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A toxicological review of *Dhatura*

Dr. Sunita Yadav[1], Dr. Anita Sharma[2]

[1]Post Graduate Scholar, [2]Prof. & Head, P.G. Dept. of Agad tantra, National Institute of Ayurved, Jaipur, Rajasthan, INDIA.

ABSTRACT

Dhatura is mentioned under the group of *Sthavara Vanaspatic Visha*, in different Ayurvedic text books it is also referred as deliriant poison. *Dhatura* is a genus of nine species of flowering plants which are poisonous in nature. On scrutinizing, the seeds and flowers of *Dhatura* plant contain alkaloids such as Scopolamine, Hyoscyamine and atropine which are highly toxic but found therapeutically essential as well. The poisonous substance (alkaloids) possess anticholinergic effects such as tachycardia, hyperthermia, mydriases etc., which can be resolve by administration of physostigmine as an antidote. Medico legally it has been found that the drug is being used as stupefying agent mixed in Prasad by the robbers for robbery, kidnapping, and also as homicidal as well as suicidal.

Key words: *Dhatura, Ayurveda, Therapeutic, Toxicology, Medico-legal.*

INTRODUCTION

The word *Gada* means poison or any toxic substance, the word *Agad* means to get rid of it. It also means the specific preparations or antidotes for various poison. This branch deals with the signs, symptoms and treatment of various poisons. *Shushruta* refers this science by the name *Agadtantra* while *Charaka* refers it as *Vishgara-Virodhaka Prashamana*, like wise in *Ashtanga*, the branch is named as *Danshtra Chikitsa*.[1] *Dhatura Metal* commonly known as thorn apple or jimson weed, belonging to the family Solanaceae has frequently been employed in traditional medicine to treat variety of ailments. It has been used as hallucinogen taken entheogenic ally to cause intense visions. It is unlikely ever, to become major drug of abuse owing to effects upon both mind and body, frequently perceived subjectively as highly unpleasant, giving rise to a state of profound and long-lasting disorientation with a potentially fatal outcome.[2]

Address for correspondence:
Dr. Sunita Yadav
Post Graduate Scholar P.G. Dept. of Agad tantra, National Institute of Ayurved, Jaipur, Rajasthan, INDIA.
E-mail: sun.yad1215@gmail.com

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Vernacular Names[3]

- English - *Dhatura*, Thorn apple, Jimson weed, Devil's trumpet
- Hindi - *Dhatur, Dhatura, Dhaatura*.
- Bengali - *Dhatura*
- Gujarati - *Dhanturo, Dhaturo*
- Kannada - *Madkunika*
- Malyalam - *Unmana*
- Marathi - *Dhotra*
- Punjabi - *Dhatur*
- Tamil - *Utapatai*
- Telgue - *Unmmet, Dhaturam*
- Arabia - Baojmasam, Jaujulmasel
- France - Taturah, Tarura

Synonyms: *Kantaka Phal, Doorta, Unmattaka, Kanakahvaya, Kharjughna, Ghantapuspa, Talphal, Tripuspa, Dhurta, Madana, Mhamohi, Matula, Shivpriya.*[4]

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Kanak, Devta, Kitava, Shatha, Madanaka, Kaali, Harivallabha, Dhatur, Shivshekhar, Maatal, Toori, Taral, Vyalahaa, Dhoostoor, Matulputrak.[5]

Types of Poison

Ayurveda - *Sthavara Vanaspatic Visha*

Modern - Neurotoxic Deliriant poison[6]

Plant Description

It is a perennial herbaceous and extremely deadly plant reaches a height of 1.5cm. Its **Leaves** are simple, alternate, dark green, broadly ovate, acute or acuminate, unequal at the base and often cordate, entire or repent dentate, shallowly lobed and denselytomentose on both the surfaces and generally glandular, **Petioles** (part of the leaf) 6-9cm. peduncles (stem) are long initially they standerect later nodding. **Calyx** (sepals) about 7.5cm long inflated towards the middle, persistent and reflexed in fruit. **Corolla** (flower)about twice as long as calyx, white tinged with green below, pubescent outside, limb 10 toothed. Their fragrance can be sweet or unpleasant depending on the season. **(Flowers)** are bell shaped deep purple in colour. **Capsule** (fruit) globose**,** nodding, covered with long rather slender spines. Fruit contains 450-500 seeds resembling the **Seeds** of the chilli.[7]

Flowering and fruiting time: Autumn (post rain) to summer seasons.

