A review of Dhatura as Poison and Kamala Patra as Antidote

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Dhatura plant has been noted for intoxicating, narcotic properties, they produce temporary insensibility (stupifying effects) in ordinary doses. Dhatura (Datura metel) is cerebrotoxic, Deleriant poison which is also classified as Upavisha in Ayurveda.
In Ayurvedic literature according to Basavrajeyam under the heading of Vish-Prativishani, Chincha Rasa and Kamal Patra churna has been described to be possessing antidote action which may act by some way to counter toxicity of Dhatura.

It is necessary to verify the efficacy of these antidotes on scientific parameters so that it can be useful in emergencies.

Keywords: Ayurveda; Dhatura; Kamal Patra churna; antidote.

1. INTRODUCTION

Agada Tantra [1] is one of the incredible branches of indigenous science derived from the Ayurveda. In ancient era this science was considered as the one of the advanced faculty worldwide.

The branch of Ayurveda which deals with the toxicity of various snakes, spiders, insects, rats etc. animals and its treatments. The word ‘Gad’ means poison and the antidote used is called as ‘Agada’.

According to modern sciences, Toxicology [2] is the science which deals with the study of poison with reference to sources properties, mode of action symptoms which they product lethal dose, nature of fatal results, treatment of their detection estimation & autopsy findings.

Dhatura [3] (Datura metel) is cerebrotoxic, deleriant poison which is also classified as Upavisha in Ayurveda. It has been used as medicine, narcotics and poison since long ago. Medicinally it is useful internally as well as externally.

Dhatura [4] is used as antispasmodic in asthma, whooping cough, rheumatic swelling of the joints, lumbago, sciatica, neuralgia, painful tumors, notes, glandular inflammations such as mumps etc. and many more conditions.

Due to gastric irritation vomiting often occurs immediately after taking the crushed seeds. A bitter taste, dryness of mouth and throat, burning pain in the stomach dysphagia, headache and difficulty in talking are the first symptoms that are complained of. These are followed by giddiness, staggering gait, in co-ordination of the muscles peculiar flushed appearance of the face, dry hot skin with a rise in temperature, photophobia, and dilated pupils with loss of accommodation for near vision, red & injected conjunctivae, urinary retention & drowsiness.

Sometimes, a scarlatinal rash of exfoliation of the skin is seen over the most of body and the temperature is raised very high. The pulse is full and bounding but later becomes weak, irregular and intermittent. The patient now becomes restless markedly excited and delirious. Delirium is a pear character. He is silent or mutters indistinct and inaudible words but usually he is noisy, tries to run away from his bed, picks at the bed clothes tries to pull imaginary threads from the tip at his fingers and is subject to dreadful hallucinations of sight & hearing sensorium is clouded.

In fatal cases drowsiness passes into stupor convulsions and coma. Death occurs usually from respiratory failure. In some cases insensibility occurs almost immediately after the poison is administered either in solution, or in very fine powder.

Various poisons have been described in Ayurveda along with their antidotes. These antidotes are readily available in the nature. Mode of action of these antidotes is not clearly mentioned in texts.

In Ayurvedic literature, Chincha Rasa and Kamal Patra churna has been described to be possessing antidote action which may act by some way to counter toxicity of Dhatura.

Kamal (Nilumbo nuciphera) is a beautiful aquatic plant with wide range of medicinal usage. It is Madhura Tikta Rasatmak and Shita Virya hence reduces Pitta Dosha.

2. REVIEW OF LITERATURE

In Ashtanga Ayurveda, Agadatantra has significant importance. In Sushruta samhita [5] Called as Agadantantra, in Charaka samhita [6] it is called as Danshtra Chikitsa, in Hasta samhita Vishtantra and in Kautilya Arthashastra Jangali.

Agadtantra [7] word made up of three different words and Agad means which destroys visha.
In Modern Medicine Agadantantra is named as Toxicology.

Toxicology is the science dealing with properties, actions, toxicity, fatal dose, detection and estimation of the results of toxicological analysis and treatment of poisons. Forensic toxicology deals with the medical and legal aspects of the harmful effects of chemicals on human beings.

*Visha* (poison)-

The Substance immediately after entering into the body causes the vitiation of healthy *Dhatus* or killing of the healthy person is defined as *Visha*.

