

Toxicology of Dhatura —Ayurvedic Review

Dr.Devendra M. Bahiram^[1], Dr. Neelam S. Valhekar^[2], Dr. Priyadarshan M. Joglekar^[3]

^{1]}PG scholar, Department – Agadtantra, Tilak ayurved mahavidyalaya pune

^{2]}Guide, Professor, Department – Agadtantra, Tilak ayurved mahavidyalaya pune

^{3]}HOD, Professor, Department – Agadtantra, Tilak ayurved mahavidyalaya pune

Abstract: Dhatura, a genus of medicinal herb from the Solanaceae family, is credited with toxic as well as medicinal properties. The different plant parts of Dhatura sp., mainly *D. stramonium* L., commonly known as Dhatura or Jimson Weed, exhibit potent analgesic, antiviral, anti-diarrheal, and anti-inflammatory activities, owing to the wide range of bioactive constituents. With these pharmacological activities, *D. stramonium* is potentially used to treat numerous human diseases, including ulcers, inflammation, wounds, rheumatism, gout, bruises and swellings, sciatica, fever, toothache, asthma, and bronchitis. The primary phytochemicals investigation on plant extract of Dhatura showed alkaloids, carbohydrates, cardiac glycosides, tannins, flavonoids, amino acids, and phenolic compounds. It also contains toxic tropane alkaloids, including atropine, scopolamine, and hyoscamine. Although some studies on *D. stramonium* have reported potential pharmacological effects, information about the toxicity remains almost uncertain. Moreover, the frequent abuse of *D. stramonium* for recreational purposes has led to toxic syndromes. Therefore, it becomes necessary to be aware of the toxic aspects and the potential risks accompanying its use. The present review aims to summarize the phytochemical composition and pharmacological and toxicological aspects of the plant Dhatura.

Keywords: Dhatura stramonium, alkaloids, atropine, cardiac glycosides, hyoscamine, Ayurveda

INTRODUCTION

Ancient scholars of Ayurveda has classified poisonous drugs into two types i.e. Sthavara (plant origin) and Jangama (animal origin) visha. Sthavara visha is again classified into mahavisha and upavisha¹. Among the mahavishas only the Vatsanabha (*Aconitum ferox*) is using for medicinal purpose now. Upavishas are the group of drugs which were less poisonous in nature and also not harmful but it can cause several toxic prodrome on consumption or administration². Depending on number of upavishas different views are there in Ayurveda. Mainly upavishas include Vishatintuka (*Strychnosnux-vomica* Linn), Ahiphena (*papaver somniferum*) Jayapala (*Croton tiglium* Linn),

Dhatura bija (*Dhatura metel* Linn.), Vijaya (*Cannabis sativa* Linn.), Gunja (*Abrus precatorius* Linn.), Bhallataka (*Semecarpus anacardium* Linn.f.) Arka (*Calotropis gigantea* Linn.) Snuhi ksheera (*Euphorbia ligularia* Roxb.), Langali (*Gloriosa superba* Linn), Karaveera (*Nerium oleander* Linn)³. Ayurveda also states that sometimes strong poisons serve as the best medicine but used only after proper Shodhana (Detoxification), provided in a proper therapeutic dose and formulation. On the contrary a good medicine may affect adversely unless it is used for proper person with proper dose. Dhatura is well known and commonly used drug for treating various ailments and it is an ingredient in most of the formulations in Ayurveda which is in practical use now. It is commonly known as 'devil's trumpet' and it was first described by Linnaeus in 1753. In some places it is prohibited to buy or sell or cultivate Dhatura plants. The main chemical composition of Dhatura are tropane alkaloids hyoscyne, hyoscyamine and atropine alkaloids. This review article is a sincere attempt to synopsise the information concerning about poisonous drug Dhatura (*Dhatura metel* Linn) described in Indian system of medicine.

Shodhana of Dhatura

First method- Dhatura seeds are tied in a pottali. This pottali is heated with cow milk in a dolayantra for three hours. Then pottali is opened and Dhatura seeds are washed with hot water. These pure Dhatura seeds are then used in the formulations. Second Method- New Dhatura seeds are heated in cow urine with the help of dolayantra and dried in the sun. These seeds are powdered & filtered through cloth. Then it is used for therapeutic purpose. Dhatura visha lakshana A person if poisoned by Dattura, his visual perceptions would all become yellowish (sarvam pashyathi peetakam) and also he would develop symptoms like kampa (tremors), laala (excessive salivation), mada (intoxicated), chardi (vomiting), smruthibhramsha (amnesia) and bhrama (giddiness).

Ayurvedic treatment for Dhatura poisoning Cow's milk with sugar can be given two times a day for treating Dhatura. Ayurvedic antidotes for Dhatura visha

Changeri swarasa internally

Administration of milk and sugar in deliriant condition

Chandana mixed with tender coconut water for internal administration

Haridra choorna with karpasa patra swarasa (*Gossypium herbaceum* Linn.) and administer internally

Mrunaala (stalk of lotus) kwatha or swarasa Vishishta yogas (Ayurvedic formulations) of Dhatura Kanakasava, Sutashekhara rasa, Mahavishagarbhataila, Unmatta rasa.