Distribution: It is found throughout India in warmer regions, in west grounds and other places.[7]

Classification

According to *Nighantus*

SN	*Nighantu* name	*Varga*
1.	*Dhanvantari Nighantu*	*Karveeradi*
2.	*Madanpaal Nighantu*	*Abhayadi*
3.	*Bhavprakasha Nighantu*	*Guduchyadi*
4.	*Priya Nighantu*	*Shatpushpadi*

Types of *Dhatura*

According to *Raj Nighantu*, there are 5 common varieties based on the colour of its flowers

- *Shweta* (white)
- *Neel* (blue)
- *Krishan* (black)
- *Lohitta (*red)
- *Peeta* (yellow)

Amongst the five above stated varieties the *Krishna (*black) is the most poisonous.[8]

Classical descriptions of *Dhatura*[9]

SN	*Ayurvedic texts*	Description
1.	*Charak Samhita*	In *Madhvasava* and *Manashiladi Lepa*
2.	*Shushrut Samhita*	In the context of *Mushikakalpa* used in *Alarkavisha*
3.	*Ashtanga Hridyam*	In *Kakkurdamsha Chikitsa.*
4.	*Ashtang Samgrah*	Sign and symptoms of *Dhatura* poisoning along with the use of *Dhaturaphala* in *Mushika, Alarkavisha.*
5.	*Sharangdhar Samhita*	In *Dhatura Tailam (Ref.-9/199)* and *Sannipatabhairava Rasa (Ref-12/233-47*
6.	*Bhav-Prakasha*	Under *Guduchyadivaraga (1st part)* and use of *Dhatura* in *Samanya Jwara Chikitsa (Ref- 2nd part/177-179*
7.	*Bhaishajya Ratnawali*	*Dhatura* as a *Upvisha (Ref.-2/165)* and its *Shodhana (Ref-2/166-76)*
8.	*Rasa Tarangini*	In 24th chapter
9.	*Yogratnakara*	In *Shwana Chikitsa, Garundanjanam, Kameshwar Ras, Sannipatik Jwara, Bhairava rasa.*

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Characterstics of *Dhatura*[10]

Rasa	*Tikta, Katu*
Guna	*Laghu, Ruksha, Vyavayi, Vikasi*
Veerya	*Ushna*
Vipaak	*Katu*
Prabhav	*Madaka*

Chemical constituents

- Leaves - Atropine, hyoscyamine and scopolamine, pyrrole derivatives
- Seeds - Hyoscyamine, daturanolone and fastusic acid and many other tropane alkaloids
- Roots - Hyoscyamine, apohyoscine, hyoscine, norhyoscine, meteloidine, cuscohygrine and tropine.
- Flower - Withanolide, wethametelins,
- Fruits - Triterpine, Daturanolone, daturadiol[11]

Toxic part: all the parts of these plants are poisonous.