**According to Modern-**

A substance which when administered, inhaled or ingested is capable of acting deleteriously on the human body.

A poison is commonly defined as a substance which when administered, inhaled or swallowed is capable of acting deleteriously on the body [4].

Any substance which injected, inhaled or absorbed or when applied to injected or developed within the body may cause damage to structure or disturbance of function. (American medical Dictionary).

**Ayurvedic Review:**

**Dhatura:**

*Dhatura* is classified in *Upavisha Varga*. It has five types viz. *Sweta*, *Nila*, *Krishna*, *Lohita*, and *Pita*. Krishna or black *Dhatura* is considered as best amongst all.

**Classification:**

According to *Ayurveda- Upavisha* [8]

According to Modern Science- Vegetable Neurotoxic, Cerebral Delirient Poison, Deliriant poison [2]

**Introduction:**

*Dhatura* is morphologically classified as a *Kshupa* (shrub), widely found all over India. Fruits have thorns over it. It is classified according to the colour of the flowers. All the varieties of it possess same properties but Krishna *Dhatura* is considered more effective. Leaves, Flowers, roots, seeds are used for medicinal purpose.

**Types –**

According to *Raja Nighantu* [9] it is classified in 5 types according to flowers.

1. *Shweta*(White)
2. *Nila* (Blue)
3. *Krishna* (Black)
4. *Rakta* (Red)
5. *Pita* (Yellow)

**Special Properties:** [10]

a. It is *Shwasa Vyadhi Nashak* and *Kapha Shoshaka*. Effective in *Unmada, Akshepaka, Netrabhishyanda, Karna Roga, Vedana, Arbuda, Lasika Granthi Shotha*, dental carries, *Amavata*, Mastitis by external application, useful in dog bite, mumps and *Prasuti Jwara*, in convulsions due to *Visarpa, Jwara*, useful in cysts, lymphanginitis, etc. by external and internal use.

b. Dose:

**Therapeutic Dose:**

*Shuddha Dhatura* Seed Powder –30 – 60 mg

Powder of *Dhatura* Leaves –60 – 180 mg

**Fatal Dose:**

100 to 120 crushed Seeds 1.20 to 1.50 gm

![Fig. 1. Dhatura](image-url)
Sign and Symptoms of Toxicity:

| Sr. No. | Signs / Symptoms          | Sr. No. | Signs / Symptoms          |
|---------|---------------------------|---------|---------------------------|
| 1.      | Yellowness of body        | 2.      | Tremors                   |
| 3.      | Salivation                | 4.      | Mada                      |
| 5.      | Vomiting                  | 6.      | Unmada                    |
| 7.      | Confusion                 | 8.      | Bitterness of mouth       |
| 9.      | Dryness of mouth and throat | 10.    | Difficulty in deglutition |
| 11.     | Sluggish Speech           | 12.     | Pharyngitis               |
| 13.     | Redness of Face           | 14.     | Dilatation of pupils      |
| 15.     | Photophobia               | 16.     | Irregular and slow pulse  |
| 17.     | Hypertension              | 18.     | Slow breathing            |
| 19.     | Delirium                  | 20.     | Drowsiness                |
| 21.     | Convulsions               | 22.     | Death due to asphyxia.    |

Treatment:-

- Vamana with the help of Yastimadu and milk should be given after that milk with sugar should be given to drink.
- Purgative drugs should be given in later stages.
- *Samudraphal* and *Gomutra, Erand Mula, Vacha* powder and curd, decoction of *Karparas* seeds, milk and sugar should be given in Dhatura poisoning.
- *Vasavrajyam* mentioned *Chincha* and *Kamal* as an antidote of Dhatura.

Formulations- [10,11,12]

Kanakasav, Pralapantak Ras, Unmadgajankush Ras, Kanaksunder Ras, Laxmivilas Ras, Unmatta Ras, Mahaiwarankush Ras, Brihatkanaksunder Ras, Tribhuvan Kirti Ras, Sutshekhar Ras, Kanak Prabha Vati Ras, Granthishothnivarka Vati, Dhattur Tail.

3. MODERN REVIEW

Habitat:

It is a native Mexico, found growing in western Himalayas, the hilly regions of the western parts of Deccan peninsula and a few other places in India. These plants are found growing commonly in waste places throughout India, Kashmir to Malabar.

