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Phytochemical and biological effects of *Passiflora foetida*: A review

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Abstract

The genus *Passiflora* is the largest and more diverse of the family *Passifloraceae*, comprising more than 560 species of vines, lianas, trees, and shrubs, commonly used for their fruits and derivatives, and as ornamental and medicinal plants. *Passiflora foetida* is a prominent medicinal plant with major phyto-constituents such as flavonoids, glycosides, alkaloids, phenolic and volatile constituents those are potent for potential therapeutic practice. It has been used in treatment of some disease like as anxiety, insomnia, convulsion, sexual dysfunction, cough and cancer. It is rich in fiber content, used in paper production industries. In various, countries *Passiflora* fruits are farmed for making cold drink, ice cream, flavor thus best source for economic earning.

Keywords: *Passiflora foetida*, chemical compounds, plants, bioactivities.

Introduction

Medicinal plants and their extracts play a vital role within the medicine system to preserve our health. Earth is a rich source of medicinal plants and a number of plant derived extracts are used against diseases in various systems of medicine such as Ayurveda, Unani and Siddha. Only few of them have been scientifically explored. Plant derived natural products such as flavonoids, terpenes and alkaloids ^[1, 2] have received considerable attention recent years due to their diverse pharmacological properties including inflammatory, antipyretic and analgesic activities. *Passiflora* is the largest genus in the *Passifloraceae* family and comprises nearly 500 species ^[3].

The genus also contains some species of ornamental use and medicinal properties as sedatives, antispasmodics and antibacterial ^[4]. Several species have edible fruits and attractive flowers, about 40 species have been cultivated, but fewer than 6 are fruit crops in the neo tropics and only one, *P. edulis* (and its varieties, such as the yellow favicarpa), is economically important ^[5]. *Passiflora foetida* L. popularly known as striking passionflower ^[6] is a particularly renowned species belonging to the genus *Passiflora*, with tremendous ethnobotanical applications. For instance, the decoction of leaves and fruits of *P. foetida* has been reported to treat asthma and biliousness, while the leaves and root decoction is employed as an Emmengogue and used in hysteria. Additionally, leaf paste is applied to the head for headache and giddiness. Besides, the herb is used in the form of poultices or lotions for erysipelas and skin diseases with inflammation ^[7]. *P. foetida* has also been described to treat anxiety, insomnia, sexual dysfunction, convulsion, cough as well as cancer ^[8]. Moreover, studies conducted on *P. foetida* have revealed extracts of the plant to possess numerous promising bioactivities such as antidiarrhoeal, antiulcerogenic, analgesic, antidepressant anti-inflammatory, anti-hypertensive, hepaprotective, anticancer, antibacterial and antinociceptive ^[7, 9, 16]. Similarly, several bioactive compounds isolated from *P. foetida*, especially flavonoids, have shown important pharmacological actions, such as luteolin and chrysoeriol that have been found to possess potent anti-inflammatory properties ^[17].

Phytochemicals

The total fatty acids as “linolenic” and “linoleic” acids varied from 61.1 to 74.8% was reported in *Passiflora foetida* ^[18]. Five cyanohydrin glycosides with a cyclopetene ring, tetraphyllin A, tetraphyllin B, tetraphyllin B sulphate, deidacin and volkenin were reported in *P. foetida* seeds collected in the Galapagos islands. While the variability in chemical contents *viz.* tetraphyllin B, volkenin and tetraphyllin B sulphate in *P. foetida* were reported when grown on Reunion Island.

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The chemical changes were accompanied by pronounced morphological differences^[19]. Different phytochemicals are present in *P. foetida*, range from alkaloids, phenols, glycoside flavonoids and cynogenic compounds^[20]. Three polyketides α -pyrones, named passifloricins, were isolated from *Passiflora foetida* resin; their structures and relative configurations were assigned through 2D NMR spectroscopic analyses. These types of compounds were not detected in other passion flowers^[21]. *P. foetida* supposed to be an enormous source of chrysoeriol, apigenin, isovitexin, vitexin, 2'-xyloxyvitexin, 2'-xylosyl vitexin, luteolin 7'- β -D-glucoside, kaempferol, etc. *P. foetida* also consists of few more important constituents like hydrocyninic acid, harmaline, harmalol, harmine^[22]. Apigenin 7,4'-dimethyl ether, 5'-Hydroxy 4',7'-dimethoxyflavone, Genkwanin 4'-methyl ether, 7'-O-Methylacetin, Acacetin 7'-methyl ether and 5'-Hydroxy 7'-methoxy 2'-(4'-methoxyphenyl)-4H-1'-benzopyran 4'-one^[23, 24, 25], Deidaclin, Linamarin, Volkenin; (1R, 4R) 'Volkenin, (1S,4S) 'Tetraphyllin B, (S) 'Tetraphyllin A^[26] have been already reported in *P. foetida*. *P. foetida* contains alkaloids and at least 10 flavonoids. One of the latter, ermanin, is a feeding deterrent to larvae of the nymphalid butterfly *Dione juno* which, in Colombia, do not attack *P. foetida* leaves, but eat the large amount of other *Passiflora* species. Thus, Ermanin can be good pesticide against such pests and insects. The presence of flavonoids pachypodol, 7, 4'-dimethoxyapigenin, ermanin, 4', 7'-dimethoxy 1'-naringenin, 3, 5'-dihydroxy 4', 7'-dimethoxy flavonone^[27, 28] has been reported. Whereas a presence of C-glycosyl flavonoids chrysoeriol, apigenin, isovitexin, vitexin, 2''-xylosylvitexin, Luteolin 7' Beta-D'glucoside, kaempferol was reported in species of *P. foetida*^[29]. It has been seen that *P. foetida* leaf extracts, which show high antimicrobial activity, have a low antioxidant power and lower amount of o-diphenol and catechin^[30].