- Flower: these are funnel shaped or large trumpet shaped therefore called Devil's trumpet
- Fruit: It is spherical in shapeandhave sharp spines therefore called as the Thorn apple.
- Seed: Fruit contain 250-500 seeds and weigh about 8gms. It resembles the chilli seeds.[12]

Medicinal dose[13]

- *Churna* - 50-100mg
- *Dravsatva* - 1-3 Drops
- *Dhatursura* - 2ml

Fatal dose

a) Seeds: 50-100

b) Alkaloids: 60mg (for Adults), 4mg (for children)

Fatal period: 24 hrs

Mode of action

Its alkaloids exert both central as well as peripheral actions. Ingestion of small dose will stimulate the central nervous system causing excitement and restlessness as it firstly stimulate the higher centres then the motor centres and further lead to depression and paralysis of medulla, the respiration is first stimulated and then depressed and the heart centre is stimulated, since the process occurs systematically over the period of time the vitals become unstable with the larger doses causing depression delirium coma and finally the loss of life. Its peripheral effects are due to blockage of cholinergic fibres with resultant parasympathetic paralysis. Therefore, they inhibit secretion of sweat, saliva, mydriasis and stimulate the heart regulating centre.[14]

Toxicity evaluation

The toxicity studies of ethanol extract of the leaves of D.*stramonium*in rats were done by Giadado et al. (2007). Two doses of 50 and 200mg/kg of extract were administered to the rats for five weeks. Parameter studies were the indices of liver and kidney function and some biochemical and haematological parameters. Feed intake, final body weight, serum AST, ALT, Bilirubin, total protein, urea and electrolyte studies were not affected by the extract administered. Serum creatinine levels were however significantly raised in rats administered with ethanol extract at the dose of 200mg/kg body weight. The biochemical and haematological parameters were also affected.[15]

Therapeutic evaluations

Series of experimental as well as clinical studies have been conducted and an ample are still carried on over the period of time, in order to prove it therapeutically. It has been proven to have great pharmacological potential with a great utility and usage as folklore medicine. Though the drug is established as poisonous plant in the Ayurvedic text but having good therapeutic properties after *Shodhan* process, on *Shodhana* the poisonous properties diminishes and therapeutic properties get improved so in Ayurvedic preparations we use *Shuddha Dhatura*. There are so many generic preparations available in old text to

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treat various diseases like gastric ulceration, rhinitis, fever, asthma, fungal infections etc. On evaluating the medicinal effects, we found that the drug proved to have wide range of actions as Antibacterial,[16] Antifungal,[17] Antioxidant,[18] Herbicidal,[19] Antiviral,[20] Antiasthmatic,[21] act on organophosphorus poisoning[22] etc. therefore, the drug can be used with various combinations to cure an ample number of diseases with correct dose and formulations after purification.

Purification of *Dhatura* seeds[23]

- *Dhatura* seeds are tied into the piece of cloth, giving the shape of a *Potali* and dipped into the cow's milk and boiled for three hours in *Dola Yantra* and then washed with hot water.
- New seeds of *Dhatura* are boiled into the cow's urine by *Dola Yantra* method and then dried off under the optimum sunlight.
- According to *Rasajalnidhi* seeds of *Dhatura* are purified on keeping immersed in cow urine overnight for 12 hrs, and then deprived off their husk by being thrashed with an iron rod in an iron motor.

Important formulations of *Dhatura*

Pralapantaka Rasa, Unmaada Gajankush Rasa, Granthishothnivarika Vartika, Kanakasava, Ekangavira Rasa, Puspadhanva Rasa, Tribhuvana Kirti Rasa, Sri Jayamangala Rasa, Laghu Vishagarbha Taila, Vishatinduka Taila, Dhattura Taila.[24]

Clinical manifestations of *Dhatura* Poisoning[25]

1. **Delirium stage:** after ingestion it causes bitter taste followed by

- Dry as Bone - dryness of mouth and throat due to inhibition of salivation resulting in, Dysphagia, and Excess thirst.
- Red as beet - face flushed due to dilatation of pupils.
- Blind as Bat - vision suffers due to dilatation of pupils
- Hot as hare - skin seems dry and hot due to inhibition of sweat secretion and stimulation of heat regulatory centre.
- Mad as a wet hen - delirious mutter, confusion, restlessness due to effect of mind.
- Giddiness, unsteady Gait, vomiting, noisy violent, hallucination.

