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Datura stramonium: An updated review

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ABSTRACT

Datura stramonium is a foul-smelling, erect, annual, freely branching herb plant in the nightshade family, indigenous to Mexico, naturalized in many other parts of the world. While this plant has lots of properties, the aim of this study is to overview its therapeutic effects than its industrial effects. This review article was carried out by searching studies in PubMed, Medline, Web of Science, and IranMedex databases 1990 to 2016.totally, of 87 found articles, 50 articleswere included. The search terms were "Datura stramonium", "therapeutic", "pharmacological", Various studies have shown that Datura stramonium PossessNeurological effects , Anti-obesity ,Antioxidative effects ,Anti-infection ,Anti-viral activity ,Rhizogenic activity Anticholinergic activity ,Immune modulatory effect ,Tropinone-reductase activities ,Enzyme activities ,Lectin properties ,Bronchodilator effects Datura stramonium was shown that is negatively correlated with infection progression. The wealth of scientific literature supports the proposal that Datura stramonium consumption have significant antimicrobial and anti-infection effect, which include both animal and human studies. But certain issues regarding the proper use of garlic, i.e use of different preparations available, dose, duration and interaction with generic drugs should be optimized. Further research should also be carried out to identify specific compounds from Datura stramonium or its products that are responsible for most of its biological effects.

Keywords: Datura stramonium, "therapeutic", "pharmacological", "pharmacognosy"

INTRODUCTION

It is proved that herbal medicine is effective in the treatment of many diseases[1-20].Datura stramoniumis a plant in the nightshade family, indigenous to Mexico, naturalized in many other parts of the world[22].

Datura stramonium is a foul-smelling, erect, annual, freely branching herb that forms a bush up to 60 to 150 cm (2 to 5 ft) tall. The root is long, thick, fibrous and white. The stem is stout, erect, leafy, smooth, and pale yellow-green. The stem forks off repeatedly into branches, and each fork forms a leaf and a single, erect flower[23, 24]. The leaves are about 8 to 20 cm (3–8 in) long, smooth, toothed, soft, and irregularly undulated. The upper surface of the leaves is a darker green, and the bottom is a light green. The leaves have a bitter and nauseating taste, which is imparted to extracts of the herb, and remains even after the leaves have been dried[25]. The egg-shaped seed capsule is 3 to 8 cm (1–3 in) in diameter and either covered with spines or bald. At maturity, it splits into four chambers, each with dozens of small, black seeds[26,27].

Datura has been used in traditional medicine to relieve asthma symptoms and an analgesic during as surgery or bone setting. It is also a powerful hallucinogen and deliriant. However, thetropane alkaloids responsible for both the medicinal and hallucinogenic properties are fatally toxic in only slightly higher amounts than the medicinal dosage, and careless use often results in hospitalizations and deaths[28, 29].

In traditional Ayurvedic medicine in India, datura has long been used for asthma symptoms. The active agent is atropine. The leaves are generally smoked either in a cigarette or a pipe. During the late 18th century, James Anderson, the English Physician General of the East India Company, learned of the practice and popularized it in Europe.

Neurological effects
The modulatory effect of alkaloid extracts from leaf and fruit of Jimson weed on critical enzymes of the purinergic was studied. The in vivo study revealed reduction in the activities of ENTPDase, E-NTDase, and Na^+/K^+ ATPase in the extract-administered rat groups compared to the control group. alterations of activities of critical enzymes of purinergic signaling (in vitro and in vivo) by alkaloid extracts from leaf and fruit of Jimson weed suggest one of the mechanisms behind its neurological effects as reported in folklore[30].

Anti-obesity
In an animal study, the effect of Datura stramonium was evaluated by examining the differences in urine and serum metabolites between Datura stramonium groups and control group. The result reflected the relationship between metabolites in rat fluid and Datura stramonium spectra. Potential differences in metabolites and metabolic pathway analysis showed that the establishment of urine and serum metabolomics methods for further evaluating drug has great significance[31].

Eightgenus of the plant Datura stramonium was examined whether the pattern of phenotypic selection on secondary compounds and a physical defense can explain geographic variation in these traits. Result showed that the patterns of selection support the existence of a selection mosaic and accounts for the positive correlation observed between atropine concentration and plant damage by herbivores recorded in previous studies [32].

Antioxidative effects
Endophytic actinomycetes isolated from Datura stramonium L. was evaluated for its effects against in vitro α-glucosidase inhibition, antioxidant, and free radical scavenging activities. The total phenolic content of the extract was 176 mg of catechol equivalents/gram extract. Perusal of this study indicates MeEA can be used as natural resource of α-glucosidase inhibitor and antioxidants[34].

In another study, it was proposed that atropine/scopolamine mixture in buckwheat food products should be consumed together: 4.0 µg/kg (atropine) and 2.0 µg/kg (scopolamine). However, in view of the large variability in the alkaloid content, depending on the origin of the Datura, we propose that risk assessment should be carried out on a case-by-case basis, taking into account the ratio between atropine and scopolamine content in a particular sample[35].

