of plant

A. serpyllifolia is an Indian plant of Acanthaceae family. This plant is grown in South India in the state of Karnataka, Tamil Nadu, and Andhra Pradesh. Densely hispid pale purple flowers are present in upper axis of the plant. This plant prevails in hill top regions with less quantity of soil and humus. (Fig: 1).

Phytochemical screening

Whole plant of A. serpyllifolia contains alkaloids, flavonoids, steroids, phenols, saponins, terpenoids, anthraquinones, sugar, glycosides, phycobalamin and tannins [22]. Some of these chemical compounds are associated to antibacterial, anti diabetic, anticancer, anti ulcer, and anti inflammatory activities [20][23].

Chemical constituents

There are some specific chemical constituents present in A. serpyllifolia which show biological activity. The flavones like apigenin 7, 4’-dimethyl ether (Fig: 2), tectochrysin, acylated flavone and glucosides components show their specific activity [7]. Serpyllin (Fig: 3) which comes under the category of flavone, has been isolated from A. serpyllifolia and its structure has been determined as 5-hydroxy-7, 8, 2’, 3’, 4’-pentamethoxyflavone having molecular formula C20H20O8, Mw 388.1158 [24].

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Fig.3: Serpyllin, IUPAC Name: 5-hydroxy-7, 8, 2′, 3′, 4′-pentamethoxyflavane

Skullcapflavone I 2′-O-B-D-glucopyranoside and Andrographidine C (Fig 4) are the two new acylated flavone glycosides, that have determined as skullcapflavone I 2′-O-β-D-(3′-E-cinnamoyl) glucopyranoside and skullcapflavone I 2′-O-β-D-(2′-E-cinnamoyl) glucopyranoside, both isolated from the whole plant of A. serpyllifolia. Structural elucidation of the glycosides was achieved by various NMR techniques including 2 D NMR (1H-1H COSY, HMOC, HMQC, HMBC and ROESY experiments), FAB-mass spectrometry, saponification and acid hydrolysis [25].

Fig.4: Structure of Andrographidine C

PHARMACOLOGICAL ACTIVITIES ON THE BASIS OF PRECLINICAL STUDIES

Antidiabetic activity

A. serpyllifolia, ethanolic extract has reduced the glucose level in normal glucose loaded and Alloxan monohydrate induced diabetic animals. The continuous treatment with ethanolic extract of A. serpyllifolia produced a significant decrement in the blood glucose level of diabetic rats. These extracts also showed improvement in parameters like body weight and lipid profile as well as serum enzymes and thus may be of value in diabetes treatment. The use of A. serpyllifolia ethanolic extract folklore is practiced as an ant diabetic [21]. By the help of computer aided drug discovery (CADD), A. serpyllifolia has been docked with the two promising targets (PPAR-γ and C/EBP-α) for T2Dype. The interaction of the receptors and inhibitors were analyzed using GOLD and the best interacting inhibitor were screened. The receptors C/EBP-α and PPAR-γ involved in the regulation of insulin resistance in type 2 diabetes interacts with 5-hydroxy-7, 8-dimethoxyflavane and 17, 19, 20-trihydroxy-5beta, 8a H, 9beta H, 10a-labd-13-En-16, 15-dolactone respectively with maximum fitness score [26][27].

Anti-inflammatory activity & Analgesic activity

A. serpyllifolia methanolic root extract shows moderate potency in the inhibition of 5-LOX. Methanolic root extract of A. serpyllifolia shows more degree of anti-inflammatory activity in vitro studies, whereas methanolic extract of A. serpyllifolia exhibited more degree of analgesic activity in vivo studies. Based on the correlation between both in vitro and in vivo data, it was concluded that A. serpyllifolia methanolic root extract possibly consists of more anti-inflammatory activity. Investigations are anticipated to identify the active components and lead to their further clinical use [28].

Antimicrobial activity

Among extracts of all parts of A. serpyllifolia, stem extract shows maximum zone of inhibition against microbes whereas leaf, root and whole plant show comparatively lesser zone of inhibition. Antimicrobial activity was found against Pseudomonas aerogen, Salmonella typhimurum, Salmonella typhi, Shigella boydii, and Shigella flexneri [13]. The ethanolic extract of A. serpyllifolia leaves is recommended for clinical applications in treatment of typhoid [12]. Antimicrobial screening assay of the different solvent extracts of A. serpyllifolia against the tested strains showed that the methanol, petroleum ether, and benzene extract of plant possess a broad spectrum of activity against microbes, being active on Gram +ve and Gram –ve organisms [20].

Antioxidant activity

The Phenolic fractions were screened for their potential antioxidant activities using DPPH, reducing power, DNA protection, and inhibition of lipid peroxidation and protein carbonyls model systems. The positive correlation between polyphenolic content of A. serpyllifolia to its antioxidant activity was observed [29]. The free radical scavenging activity of methanolic extract of the plant was assessed by DPPH assay. There was significant decrement in the concentration of free radicals due to the scavenging ability of A. serpyllifolia [20].

Antiproliferative activity

Phenolic extract of A. serpyllifolia contributes to antiproliferative activities which determine to justify the traditional result of anticancer properties. Phenolic extract showed antiproliferative activity with increased malondialdehyde (MDA) as well as decreased levels of glutathione (GSH) [29].

Hepatoprotective activity

Treatment with standardized extract at different dose level showed protection respectively with the depletion of aspartate transaminase (AST), alanine transaminase (ALT), Serum alkaline phosphates (ALP) and total serum bilirubin (T.Bil) in serum which significantly reduced lipid peroxidation (LPO), glutathione (GSH) and superoxide dismutase (SOD) and increased in levels of Catalase (CAT) against CCh induced hepatotoxicity. [12].

CURRENT FINDINGS AND FUTURE PROSPECTS

The present study is indicative of multiple useful clinical effects of A. serpyllifolia especially as digestive problems, snake bite etc. Further long-term studies will help to determine the exact mechanism by which A. serpyllifolia inhibits the growth of microbes, also the reported antioxidant activity by IC50 value of DPPH assay, ant diabetic and cancer research done on this plant. Future prospects are very bright because this drug has very less side effects. Currently, a pilot study is going on by national botanical research institute, India for determination of more pharmacological activities, preclinical, clinical studies, and comparison with marketed drugs for treatment of diabetes, jaundice, malaria, typhoid, cancer, etc.

CONCLUSIONS

The therapeutic potential of this plant in terms of its efficacy and versatility is described in this paper along with the potential of this herb against jaundice, malaria, diabetes, typhoid, cancer etc. The growing number of herbal preparations in the market, including A. serpyllifolia, raised the possibility of complications related to improper use of these products, or the lack of medical supervision along with the likelihood of interactions with the drugs and herbs on simultaneous use. Several of the recent cases reported to the special nutritions, adverse event monitoring system indicate the importance of providing patient counseling on the use of herbal preparations.

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