*Datura metel* is a genus of poisonous herbs shrubs or small trees distributed throughout the tropical and warm temperate regions of the world, reaching up to height of 3 – 4 ft.

The whole plant – leaves, seeds and roots, dried leaves and the dried ripe seeds and fruit.

Constituents (According to Indian Materia Medica) [13]:

Leaves contain a poisonous alkaloid – daturine mucilage, albumin and ash 17% which contains potassium nitrate 25%, seeds contain the active principles daturine, resin mucilage, proteids, malic acid, scopolamine and ash 3%.

Therapeutic use:

*Dhatura* is useful internally as well as externally. The leaves, flowers, seeds & roots have great medicinal value. The paste of its roots mashed is cow’s urine or the juice of leaves is applied externally to alleviate edema and pain in sciatica, mumps, lumbago neuralgia etc.

- The mustard oil medicated with the pulp of *Dhatura* seed is used in the cracked feet.
- In alopecia the juice of leaves is rubbed on the affected area of the skin.
- The oil of seeds is effective in scabies.
- The pessary of the pulp of *Dhatura* effectively reduces the pains in hemorrhoids.
- Seeds are used to treat dandruff and lice.
- Internally, *Dhatura* dries up the mucous secretions in the respiratory tract and is a bronchodilator as well. Hence it is beneficial in bronchial asthma and cough.
- In rabid dog bites the mixture of roots of Bohervia diffusa and *Dhatura* in 12:1 proportion is given along with milk.
• *Dhatura* is beneficial in fever to relieve the sensation of cold and chills, Diarrhea and dysentery.

• The leaves made into cigarettes are smoked to relieve asthmatic attacks.

• Leaves are also used in treatment of Parkinsonism.

• *Dhatura* is administered in form of pills, tablets tinctures and extracts

• *Dhatura* in ointment form containing lanolin yellow wax and petroleum is employed in the treatment of hemorrhoids.

• The leaves are applied boils sores and fish bite and the juice of the flower are used for earache.

9 D’s of *Dhatura*

The important symptoms and signs can be summarized under 9 Ds (i.e. *Dhatura* symptoms) as follows.

1. Dryness of the mouth & throat.
2. Difficulty in talking
3. Dysphasia.
4. Dilatation of cutaneous blood vessels
5. Dilatation of pupils
6. Dry hot skin
7. Drunken gait
8. Delirium
9. Drowsiness

Treatment:

• Wash out stomach repeatedly with a solution of potassium permanganate or tannic acid.

• Wash out the lower bowel frequently by giving purgatives.

• Inj. Physostigmine half mg. I.V. or I.M. (2 hourly intervals). In many cases single dose is sufficient.

• Pilocarpine nitrate 5mg. or neostigmine may make the patient more comfortable, but it does not antagonize the central action of *Dhatura* on the brain.

• Morphine is to be avoided, as it has a depressant action on the respiratory centre.

• Delirium can be controlled by short acting barbiturates & bromides.

• Administration of ether by inhalation is considered more beneficial.

• Chloral hydrate or paraldehyde in moderate doses is useful for marked excitement.

• Tepid water sponging is good for the raised temperature and dry skin.

• Stimulants, such as caffeine, should be given and artificial respiration; oxygen inhalation should be started when necessary.

• A large warm enema may be given with advantage to the patient.

• Darken the room for marked photophobia.

Drug Review:

![Fig. 2. Kamal](image)

**Kamal (Nelumbo nucifera): [14]**

**Botanical classification:**

- Kingdom: Plantae
- Division: Magnoliophyta.
- Class: Magnoliopsida.
- Order: Proteales.
- Family: Nymphaeaceae.
- Genus: Nelumbo.
- Species: Nucifera.

**Description:**

The roots of *Nelumbo nucifera* are planted in the soil of the pond or river bottom, while the leaves float on top of the water surface. The flowers are usually found on thick stems rising several centimeters above the water. The plant normally grows up to a height of about 150 cm and a horizontal spread of up to 3 meters, but some unverified reports place the height as high as over 5 meters. The leaves may be as large as 60 cm in diameter, while the showy flowers can be up to 20 cm in diameter.
Researchers report that the lotus has the remarkable ability to regulate the temperature of its flowers to within a narrow range just as humans and other warm blooded animals do. The traditional Sacred Lotus is distantly related to *Nymphaea caerulea*, and possesses similar chemistry. Both *Nymphaea caerulea* and *Nelumbo nucifera* contain the alkaloids nuciferine and aporphine.