Biological activities

Antiproliferative, Antioxidant effects

Results proved *Passiflora foetida* methanol extract exhibits a high anti-proliferative activity against HeLa (IC₅₀) of 10.83±3.65µg/ml). The PFME manifested high antiradical properties (EC₅₀) of 1.37±1.17µg/ml) and moderate antioxidant reducing power (0.41±0.03mM FE), with 82.09±13.82mg GAE/g of TPC and 205.59±6.57mg QE/ of TFC values. However, fractions shows higher IC₅₀ values against HeLa compare to PFME. GC-MS study revealed the presence 8-32 compounds from each sample Tetradecanal was identified to possibly possess high anticancer properties. This study is the first to demonstrate that PF has anti-proliferative effect on human cervical cancer cells. PFME might be more potent than the fractions as demonstrates a moderate amount of antioxidant activity^[31].

Antimicrobial activity

The antibacterial properties of leaf and fruit (ethanol and acetone) extracts of *Passiflora foetida* (stinking passion flower) were screened against four human pathogenic bacteria that is *Pseudomonas putida*, *Vibrio cholera*, *Shigella flexneri* and *Streptococcus pyogenes* using well-in agar method. The results showed the leaf extract having remarkable activity against all bacterial pathogens compared to fruits^[32].

Anti-inflammatory effect

The anti-inflammatory effect of methanolic extracts of *P. foetida* L. (PFME) and the involvement of nuclear factor- κ B (NF- κ B) signaling in the regulation of inflammation were

investigated. PFME prevented the production of prostaglandin E₂ (PGE₂) and the expression of inducible cyclooxygenase-2 (COX-2) in lipopolysaccharide (LPS)-induced macrophage cells. Additionally, PFME reduced the release of pro-inflammatory cytokines. Moreover, in LPS-induced RAW264.7 cells, the phosphorylation of MAPKs (ERK1/2, p38 and JNK) was suppressed by PFME. Furthermore, PFME inhibited the NF- κ B activation induced by LPS, which was associated with nuclear p65 levels with the abrogation of I κ B α degradation and subsequent decreases. These results indicated that the PFME inhibited the LPS-induced inflammatory and oxidative responses. Therefore, PFME may be therapeutic for treating inflammatory diseases^[33].

Antidiabetic effect

Passiflora foetida (PSF) aerial parts against antidiabetic activity in rats. The carbohydrate metabolic enzymes were studied and there were elevation levels of carbohydrate metabolizing enzymes when treated with PSF extract when compared with doxorubicin induced diabetic rats. The significance of pure silver nanoparticles were induced for diabetic rats and there were reducing of carbohydrate metabolizing enzymes. By our present investigation the influence of bio active compounds of PSF plant extract and silver nanoparticles has impact against diabetic rats^[34].

Inhibition of acetyl cholinesterase (AChE) and antimicrobial activity

This study determined the chemical composition (IR), characterize minerals (ICP-OES), antioxidant activity, total phenols, inhibition of acetylcholinesterase (AChE) and antimicrobial activity of leaf extract of wild passion fruit (*Passiflora foetida* L.). The results obtained by Infrared of the hexane extract indicate the presence of aliphatic compounds such as fatty acids and esters, long chain alcohols and steroids. The hexane extract showed inhibition of 17.97% for antioxidant activity. The activity on AChE was 96.46% inhibition. As for microorganisms, the extract showed inhibition on Gram-positive bacteria *Bacillus cereus* (77.93%), *Staphylococcus aureus* (88.25%), Gram-negative *Citrobacter freundii* (82.74%), *Salmonella typhimurium* (83.21%) and yeast *C. albicans* (53.29%)^[35].

Conclusion

The ethno pharmacological importance of *P. foetida* L. has proven extensively by modern research. Undoubtedly, the Plant comprises a varied array of bioactive phytoconstituents.

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