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Database

A database for anti-diabetic plants with clinical/ experimental trials

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Abstract
A number of plants have been described in Ayurveda and other traditional medicine for the management of diabetes. However, information about them is not easily available. Active constituents of any medicinal plant define the efficacy and safety of treatment to control hyperglycemia. We describe the database to maintain the record of medicinal plants having anti-hyperglycemic or anti-diabetic activity. The database contains information such as plant name, its geographical distribution, useful plant part, known dosage, active constituents, mechanism of action and clinical/experimental data. The database also includes information about plant raw material suppliers or manufacturers in India. The current database includes 238 plants species and 123 Indian industries using them.

Availability: The database is freely available at http://www.biotechpark.org.in/antidia/index.html

Keywords: diabetes; medicinal plants; database; literature; anti-oxidant

Background:
Diabetes is a syndrome characterized by deranged carbohydrate metabolism resulting in abnormally high blood sugar level (hyperglycemia). It is caused by hereditary, increasing age, poor diet, imperfect digestion, obesity, sedentary lifestyle, stress, drug-induced, infection in pancreas, hypertension, high serum lipid and lipoproteins, less glucose utilization and other factors. It is estimated that the diabetic patients in India will increase by 195% in the near future **[1].** The treatment of diabetes with synthetic drugs is costly and chances of side effects are high. For example, long-term use of *Exenetide* (Byetta) **[2]** has lead to side effects such as nausea, vomiting, diarrhea, dizziness, headache, jittery feeling and acidity. *Sulfonylureas* cause abdominal upset, headache and hypersensitivity, while *Metformin* **[3]** causes diarrhea, nausea, gas, weakness, indigestion, abdominal discomfort and headache. *Thiazolidinediones* has side effects like, upper respiratory infections and sinusitis, headache, mild anemia, retention of fluid in the body which may lead to heart failure and muscle pain.

Ayurveda and other traditional medicinal system for the treatment of diabetes describe a number of plants used as herbal drugs. Hence, they play an important role as alternative medicine due to less side effects and low cost. The active principles present in medicinal plants have been reported to possess pancreatic beta cells regenerating, insulin releasing and fighting the problem of insulin resistance **[4]**. *Aloe vera* juice stimulates the release of insulin from the beta-cells in human, *Acacia catechu* wood extract enhances the regeneration of pancreatic beta cells in rabbits, *Momordica charantia* fruit extract enhances insulin secretion by the islets of Langerhans etc. A significant proportion of these plants have been observed to possess potent antioxidant activity, which may contribute to anti-diabetic property in streptozotocin/alloxan, induced animal model **[5].** Not only in Ayurveda, but also in several other traditional systems of medicine, it is described that plants useful in diabetes also possess strong antioxidant/free-radical scavenging properties **[6].** In Ayurveda, diabetes is described as 'Madhumeha'. Ayurvedic preparations in spite of their established efficacy for the treatment of diabetes are not very popular due to lack of systematic information about the active constituent(s) for a given plant, their mechanism of action, side effects, clinical or experimental data etc. Thus, there is a need to document such information in the form of a database. Limited databases are available for anti-diabetic plants. However, information on clinical/experimental trial and supplier industries of raw materials of anti-diabetic medicinal plants are not available in such databases. Here, we describe a database containing information for anti-diabetic plants and their use. The database describes medicinal plants having anti-diabetic activity with other related information including relevant references. The database also contains detailed information about the plant raw material supplier industries in India with respective products.

Methodology
Data collection
Data of anti-diabetic plants on clinical/experimental trials were collected from literature sources such as PubMed **[7],** Science Direct **[8],** Biomed Central **[9],** Springerlink **[10],** Scirus **[11],** Wiley journals **[12],** Journals of phyto-medicine **[13],** Journals of Ethanopharmacology **[14]** and through collection of folklore medicinal usage. The information about the plant raw material suppliers or manufacturers has been collected from their websites. The database includes 203 genus and 238 species of plants having role in the treatment of diabetes and 123 plant raw material suppliers/manufacturers within India.

