

Ethnomedicinal Studies on Commonly Used Medicinal Angiosperms for Therapy of Diabetes in Bihar, India

*Sudhir Chandra Verma and Chandra Bhanu Singh¹

Department of Botany,

G.D. College,

BEGUSARAI – 851101 (BIHAR) INDIA

¹University Department of Botany,

T. M. Bhagalpur University,

BHAGALPUR – 812007 (BIHAR) INDIA,

*Corresponding Author

E-mail : verma_sudhir7@yahoo.com

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ABSTRACT

This paper deals with 75 angiospermic species, under 69 genera and 44 families, commonly used in the therapy of diabetes in Bihar. The very useful non-dietary antidiabetic angiosperms are *Aloe vera*, *Azadirachta indica*, *Cassia fistula*, *Catharanthus roseus*, *Gymnema sylvestre*, *Helictere sisora*, *Ocimum tenuiflorum*, *Phyllanthus niruri*, *Pterocarpus marsupium*, *Ricinus communis*, *Scoparia dulcis*, *Senna occidentalis*, *Syzygium cumini*, *Tinospora cordifolia* and *Withania somnifera*. The most valuable dietary angiosperms with hypoglycemic properties include *Allium cepa*, *Allium sativum*, *Beta vulgaris*, *Cinnamomum zeylanicum*, *Coccinia indica*, *Curcuma domestica*, *Linum usitatissimum*, *Momordica charantia*, *Moringa oleifera*, *Murraya koenigii*, *Piper nigrum*, *Trachyspermum ammi*, *Trigonella foenum-graecum* and *Zingiber officinale*. *Allium cepa*, *Ipomoea aquatica*, *Ricinus communis* and *Scoparia dulcis* alleviate fasting blood glucose level (BGL) while many others reduce post-prandial BGL. The instant hypoglycemic effect of *Cinnamomum zeylanicum*, *Moringa oleifera*, *Zingiber officinale* seems to be beneficial for the persons with diabetes. Medicinal angiosperms are emerging as alternative drugs to synthetic one in the medication of diabetes.

Figure : 00

References : 40

Table : 01

KEY WORDS : Antidiabetic angiosperms, Bihar, Ethnomedicinal studies

Introduction

Diabetes mellitus (DM), often termed as diabetes, is a serious metabolic disorder caused due to insulin insufficiency (Type 1 DM) or insulin resistance (Type 2 DM). Its incidence is rapidly increasing especially in urban area and posing severe threats to mankind in all parts of the world. It is assessed that the number of persons suffering from diabetes would increase upto 783 million until 2045. This multifactorial disease leads to huge financial loss and many serious health complications as blindness, heart attack/stroke, kidney failure, neuropathy, etc. Several modern synthetic medicines are available in the markets for effective control of this incurable ailment but the synthetic medicines are very costly as well as harmful due to their own side effects. The common people are incapable to afford high prices of such lifesaving drugs. Obviously,

they are compelled to use folk medicines from angiosperms with antidiabetic / hypoglycemic activity for the therapy of diabetes. Medicinal angiosperms having vast antidiabetic / antihyperglycemic potential and fewer side effects are easily accessible to them. However, the ethnomedicinal study focusing on the medication of diabetes in Bihar is limited to some medicinal angiospermic plants (46) confined in a district out of 38 districts of the province¹⁸. Further the earlier ethnomedicinal studies of Buxar and Bhagalpur districts of the state include only 04 and 10 antidiabetic angiosperms out of 84 and 75 medicinal angiosperms respectively^{33,34}. Therefore, the present research work is an attempt to search out commonly used medicinal angiosperms in the remedy of diabetes prevalent in Bihar.

TABLE-1 : Enumeration of commonly used antidiabetic plants of Bihar (India)