**Habitat and Distribution:**

Since it is an aquatic plant, grows in the mud of shallow ponds (water) lagoons, marshes, to flooded fields in damp conditions. It is found throughout India and is native to parts of the Middle East, Asia, and Australia.

**Propagation:**

It is propagated by seeds and rhizomes in muddy water.

**Pharmacognostic Features:**

A large good looking aquatic herb (*kshupa*) growing up to a height of 19 feet, leaves are shiny, roundish having a diameter of 1 to 3 feet in diameter; flowers are big, single, white to pink in colour, solitary having diameter of 4 to 10 inch and flower stalk is 3 to 6 feet in length; Stamens are many ripe carpels 10 mm long, ovoid glabrous; Seeds are ½ inch long, round and dark brown in colour; Rhizomes firmly anchored in the mud beneath the water surface, pocketed with air tunnels.

**Parts used –**

Whole plant

**Properties –**

**Plant** – astringent, Bitter, Sweet, Cooling, emollient Diuretic, antifungal, Antipyretic and cardio tonic

**Stem** – astringent, cooling, fragrant, diuretic and anti helmenthic

**Roots** – bitter cooling emollient and diuretic

**Leaves** – bitter, cooling, and diuretic and

**Flowers** – sweet, astringent refrigerant and cardio tonic

**Stamens** – cooling, diuretic, tonic, depurative and aphrodisiac.

**Chemical Constituent**–

Nuciferine 10-nonacosanol, β and γ sitosterol, nelumboside, glucose, palmitic acid and chlorophylls lupeol, α-amyrin, lutein, arginine, neferine, catechol, nuciferin, myristic acid, lenoleic acid, nelumbine quecitring, oxtosshinsunine.

Underground stem contains: Moisture 83.80%, Protein 2.70%, Fats 0.11%, Starch 9.25%, Sucrose 0.41%, and Aspirin 2%.

**Pharmacological activities**–

**Effects on gastrointestinal system** [15] - The Methanolic extract of *Nelumbo nucifera* a shows significant inhibitor, activity against castor oil induced deduced diarrhea & PGF, induced entero polling in rats. It also shows significant reduction of gastro intestinal motility in rats.

**Effects on CNS** [16] - Nuciferine & Atherosperminine alkaloid shows divergent psychopharmacological effect. Nuciferine is known to cause dopamine receptor blockage while atherosperminine shows diphenyl hydantoin is the only activity common to both of the compound.

**Anti-inflammatory** [17], **Analgesic & Antipyretic activity** [18] - *Nelumbo nucifera* rhizomes are known to have potent & anti inflammatory activity.

**Hypoglycemic Activity** [19] - Methanolic extract of the rhizomes has been found to possess significant hypoglycemic activity on streptozotocin induced diabetic rats.

**Miscellaneous activities** - *Nelumbo nucifera* is used in piles as demulcent, beneficial in Dysentery & chronic dyspepsia. It is also used as Diuretic.

**Clinical and Experimental Studies**–

It shows Anti- diabetic Activity [20], Anti- oxidant activity [21] and Anti –Inflammatory Activity [22-25].

**Contraindication** –

No contraindications with Lotus are documented.
Toxicity –
No toxic effects have been reported.

Drug interactions –
No drug interactions are reported.

4. DISCUSSION

*Dhatura* is used as in asthma, whooping cough, rheumatic swelling of the joints lumbago, sciatica, neuralgia, painful tumors, notes, glandular inflammations such as mumps etc. and many more conditions.

This plant has been noted for intoxicating, narcotic properties, they produce temporary insensibility (stupefying effects) in ordinary doses.

Constituents - Main chemical constituent of *Dhatura* is Dhaturaine which includes hyoscine, hyoscyamine and atropine. All these are Alkaloids. Alkaloids are Complex substances with nitrogenous base and consist in all the plants. Generally alkaloids converted into salts when combines with acids.