Database design
The Database was constructed using standard HTML and JavaScript. It has a web-based, flat-file type user interface with simple global search, specific database search, keywords help and with links to references in other external databases. The schema for anti-diabetic plant database is given in Figure 1.

Software:
Microsoft Windows 95/98/2000/2003/XP operating system was used in the development. HTML was used for the creation of web pages and java script was used for the development of database front end.

Hardware
Personal computer with high-speed processor with Windows 95/98/2000/XP OS was used. We used 10.08 MB memory for running the database.

Database features
The record entry contains the following information: (a) name of the plant; (b) geographical distribution; (c) part of the plant investigated; (d) dosage; (e) active constituents with anti-diabetic property (active constituents also have a link which provided compound structure as well as their physical and chemical properties.); (f) action; (g) model organism (Human, dog, rabbit, rat, mice etc. and their quantity) on

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which the clinical /experimental studies have been done. This web database also contains information about plant raw material supplier or manufacturer industries in India such as company name; contact person; address; contact number; E-mail ID; websites and products. These industries are the sources of plant raw material for direct use and production of herbal drug material for treatment of diabetes as well as other diseases. The database also contains current information about diabetes incidences across the world. The information about plants can be retrieved alphabetically using botanical name or common name of plant and about plant raw material supplier industries through name of the industry.