S. No.	Botanical name, Common name, Vernacular name, Family, Habit	Mode of Utilization
1.	<i>Acacia nilotica</i> , Acacia, Babul / Kiker, Mimosaceae, Thorny tree	Half cup of stem bark decoction is consumed twice everyday by the diabetic patients for 2-3 months to reduce blood glucose level (BGL) and get relief from diabetes.
2.	<i>Acalypha indica</i> , Indian mercury, Khokhill/Kuppi / Kanghi, Euphorbiaceae, Annual herb	Half cup of leaf decoction is continuously taken 2-3 times a day depending on the severity of ailment.
3.	<i>Achyranthes aspera</i> , Chaff-flower, Chirchita/ Chirchiri, Amaranthaceae, Perennial herb	Half cup of root decoction is consumed daily in the morning for 2-3 months.
4.	<i>Aegle marmelos</i> , Bael / Wood apple, Bel, Rutaceae, Deciduous tree	200-250 ml aqueous extract of fruit pulp is regularly drunk twice a day for one month as an effective therapy of diabetes. In fact, the dose of fruit pulp extract depends on age and health of the diabetic patients besides other conditions of the ailment.
5.	<i>Albizia lebbek</i> , Kokko, Siris, Mimosaceae, Deciduous tree	Half cup of stem bark decoction is taken twice everyday.
6.	<i>Allium cepa</i> , Onion, Piyaz, Amaryllidaceae, Biennial herb	100g fleshy leaves from bulbs are consistently eaten raw per day to reduce fasting BGL
7.	<i>Allium sativum</i> , Garlic, Lahsun, Amaryllidaceae, Perennial herb	Usually 3-4 cloves (bulblets) are eaten raw per day as an effective herbal medicine of diabetes.
8.	<i>Aloe vera</i> , Indian Aloe, Ghikumar, Asphodelaceae, Succulent herb	Fresh leaf juice (10 -15 ml) is consumed everyday by the patients over one month.
9.	<i>Annona squamosa</i> , Sugar apple / Custard apple, Sharifa, Annonaceae, Medium tree	Half cup of leaf extract is taken twice per day for at least 2-3 months.
10.	<i>Areca catechu</i> , Betel nut, Supari, Arecaceae, Straight medium tree	Overall, 15-25g dehusked and dried nuts of good quality are chewed per day @ 3-4g / dose. The quantity of dose depends largely on the severity of disease.
11.	<i>Artocarpus heterophyllous</i> , Jack fruit, Kathal, Moraceae, Evergreen tree	Half cup of leaf decoction is consumed in the empty stomach in morning for 2-3 months.
12.	<i>Asparagus racemosus</i> , Indian Asparagus, Satavar / Satavari, Asparagaceae, Climbing shrub	Two teaspoonsful of root tuber decoction is regularly consumed once or twice a day depending on the severity of disease.
13.	<i>Azadirachta indica</i> , Margosa tree, Neem, Meliaceae, Evergreen tree	One teaspoonful fresh leaf juice is taken or 8-10 tender leaves are chewed daily in the empty stomach in morning for quick relief from diabetes.

S. No.	Botanical name, Common name, Vernacular name, Family, Habit	Mode of Utilization
14.	<i>Beninca shahispida</i> , Wax gourd / Ash gourd / Winter gourd, <i>Petha / Bhua</i> , Cucurbitaceae, Climbing or trailing herb	Half cup of fruit peel extract is taken once everyday for 3-4 months
15.	<i>Beta vulgaris</i> , Beet root, <i>Chukandar</i> , Chenopodiaceae, Biennial herb	Half cup of root juice is regularly consumed twice a day. Alternatively, the root slices are frequently and lavishly eaten raw as salads.
16.	<i>Boerhavia diffusa</i> , Spreading hogweed, <i>Punarnava</i> , Nyctaginaceae, Creeping perennial herb	Half cup of root decoction is taken once everyday for 2-3 months
17.	<i>Bombax ceiba</i> , Cotton tree, <i>Semul</i> , Bombacaceae, Deciduous tree	One teaspoonful of leaf extract is consumed everyday in the morning and evening.
18.	<i>Brassica juncea</i> , Brown mustard, <i>Rai</i> , Brassicaceae, Annual cultivated herb	One teaspoonful of seed powder is added in lime juice, mixed thoroughly and mixture is consumed once daily for one month.
19.	<i>Butea monosperma</i> , Bengal kino / Parrot tree / Sacred tree, <i>Dhak / Palas</i> , Fabaceae, Deciduous tree	Half cup of leaf decoction is drunk once daily on regular basis.
20.	<i>Cajanus cajan</i> , Pigeon pea, <i>Arhar</i> , Fabaceae, Shrub	The cooked cotyledons are eaten regularly.
21.	<i>Carica papaya</i> , Papaya, <i>Papita</i> , Caricaceae, Soft wooded tree	20-25 ml leaf extract is consumed everyday.
22.	<i>Carissa carandas</i> , Karanda, <i>Karaunda</i> , Apocynaceae, Spiny shrub	The pickles prepared from unripe fruits are regularly eaten lavishly many times everyday as a natural medicine to maintain glucose level in blood.
23.	<i>Cassia fistula</i> , Golden shower tree, <i>Amaltas</i> , Caesalpiniaceae, Deciduous tree	Half cup decoction of stem bark or fruit pulp is consumed twice everyday.
24.	<i>Catharanthus roseus</i> , Madagascar Periwinkle, <i>Sadabahar</i> , Apocynaceae, Perennial herb	Either 5-10 tender leaves are chewed or their juice mixed with milk is consumed daily in the empty stomach during morning time for quick relief from the elevated BGL.
25.	<i>Cinnamomum zeylanicum</i> , Ceylon cinnamon, <i>Dalchini</i> , Lauraceae, Evergreen tree	The decoction / infusion or powder of stem bark (2.0-4.0 g) is taken by the patients for instant relief from discomfort of ailment.
26.	<i>Coccinia grandis</i> , Ivy gourd, <i>Tilkocha / Tilkor</i> , Cucurbitaceae, Climbing or trailing herb	A teaspoonful of root or leaf juice is regularly consumed twice a day.
27.	<i>Coccinia indica</i> , Little gourd, <i>Kundri / Kundru</i> , Cucurbitaceae, Twining or spreading herb	A cup of fruit juice is regularly drunk twice a day.