Mechanism of Action: They block the acetyl choline receptors and thus produce sympathomimetic or parasympatholytic actions (anti cholinergic actions). *Dhatura* leaves contain toxic alkaloid dhaturine, mucilage, albumin and ash 17 p.c. with poattassium niatrare 25%. *Dhatura* seeds consists dhaturine, resine, mucilage proteins, malic acid, scopolamine and ash 3 p.c. the ratio of hyoscyamine and hyosine is 2:1. It also consist Atropine. Atropine stimulates central nervous system specially motor area which is responsible for body incardination but the over dosing of Atropine causes restlessness. Confusion, irrelevant talk. *Dhatura* is consists around 10 such alkaloids.

According to *Ayurvedic* references and antidote properties of *Kamal Patra* can be discussed as follows:

1. *Kamal* is Madhura Rasatmaka, Madhura Vipaki and Sheeta Virya hence it may useful to prevent hyperpyrexia, dyspepsia, dryness of mouth.
2. *Kamal* has Vishaghna property and it is useful against vegetative poisoning.
3. It is useful as against vomiting as *Charaka* stated it in Chhardinigraha Gana so it gets used in *Dhatura* poising.
4. *Kamal* has Rasayana and Medhya property and is used in various CNS related disorders therefore it can be used in Various CNS disorders due to *Dhatura* intoxication.
5. *Kamal* is very effective in haemostasis hence can be useful in haematemesis due to intoxication due to *Dhatura*.

On the basis of analytical study, antidote properties of *Kamal Patra* can be discussed as follows:

1. Flavonoids (Vit p and Citrin) in *Kamal* improves blood vessels tone hence it is useful in hypotension and inflammation. Therefore it may prevent irregular pulse rate and irregularity in B.P. due to *Dhatura* toxicity.
2. Flavonoids like neferine, lienosinine acts on central nervous system and its disorders. Hence it may prevent CNS symptoms like delirium, giddiness, hyperthermia due to *Dhatura* toxicity.
3. *Kamal Patra* is also useful to reduce blood lipids and fatty liver disorders. It also contains the lotus alkaloids with hypotensive effect.
4. Sterols in *Kamal Patra* has characteristics Antipyretic property hence Hyperthermia in *Dhatura* toxicity can be prevented.
5. Vitamins C in *Kamal Patra* is antioxidant which improves circulation hence it may help to prevent cardiac failure due to *Dhatura* toxicity.
6. As well as *Kamal Patra* contain antioxidant flavonoids QC-3-Glc and QC-3-Cln which also improves antioxidant properties.
7. Carbohydrate improves blood glucose level by which the body energy gets increases. Therefore it may helps to prevent weakness, fatigue due to intoxication.

5. CONCLUSION

*Dhatura* plant possesses wide range of utility viz. medicine, narcotics, poison and antidote in medical sciences. *Dhatura* is neurotoxic cerebral deliriant poison which is also classified as Upavisha in *Ayurveda* with ‘9 Ds’ toxic effects. The active principle is dhaturine containing hyoscine, hyoscyamine and atropine. It blocks the acetyl choline receptors and thus produces
sympathomimetic or parasympatholytic actions (anti cholinergic actions).

According to Ayurvedic literatures and also on the basis of analytical study Kamal Patra shows antidote properties like –

Hyperthermia caused due to toxicity gets significantly reduced; Duration of appearance of convulsions gets increased; Duration of dilatation of pupil gets significantly increased.

Thus from above study we can conclude that Kamal Patra can resists toxic effects of Dhatura up to some extent.

NOTE:
The study highlights the efficacy of “ayurveda” which is an ancient tradition, used in India. This ancient concept should be carefully evaluated in the light of modern medical science and can be utilized partially if found suitable.

CONSENT AND ETHICAL APPROVAL
It is not applicable.

COMPETING INTERESTS
Authors have declared that no competing interests exist.