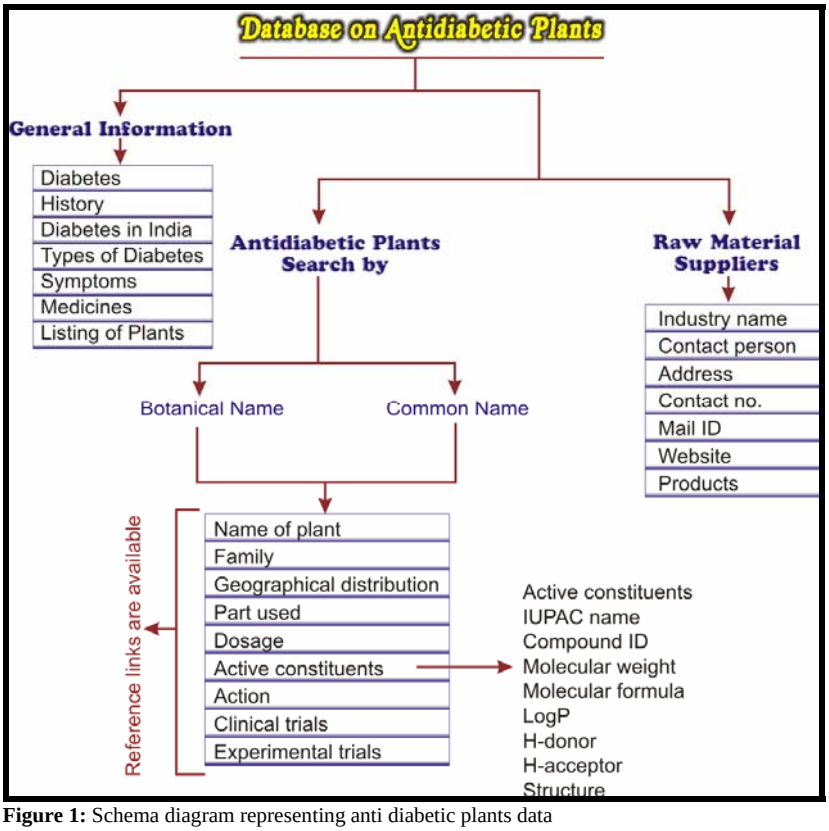

Figure 1: Schema diagram representing anti diabetic plants data

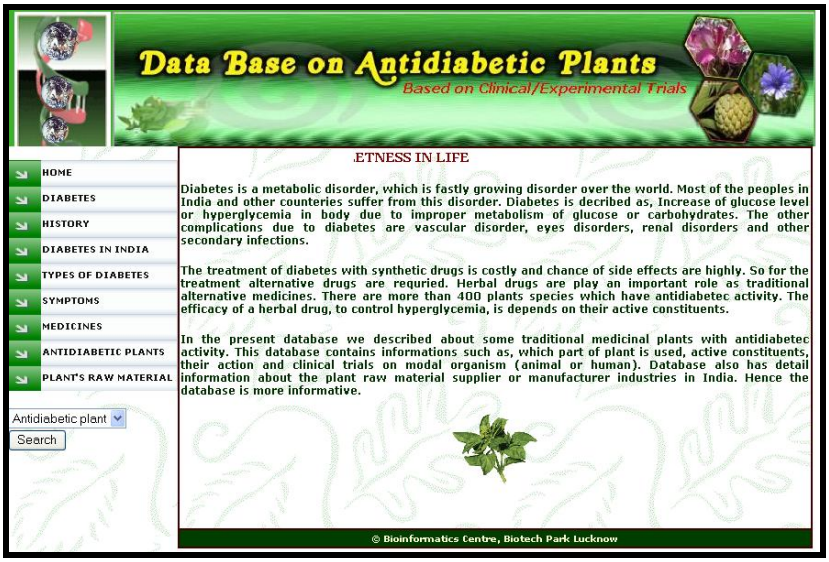

Figure 2: A screen shot of the database "Database on anti-diabetic plants" home page with links and dropdown search window.

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Utility
This freely available web database provides supplementary and useful information about anti-diabetic plants capable of controlling diabetes. The database also contains clinical or experimental trials data with source of plant raw material for potential use as therapeutic material. The database is also useful for the scientific community and industries for a quick and informative review on anti-diabetic plants.

Future development
We plan to further refine and update this database with links to known drugs related data in the near future.

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[6] L McCune *et al., J. Ethnopharmacol.,* **82 :** 197 (2002), [PMID: 12241996]
[7] http://www.ncbi.nlm.nih.gov/PubMed/
[8] http://www.sciencedirect.com
[9] http://www.biomedcentral.com
[10] http://www.springerlink.com
[11] http://www.scirus.com
[12] http://www3.interscience.wiley.com/cgi-bin/home
[13] http://www.ingentaconnect.com/content/urban/211/
[14] http://www1.elsevier.com/cdweb/journals/03788741/viewer.htm