S. No.	Botanical name, Common name, Vernacular name, Family, Habit	Mode of Utilization
28.	<i>Coriandrum sativum</i> , Coriander, <i>Dhaniya</i> , Apiaceae, Annual herb	Often a quarter-half teaspoonful mature fruits (called coriander) are chewed or their (coriander) extract is taken once a day in effective lowering of BGL.
29.	<i>Cuminum cyminum</i> , Cumin, <i>Jeera</i> , Apiaceae, Annual herb	1.5 – 2.5g of slightly roasted fruit powder is mixed with water and the mixture (commonly called <i>jeera</i> water) is consumed daily.
30.	<i>Curcuma domestica</i> , Turmeric, <i>Haldi</i> , Zingiberaceae, Perennial herb	The regular consumption of 0.5-2.0 g turmeric (rhizome) powder per day alongwith food items is considered to prevent the development of diabetes
31.	<i>Cuscutareflexa</i> , Dodder, <i>Amarbel / Amarlata</i> , Convolvulaceae, Perennial herb (Stem parasite)	The plant paste is added in a cup of water and mixed thoroughly. Thereafter, the mixture is filtered and the filtrate (<i>i.e.</i> , plant extract) is taken orally everyday.
32.	<i>Dalbergia sissoo</i> , <i>Shisham</i> , Fabaceae, Deciduous tree	A cup of bark / leaf decoction is daily drunk once a day.
33.	<i>Euphorbia hirta</i> , Garden spurge / Hairy spurge, <i>Dudhi</i> , Euphorbiaceae, Annual wild herb	A cup of shoot decoction is continuously drunk once or twice everyday depending on the severity of disease.
34.	<i>Ficus racemosa</i> , Cluster fig, <i>Gular</i> , Moraceae, Large shrub / Small tree	Half cup of stem bark infusion or unripe fruit decoction is taken once everyday.
35.	<i>Ficus religiosa</i> , Sacred fig tree, <i>Pipal</i> , Moraceae, Fast growing tree	The regular oral administration of stem bark decoction (2-3 teaspoonful) or powder (2 teaspoonful) proves as an effective measure in the healing of diabetes. The frequent drinking of half cup of its leaf decoction in the empty stomach in morning also acts as a useful therapy against this ailment.
36.	<i>Foeniculum vulgare</i> , Fennel, <i>Saunf</i> , Apiaceae, Aromatic herb	One teaspoonful mature fruits (called fennel) are regularly consumed either directly by chewing after meal or indirectly by drinking fennel water. The fennel water is prepared by soaking fennel overnight in 200-250 ml water. Then the fennel water is drunk in the empty stomach in morning and the soaked feneel is chewed.
37.	<i>Gymnema sylvestre</i> , Gymnema, <i>Gurmar</i> , Asclepiadaceae, Woody climber	Either 4-5 leaves are chewed or their juice is consumed daily in the empty stomach during morning hours as an effective natural remedy of diabetes.
38.	<i>Helicteres sisora</i> , Marodphali / Indian screw tree, <i>Jari</i> , Sterculiaceae, Large shrub / Small tree	One fresh fruit is eaten raw or its aqueous extract is taken once everyday by the patients for two months.