Anti-infection
The effect of kappa/beta-carrageenan from red aldaTichocarpuscrinitus on the development of a potato virus X (PVX) infection in the leaves of Datura stramonium L. has been studied. The carrageenan-induced stimulation of lytic processes results in the destruction of viral particles and can be considered as one of the defense mechanisms, preventing the intracellular accumulation of viruses. The carrageenan-stimulated formation of PVX-specific laminar structures, able to bind viral particles and, therefore, prevent their intracellular translocation and reproduction, represents another carrageenan-induced mechanism of the antiviral defense in plant cells[37].

Anti-viral activity
Influence of fucoidan from brown alga Fucusevanescens C. Ag. on the development of infection induced by potato virus X (PVX) in Datura stramonium leaves was studied. It has been shown that 24 h after the treatment of the leaves with fucoidan and following infection of them with PVX the accumulation of virus particles in infected cells during early infection period was substantially less than that in untreated control. Using ultrastructure-morphometric analysis, it has been established that fucoidan treatment increases at protein-synthesizing capability of cells

(nucleolus dimension, amount of mitochondria and rough endoplasmic reticulum membranes become increased) [40].

Rhizogenic activity
A SAMDC cDNA of Datura stramonium was introduced in tobacco andthe effect of the genetic manipulation on PA metabolism, ethylene production and plant morphology was analysed in primary transformants (R0). In these in vivo-grown second generation transgenic plants, at the vegetative stage, SAMDC activity was scarcely reduced, and PA titres did not change. Finally, the rhizogenic potential of in vitro-cultured leaf explants excised from antisense plants was significantly diminished as compared with WT ones, and the response to methyl jasmonate, a stress-mimicking compound, in terms of PA conjugation, was higher and differentially affected in transgenic leaf discs relative to WT ones. The effects of SAMDC manipulation are discussed in relation to plant generation, culture conditions and response to stress [41].

Anticholinergic activity
The impact of the administration of physostigmine and of nasogastric evacuation of Jimsonweed seeds on intensive-care unit (ICU) use was examined .The successful removal of Jimsonweed seeds did not decrease ICU use rates (P = 0.68) or shorten length of stay in the hospital compared with not recovering seeds (P = 0.85). The use of physostigmine and the successful nasogastric lavage of Jimsonweed seeds did not result in decreased intensive-care use or shorter length of stay in the hospital for Jimsonweed-induced anticholinergic toxicity [42].

Immune modulatory effect
It is suggested that the lectin binds to D (+) Gal residues of DSA to interfere with mast cell activation induced by DSA, a glycoprotein with arabinose and Gal residues. The effects of plant lectins with affinity to D (+)Gal, N-acetyl galactosamine and/or sialic acid and L(-)Fuc on the histamine release induced by DSA, compound 48/80 and substance P were also examined[44].

Tropinone-reductase activities
The influence that these differential interactions might have on metabolism was investigated in transformed root cultures of D. stramonium. It is concluded that the relative levels of activity of the two tropinone reductases might play an important role in regulating the balance of tropan-3α-ols to tropan-3β-ols seen in the spectrum of tropane-alkaloid-producing plants [46].

Enzyme activities
The factors by which the endogenous regulation of tropane-alkaloid biosynthesis may be effected have been examined in Datura stramonium. It is concluded that the pathway is not regulated in a simple manner and that (i) the early enzymes of the pathway are at near rate-limiting levels, (ii) there is a major limitation to flux at the level of the esterification of tropine, and (iii) the level of free tropine may be important in determining the flux into and through the tropanepathway [47].

The activities of enzymes related to the biosynthesis of N-methylputrescine, a precursor of the alkaloid hyoscyamine, have been measured in root cultures of Datura stramonium L. and Atropa belladonna L. transformed with Agrobacterium rhizogenes. This study indicates clearly that arginine is metabolised to hyoscyamine at least in part via decarboxylation to agmatine, even though a high activity of arginase (EC 3.5.3.1) was measurable under optimal conditions. The effect of unlabelledputrescine in diminishing the incorporation into hyoscyamine of label from DL-[5-(14) C] ornithine and L-[U-(14)C] arginine does not lend support to the theory that ornithine is metabolised via a bound, asymmetric putrescine intermediate[48].

Lectin properties
Results obtained suggest that it has a subunit mol.wt. Of about 30000 and that it probably associates into dimers. This is probably due to the inhibitory effect of the negative charge on the adjacent arabinofuranoside residues. The similarities and differences between the lectins from Datura and potato are discussed, as are their structural resemblance to glycopeptides that have been isolated from plant cell walls [49].

Bronchodilator effects
The effect on specific airway resistance (sRaw) of inhaling the smoke of one Datura stramonium cigarette was examined. The inhalationof a synthetic anticholinergic agent proved as effective as salbutamol in these patients. In

one patient the cigarette smoke and SCH 1000 produced only a negligible amount of bronchodilatation whereas the bronchial obstruction was reversible with salbutamol. Minor side effects were observed in six patients after the cigarette [50].

CONCLUSION

Datura stramonium was shown that is negatively correlated with infection progression. The wealth of scientific literature supports the proposal that Datura stramonium consumption have significant antimicrobial and anti-infection effect, which include both animal and human studies. But certain issues regarding the proper use of garlic, i.e use of different preparations available, dose, duration and interaction with generic drugs should be optimized. Further research should also be carried out to identify specific compounds from Datura stramonium or its products that are responsible for most of its biological effects.

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