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Supplementary material

Raw material supplier Industries in India

A Indian Neem Tree Company
Aatish Industries
AayurMed Biotech Pvt. Ltd.
Advance chemical processor (L)
Agya Enterprises, Bhopal
Alchemy Chemicals
Amruta Herbals Private Limited
Ansar Industries
Apex International
Apollo Herbal Export
Archana Exports
Arun India Exports
Athulya Exports
Atlas Industeries
Aum Agri Freeze Foods
Aushdhi
Balaji Global Impex
Best Exports
Bhoomi Nutraceuticals Pvt. Ltd
Biosourcing.com (p) ltd
Boom Buying Pvt. Ltd.
Cherain chemicals
Clarion Pharmaceutical Co.
Cymbio Pharma Pvt Ltd.
Dabur India Ltd.
Deepak Trading Company, Bangalore
Digvijaypharma Industries
Disha consultancy services
Divya International
Ecotech Technologies (I) Private Limited
Exports & Agencies
Fairy Food Products Pvt. Ltd.
Farmawealth Bio-Tech
Floral Seed Company
G. Mohanraj
Geet Herbal Farms and Essential Oils
Green Earth Products
Grover Sons
H. Bilal & Co.
Herbal avenue
Herbex Laboratories
Herbs India, Tuticorin
Indo World Trading Corporation
Ishita Health Care
K. Mohamed & Company
K. Patel Phyto Extractions Pvt. Ltd.
Kapoor herbal products
Karnataka Aromas, Bangalore
Kashmir Honey Trading Co.
Khandige Herbs and Plantations Pvt Ltd
Kumaon Chemical Products
Lala Jagdish Prasad & Co.
Leela Industeries
Maharaja Dehydration Pvt. Ltd.
Malhar Enterprise
Manilal Jamnadas
Megha Products
Modiorchards Limited
Mother Herbs [P] Ltd.
M.S.S. Asan Expots
Multibiz Natural Products
Natraj Exports
Nav Bharat Trading Company
Navshakti Herbal Labs
Nivas Impex
Omkrown Pharma Chem Pvt. Ltd.
Omshakthi Exports
Packiam Botanicals
Padmavati Agro Overseas
Pas Kosmosis Agro Pvt. Ltd.
Perennial Biotechs Pvt Limited
Phyto Concentrates
Phyto Organics Pvt Ltd
Pioneer Enterprise
Pradhan International
Prakruti Products
Prakruti Products Pvt. Ltd.
Protek India
P.S.S.J. Suthanthira Enterprise
Quest Marketing Company
R. S. V. Nadar & Co.
Raj and group
Ras Agro Associates
Ratanjot Green Fuels Private Limited
Rampal
Rohit Marketing
Ruchi Biochemicals
S. D. Biotech
S. & H. Industries
S. J. Herbals and Health Care
S. S. Herbals
Sai Phytoceuticals Pvt. Ltd.
Sanjeevani Herbals
Sanjivini Herbals
Santosa Impex
Scat Herbal Pvt. Ltd.
Scion Agri
Sharda Enterprises, Bikaner
Shimla Hills Offerings Pvt. Ltd
Shree Shyam Manohar Isabgol Industries Pvt. Ltd.
Shubhmets
Silverline Chemicals
Sip india exports
Siris Impex
Sitaram & Co.
Southern India Spices Essences
Stevia Biotech Pvt. Ltd
Surajbala Exports Private Limited
The Gwalior Forest Products Limited
The Stevia Agro India
The Universal Good Life Centre, Coimbatore
Tulsi Amrit Pvt. Ltd.
Unico Pharmaceuticals
Vaasanthi Herbal
Vaghasia Exports Pvt. Ltd
Vanashree Agrotech
Varushapriya Agrotech Pvt. Ltd
Vedantika Herbals (NCL Agro Foods)
Venkatesh Food Industries
Vignesh Exports
Vishal Organix
VPS Agro Oils Private Limited
Wingz Inc.

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List of Antidiabetic Medicinal Plants in Alphabetical order:

A

Abelmoschus moschatus
Abroma augusta
Acacia arabica
Acacia catechu
Acanthopanax senticosus
Achillea santolina
Achyranthes aspera
Achyrocline satureioides
Acosmium panamense
Aegle marmelose
Agaricus bisporus
Agrimony eupatoria
Ajuga iva
Allium cepa
Allium sativum
Aloe barbadensis
Anacardium occidentale
Andrographis paniculata Anemarrhen asphodeloides
Angylocalyx pynaertii
Annona squamosa
Arctium lappa
Areca catechu
Arfazetin
Artemisia herba alba
Artemisia dracunculus
Artemisia sphaerocephala Krasch
Astragalus membranaceus
Averrhoa bilimbi Linn
Azadirachta indica
Azorella compacta

B

Bacopa monniera
Bauhinia candicans
Bauhinia forficate
Beta vulgaris Boerhaavia diffusa
Bidens pilosa
Biophytum sensitivum Bixa orellana
Brassica juncea
Bryonia alba
Bumelia sartorum

C

Caesalpinia bonducella Cajanus cajan
Camellia sinensis
Capparis spinosa Capsicum frutescens Carum carvi
Casearia esculenta Cassia auriculata Cassia fistula
Catharanthus roseus Cecropia obtusifolia Chamaemelum nobile
Chelidonium majus Cichorium intybus Cimicifuga dahurica
Cinnamomum cassia Cinnamomum zeylanicum
Cirsium pascuarense
Cissus sicyoides Citrullus colocynthis Clausena anisata
Clerodendron phlomoides
Coccinia indica Cogniauxia podoleana baillon
Commelina communis Coriandrum sativum Cornus officinalis
Croton cajucara Cryptolepis sanguinolenta
Cucurbita ficifolia
Cuminum cyminum Cuminum nigrum Curcuma longa
Cyamopsis tetragonalobus
Cynodon dactylon