Toxicology of Dhatura

In addition to a number of beneficial health outcomes, the presence of anticholinergic alkaloids such as tropane renders the Dhatura species toxic to the nervous system⁴, and the symptoms of toxicity include fever, dry skin, dry mouth, headache, hallucinations, convulsions, rapid and weak pulse, acute confusion, delirium, tachycardia, coma, and death⁵. However, *D. fastuosa* was rendered safe up to a 2000 mg/kg body-weight dosage since it produced no sign of toxicity or mortality. Histological studies demonstrated the reduced weight of the organs, necrotic modifications in the liver accompanied by elevation of serum alkaline phosphatase, serum glutamic-oxaloacetic transaminase, and glutamyl pyruvic transaminase^{6,7}. Moreover, due to its toxicity, *D. stramonium* should not be used in case of glaucoma, pyloric stenosis, paralytic ileus, tachycardia arrhythmias, enlarged prostate, and acute pulmonary edema. The seed extracts at a concentration greater than 0.5% induced adverse physiological modifications. In fact, all the parts of Dhatura have severe anticholinergic effects due to suppression of central and peripheral cholinergic neurotransmission, ultimately leading to death in humans. Intoxication with Dhatura extracts leads to adverse impact on the central nervous system, disorientation, memory loss, inability to process information, impaired vision due to mydriasis, myoclonic jerking, hyperpyrexia, and respiratory and cardiovascular problems. However, the aqueous extracts of leaves and seeds of *D. metel* demonstrated certain neurological effects in rats at doses of 400 and

800 mg/kg, which include enhanced motor activity in the brain, aggravated catalepsy, antagonized ptosis, and reduction in the duration of barbiturate induced sleep, in addition to its antidepressant characteristics at low doses. The study also suggested that the seed extracts were comparatively safer to induce sleep with better anesthetic indices.

Pharmacological activity

Antiasthmatic activity

D. stramonium in asthma treatment and possible effects on prenatal development was studied. Exposure of the foetus to *D. stramonium* when a mother use it for asthma, will cause a continuous release of acetylcholine, resulting in the desensitization of nicotinic receptors, this could ultimately result in permanent damage to the foetus. Therefore we conclude that this African herbal remedy should be used with caution during pregnancy.

Anticholinergic activity

The alkaloids found in *D. stramonium*, are organic esters used clinically as anticholinergic agents. Jimson weed has been reported as a drug of abuse and has been involved in the accidental poisoning of humans and animals. Symptoms of acute jimson weed poisoning included dryness of the mouth and extreme thirst, dryness of the skin, pupil dilation and impaired vision, urinary retention, rapid heartbeat, confusion, restlessness, hallucinations, and loss of consciousness. The anticholinergic syndrome results from the inhibition of central and peripheral muscarinic neurotransmission.

Acaricidal, repellent and oviposition deterrent properties

The ethanol extracts obtained from both leaf and seed in *D. stramonium* (Solanaceae) were investigated for acaricidal, repellent and oviposition deterrent properties against adult two-spotted spider mites (*T. urticae* Koch) (Acari: Tetranychidae) under laboratory conditions. Leaf and seed extracts, which were applied in 167.25 and 145.75 g/L concentrations, respectively (using a Petri leaf disc-spray tower method), caused 98% and 25% mortality among spider mite adults after 48 h. These results suggest that *D. stramonium* extracts could be used to manage the two-spotted spider mite.

Antimicrobial Activity

The methanol extracts of *D. stramonium* and Dhatura inoxia showed activity against Gram positive bacteria

in a dose dependent manner. Little or no antimicrobial activity was found against *Escherichia coli* and *Pseudomonas aeruginosa*. The anti-microbial activity of combined crude ethanolic extract of *D. stromonium*, *Terminalia arjuna* and *Withania somnifera* in cup plate diffusion method for antibacterial and antifungal activity. The extracts were subjected to screening to detect potential antimicrobial activity against *Staphylococcus aureus*, *Bacillus subtilis*, *Escherichia coli*, *Klebsiella pneumoniae*, *Micrococcus luteus* and *Candida albicans* with compare Ciprofloxacin standard drug.

Anticancer activity

An integrated approach is needed to manage cancer using the growing body of knowledge gained through scientific developments. Thousands of herbal and traditional compounds are being screened worldwide to validate their use as anti-cancerous drugs. *D. stromonium* in therapeutic dose of 0.05-0.10 g was used to cure cancer. Likely unsafe produce vomiting, hypertension, loss of consciousness may lead to coma but may interact with anti-cholinergic drugs.