2. **Stage of coma:** Drowsiness, Stupor, Coma, Death due to respiratory failure.

Symptoms summarised under D-

- Dryness of mouth
- Difficulty in talking
- Dysphagia
- Dilatation of cutaneous blood vessels
- Dry hot skin
- Dysuria
- Drunken gait
- Delirium
- Dilatation of pupil
- Diminished bowel sound
- Drowsiness

Management of ingested *Dhatura* Poisoning[26]

SN	Principle	Condition of patient	Treatment
1.	Resuscitation	Respiratory distress	Inj. Aminophylline and hydrocortisone O2 inhalation and Ventilation
2.	Removal of unabsorbed poison	If patient is conscious,well oriented and vitals stable	*Sadya Vamana* - *Yastimadhu Fant* Or *Sandhav Lavan* water
		If patient is unconscious, disoriented, unstable vitals	Gastric lavage with KMNO4 solution 1:1000

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		If no diarrhoea	*Tikshna Virechan* with *Icchabhedi Rasa.*
3.	Removal of absorbed poison	If no renal failure	Forced Diuresis (*Mutraldravya)* Use *Punarnavaashtaka Kwatha*
		If renal failure	Haemodialysis
4.	Use of Antidot	Mechanical	*Goghrit, Godugdha*
		Specific (modern)	Inj. Physostigmine 1-2 mgIV over 2 min or Inj. Neostigmine 2.5mg/IV/3hrly till the poisoning reverses
		Specific (Ayurvedic)	1. *Vrintakaphalbeej Rasa Paan (1 pal)* 2. *Godugdh (1prasth)+Shark ara (2pal)* 3. *Karpaas (asthi+pushpa) Kwath* 4. *Nimbuswaras + Jeeraka*
5.	Symptomatic management	Anticonvulsant	Inj. Diazepam 5mg/IV slow over10 min.
		Metabolic Acidosis	Inj. Sodium bcarbonate 7.5% 10ml/IV

Medico Legal Aspects / Circumstances of Poisoning

Accidental - cases occur among children from eating the seeds as fruit.

1. Suicidal - occasionally
2. Homicidal - generally not found
3. Road poison - it is used as the common stupefying agent for the purpose of robbery and rarely kidnapping. Also called as *Rail Road Poison.*
4. Occasionally used for criminal abortion.
5. Unintentional overdose from therapeutic dose may occur.
6. Scopolamine can be used as an alternativefor Sodium amytal for narco test analysis
7. It is used as an adulterant in country liquor for enhancing feeling of euphorbia.
8. Sometimes used as an aphrodisiac and as a recreational hallucinogen.[27]

Discussion

The present review indicates that a lot of descriptions available in various Ayurvedic texts, it is a wild plant having nine other species with wide range of medicinal and pharmacological properties. *Dhatura* seeds have hyoscyamine, fastusic acid dhaturanolone and many other tropane alkaloids, which are absorbed through the mucous membrane of GIT and respiratory tract and through skin and conjunctiva causing wide range of toxicity inside the living body. Despite being a poisonous plant, it has been found useful in various diseases like Asthma, pain, dog bite, inflammation, viral, fungal as well as bacterial infections on therapeutic evaluation. While using it for therapeutic purpose, it is necessary to purify the crude drug first. Since, In Ayurveda it is clearly mentioned that the drug *Dhatura metal* should be used only after purification. Purification plays an important role in reducing the adverse effects caused during internal administration.

Conclusion

Dhatura metal is mentioned in the group of *Sthavara Vanaspatik Visha,* in different Ayurvedic text books also it is named under neurotoxic deliriant poison. Synonyms of *Dhatura* such as *Mahamohi, Unmattaka* etc. signifies the name deliriant or stupefying. We find *Laghu, Ruksha, Vyavayi, Vikasi*, properties along with hot potency in *Dhatura* which resembles to poison.

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