D

Dioscorea dumetorum

E

Eclipta alba
Emblica officinalis Ephedra distachya
Enicostemma littorale Equisetum myriochaetum
Erigeron breviscapus
Eriobotrya japonica Eucalyptus globules Euphrasia officinale

F

Ficus bengalensis
Ficus carica
Ficus glomerata
Filipendula ulmaria Fraxinus excelsior

G

Garcinia kola
Gentiana olivieri Ginkgo biloba
Globularia alypum Glycine max
Glycyrrhiza glabra
Glycyrrhizae radix Glycyrrhiza uralensis Gongronema latifolium
Gymnema montanum Gymena sylvestre

H

Harpagophytum procumbens
Helicteres isora Hintonia latiflora
Hintonia standleyana Hordeum vulgare Hydrastis Canadensis
Hypoxis hemerocallidea

I

Ibervillea sonorae
Inula racemosa
Ipomoea aquatica

J

Jatropha curcas Juniperus communis

K

Kalopanax pictus

L

Larrea tridentate Lagerstroemia speciosa Leguminous
Lepechinia caulescens Lepidium sativum
Linum usitatissimum
Loranthus begwensis Luffa aegyptiaca Lupinus albus

M

Mangifera indica Medicago sativa
Mentha piperitae
Momordica charantia Morinda lucida Benth Moringa oleifera
Morus alba
Morus indica
Morus insignis
Morus nigra
Mucuna pruriens Murraya koenigii
Musa sapientum
Myrcia uniflora
Myrtus communis

N

Nelumbo nucifera Nigella sativa

O

Oceimum canum Ocimum gratissimum Oceimum sanctum
Olea europaea
Opuntia megacantha Opuntia robusta
Origanum vulgare Otholobium pubescens

P

Paeonia lactiflora Panax ginseng
Panax quinquefolius L
Pandanus odorus Pantoea agglomerans Parmentiera edulis
Peganum harmala Phaseolus vulgaris Phellinus baumii
Phyllanthus amarus Phyllanthus sellowianus Picrorhiza kurrooa
Piper sarmentosum Pistacia atlantica Polygala senega
Polygonatum officinale Premna integrifolia Prunus davidiana
Psacalium decompositum
Psacalium peltatum Psidium guajava
Psoralea corylifolia Pterocarpus marsupium Pueraria lobata
Pueraria thunbergiana Punica granatum

Q

Quercus infectoria

R

Retama raetam
Rhazya stricta Rhizophora apiculata
Rubus fructicosis
Rubus ulmifolius

S

Salacia oblonga
Salacia reticulata
Salvia coccinia
Salvia lavandulifolia Salvia officinalis
Sambucus nigra
Sanguis draxonis Saussurea lappa
Sclerocarya birrea
Scoparia dulcis Scrophularia deserti
Securigera securidaca
Sesamum indicum Sesbenia aegyptiaca Silybum marianum
Smallanthus sonchifolius
Solanum lycocarpum Spergularia purpurea
Stevia rebaudiana Bertoni
Strychnos nux vomica Suaeda fruticosa
Sutherlandia frutescens Swertia chirayita Syzigium alternifolium
Syzigium cordatum Syzigium cumini

T

Tamarindus indica Taraxacum officinale Telfaria occidentalis
Tephrosia purpurea Terminalia bellirica Terminalia chebula

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Tetrapleura tetraptera Teucrium polium Thunbergia laurifolia Linn Tinospora cordifolia Tournefortia hirsutissima Tragia involucrate Tribulus terrestris Trichosanthes anguina Trichosanthes cucumerina Trichosanthes kirilowii Trigonella foenumgraecum Triticum vulgare

Turnera diffusa

U

Urtica dioica

V

Vaccinum myrtillus Verbesina crocata Verbesina persicifolia Viburnum foetens

W

Withania somnifera

X

Xanthocercis zambesiaca

Y

Not Avialable

Z

Zingiber officinale Zizyphus sativa Zizyphus spina-christi Zygophyllum gaetulum

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