Antiinflammatory activity

Coriandrum sativum (*C. sativum*), *D. stromonium* and *Azadirachta indica* (*A. indica*) are traditionally used in treatment of inflammation. Ethanolic extracts of fruits of *C. sativum*, leaves of *D. stromonium*. Ethanolic extracts of fruits of *C. sativum*, leaves of *D. stromonium* and *A. indica* were subjected to preliminary screening for anti-inflammatory activity in albino rats. All ethanolic extracts exhibited significant anti-inflammatory activity comparable to the standard drug diclofenac sodium against carrageenan induced rat paw edema method. Among these plant *A. indica* showed maximum anti-inflammatory activity per hour.

Larvicidal and mosquito repellent activities

Ethanolic extracts of leaves of *D. stromonium* were evaluated for larvicidal and mosquito repellent activities against *Aedes aegypti*, *Anopheles stephensi* and *Culex quinquefasciatus*. The LD₅₀ values for larvicidal activity were found to be 86.25, 16.07 and 6.25 mg/L against *Aedes aegypti*, *Anopheles stephensi* and *Culex quinquefasciatus* respectively. The ethanolic leaves extract of *D. stromonium* provided complete protection time (mosquito repellency) of 2.7, 71.7 and 117.7 min against *Aedes aegypti*, *Anopheles stephensi* and *Culex quinquefasciatus* at higher concentration (1%).

Pesticide toxicity

Extract of *D. stromonium* was effective in countering the toxicity of the cypermethrin pesticide toxicity.

Antifungal activity

Antifungal activity of a concoction brewed from *D. stromonium*, *Calotropis gigantea*, *A. indica* (neem) and cow manure (T1) followed by methanol-water (70/30 v/v) extracts of *D. stromonium*, *Calotropis gigantea* and *A. indica* T2 against *Fusarium mangiferae*. The study proved that the concoction-brewed compost T1 is effective, inexpensive, easy to prepare and constitutes a sustainable and eco-friendly approach to control floral malformation in mango when it is sprayed at bud break stage and again at fruit set stage.

Vibriocidal activity

A simple in vitro screening assay was employed for the standard strain of *Vibrio cholerae*, 12 isolates of *Vibrio cholerae* non-O1, and *Vibrio parahaemolyticus*. Aqueous and organic solvent extracts of different parts of the plants were investigated by using the disk diffusion method. Extracts from 16 medicinal plants were selected on account of the reported traditional uses for the treatment of cholera and gastrointestinal diseases, and they were assayed for vibriocidal activities. The results indicated that *Lawsonia inermis*, *Saraca indica*, *Syzygium cumini*, *Terminalia bellerica*, *Allium sativum*, and *D. stromonium* served as broad-spectrum vibriocidal agents.

CONCLUSION

Datura is included one among the upavisha by laghutrayees, except sharangadhara samhitha. In Ayurvedic literatures, *Datura* is described as a useful remedy for various diseases like jwara, kushta, krimi, visha. For the preparation of many Ayurvedic formulations like Kanakasava, Sootashekhara rasa, mahavishagarbha taila *Datura* is used as one of the ingredient. Improper or inadequate shodhana and *Datura* in high dose, can give rise to toxic problems like dryness of mouth, excessive thirst, nausea, vomiting, giddiness. The most toxic part of *Datura* is seeds in modern concept it is a deliriant type of cerebral poison and the main toxic principles are hyoscyamine, hyoscyne, and atropine. So for getting rapid outcome in ayurvedic treatments we can use *Datura* like upavishas in ayurvedic formulations.

REFERENCES

- [1] Pandit Kashinath Shastry (2004).Rasa Tarangini.Motilal Banarasidas Publications Varanasi.
- [2] Namburi Shekhar U.R (2013).A Textbook of Agadtantra.Chukhambha Sanskrit Sansthan Varanasi.
- [3] Pandit Kashinath Shastry (2004).Rasa Tarangini,.Motilal Banarasidas Publications
- [4] Shah V.V., Shah N.D., Patrekar P.V. Medicinal Plants from Solanaceae Family. Res. J. Pharm. Technol. 2013;6:143–151.
- [5] Al-Snafi A.E. Medical Importance of Dhatura fastuosa (Syn: Dhatura metel) and Dhatura stramonium—A Review. IOSR J. Pharm. 2017;7:43–58. doi: 10.9790/3013-0702014358.
- [6] Bouzidi A., Mahdeb N., Kara N. Toxicity Studies of Alkaloids of Seeds of Dhatura stramonium and Synthesis Alkaloids in Male Rats. J. Med. Plants Res. 2011;5:3421–3431. [Google Scholar]
- [7] Ogunmoyole T., Adeyeye R.I., Olatilu B.O., Akande O.A., Agunbiade O.J. Multiple Organ Toxicity of Dhatura stramonium Seed Extracts. Toxicol. Rep. 2019;6:983–989. doi: 10.1016/j.toxrep.2019.09.011