REFERENCES
1. Ayodhyaprasad Achal, Agadtantra, Chaukhmbha Publication, Varanasi; 1989.
2. Singhal SK. Toxicology at a Glance, 7th Edition, the National Book Depot, Mumbai
3. Apurba Nandy, Principles of Forensic Medicine, 2nd edition, New central Book Agency LTD, Calcutta.
4. Jr, B. F. P., Federico R. Tewes. What attorneys should understand about Medicare set-aside allocations: How Medicare Set-Aside Allocation Is Going to Be Used to Accelerate Settlement Claims in Catastrophic Personal Injury Cases. Clinical Medicine and Medical Research. 2021;2(1):61-64. Available: https://doi.org/10.52845/CMMR/2021v1i1a1
5. Parikh CK. Parikh’s textbook of medical jurisprudence forensic medicine & Toxicology, 6th Edition CBS Publishers & Distributors, New Delhi; 1999.
6. Sushruta; Sushruta Samhita; with the Nibandha sangraha commentary of Sri Dalhana charya; Reprint edition, Edited by Jadavaji Trikamji Acharya, Varanasi; Chaukhmbha Surbharati Prakashan; 2012.
7. Daniel V, Daniel K. Diabetic neuropathy: new perspectives on early diagnosis and treatments. Journal of Current Diabetes Reports. 2020;1(1):12–14. Available:https://doi.org/10.52845/JCDR/2020v1i1a3
8. Agnivesha, Revised by Charaka and Dhradabala; Charak Samhita with The Ayurveda – Dipika Commentary Of Chakrapanidatta, Edited by Jadavaji Trikamji Acharya, Chaukhmbha Surbharati Prakashan; 2000.
9. Amarasimha; Amarakosha; 4th Ed, Edited by Pt Haragovinda Shastri; Varanasi; Chaukhmbha Sanskrit Samsthan; 2001.
10. Daniel V, Daniel K. Perception of Nurses’ Work in Psychiatric Clinic. Clinical Medicine Insights. 2020;1(1):27-33. Available:https://doi.org/10.52845/CMI/2020v1i1a5
11. Yugalkishor Gupta, Ramanath Dwivedi, Vyavahar Ayurveda and Vishvagyan, 12th Edition, Chaukhmbha Amarbharati; 1982.
12. Pandit Narahari, Raj Nighantu; Dravyaguna Prakachika Vyakhya, Edi. By Dr. Indradeo Tripathi, Ed.; 1998.
13. Rasatarangini, Kashinath Shastri, 11th edition, Motilal Banarasidas Delhi; 1976.
14. Rasatarangini; Pranacarya Sri Sadananda Sarma, Prasadini Sanskrita Com by Ayurvedacarya Sri Haridatta Shastri, Rasa Vidynana Hindi Com by Pt Dharmananda Shastri, 11th Edition, Publication: Motilal Banarsidas, Delhi.
15. Sharangdhar Samhita; Pandit Sharangdhar, Edi. By Pandit Parasurama Sastri, Chaukhmbha Orientalia, Varansi, Edi; 2012.
16. Daniel V, Daniel K. Exercises training program: It’s Effect on Muscle strength and Activity of daily living among elderly people. Nursing and Midwifery. 2020; 1(01):19-23. Available:https://doi.org/10.52845/NM/2020v1i1a5
17. The Wealth of India; Raw Materials, council for Scientific and Industrial Research New Delhi; 1962.
18. The Ayurvedic Formulary of India: Govt. of India, Ministry of Health and Family Welfare, Department of Indian Systems of
19. Mukherjee PK, et al. Antidiarrhoeal evaluation of Nelumbo nucifera rhizome extract. Ind J Exp Biol. 1995;27:262–264.
20. Mukherjee PK, et al. Studies on psychopharmacological effects of Nelumbo nucifera Gaertn. Rhizome extract. J Ethnopharmacol. 1996;54:63–67.
21. Mukherjee PK, et al. Studies on the anti-inflammatory activity of rhizomes of Nelumbo nucifera. Planta Med. 1997;63:367–369.
22. Sinha S, et al. Evaluation of antipyretic potential of Nelumbo nucifera stalk extract. Phytother Res. 2000;14:272–274.
23. Mukherjee PK, et al. Hypoglycemic activity of Nelumbo nucifera rhizome (methanolic extract) in streptozotocin induced diabetic rats. Phytother Res. 1995;9:522–524.
24. Mukherjee PK, et al. Effect of Nelumbo nucifera rhizomes extract on blood sugar level in rats. J Ethnopharmacol. 1997;58:207–213.
25. Hu M, Skibsted LH. Antioxidative capacity of rhizome extract and rhizome knot extract of edible lotus (Nelumbo nuficera). Food Chem. 2002;76:327–333.