S. No.	Botanical name, Common name, Vernacular name, Family, Habit	Mode of Utilization
39.	<i>Hibiscus rosa-sinensis</i> , China rose, <i>Gudhal</i> , Malvaceae, Ornamental shrub	Half cup of leaf decoction is orally administered once everyday for 3-4 months.
40.	<i>Ipomoea aquatica</i> , Water spinach, <i>Karmi</i> , Convolvulaceae, Trailing herb	The cooked green leaves are eaten as vegetable to alleviate fasting blood glucose level.
41.	<i>Leucasa spera</i> , Thumbai, <i>Dhurpi / Guma</i> , Lamiaceae, Annual herb or undershrub	One teaspoonful of fresh leaf extract is taken everyday in the morning and evening as an effective control measure of diabetes.
42.	<i>Linum usitatissimum</i> , Linseed, <i>Alsi / Tisi</i> , Linaceae, Annual herb	The diabetic persons often consume food items prepared utilizing seed powder or oil (known as flax oil or linseed oil) of this plant. In addition, they consume one teaspoonful of seed powder twice a day for 3-4 months.
43.	<i>Madhuca indica</i> , Indian butter tree, <i>Mahua</i> , Sapotaceae, Deciduous tree	The decoction of bark powder (15-20g) is regularly taken once a day.
44.	<i>Mangifera indica</i> , Mango, <i>Aam</i> , Anacardiaceae, Evergreen tree	The leaf decoction of wild varieties is commonly consumed by the patients in doses recommended by the local herbalists.
45.	<i>Momordica charantia</i> , Bitter gourd, <i>Karela / Kareli</i> , Cucurbitaceae, Annual climbing or trailing herb	A cup of fruit juice is drunk once everyday in the empty stomach in morning.
46.	<i>Moringa oleifera</i> , Drumstick tree, <i>Munuga / Sahjan</i> , Moringaceae, Evergreen tree	A glass of fresh leaf decoction (200 ml) is drunk anytime for instant hypoglycemic effect in post-prandial blood glucose level. From the next day, a cup of fresh leaf decoction is regularly drunk by the patients in the empty stomach in morning to keep themselves relaxed from the discomfort of ailment.
47.	<i>Morus alba</i> , White mulberry, <i>Shahtut / Tut</i> , Moraceae, Deciduous tree	A cup of leaf extract is frequently drunk for quick alleviation of high glucose level in blood.
48.	<i>Murraya koenigii</i> , Curry leaf tree, <i>Mithaneem / Curry patta</i> , Rutaceae, Large shrub / Small tree	In general, 12-15 fresh leaves are chewed or their juice / decoction is taken every night in the empty stomach to keep the disease at bay.
49.	<i>Nigella sativa</i> , Black cumin, <i>Kala jeera / Kalongi / Mangrela</i> , Ranunculaceae, Annual herb	A teaspoonful of fine seed powder is added in a cup of water, mixed properly and wet mixture is frequently consumed in morning and evening.
50.	<i>Ocimum tenuiflorum</i> , Holy basil, <i>Tulsi</i> , Lamiaceae, Annual herb	A cup of leaf decoction is regularly drunk 2-3 times per day as a natural remedy of the ailment.

S. No.	Botanical name, Common name, Vernacular name, Family, Habit	Mode of Utilization
51.	<i>Phaseolus vulgaris</i> , Kidney bean, <i>Bakla</i> , Fabaceae, Annual herb	100g seeds are soaked overnight in water, cooked properly and eaten everyday with low glycemic diet such as barley, bread, fruits, vegetables, etc. as an effective control measure of diabetes.
52-54.	<i>Phyllanthus emblica</i> , Indian gooseberry / Emblic myrobalan, <i>Amla</i> , Phyllanthaceae; <i>Terminalia bellirica</i> , Bellericmyrobalan, <i>Bahera</i> , Combretaceae and <i>Terminalia chebula</i> , Chebulic myrobalan, <i>Harad / Harre</i> , Combretaceae (All three deciduous trees)	The mature fruits of these popular medicinal plants are purchased from the local markets. The procured fruits are dried properly, mixed together in equal proportions (1:1:1) and ground to make a polyherbal powder. This folklore medicine is no doubt cheap but almost similar in the medicinal benefits of an ayurvedic medicine called <i>Triphalachurna</i> . A fraction (1.0-1.5g) of the self prepared powder is mixed properly with milk by constant stirring and the mixture is consumed everyday in an empty stomach during morning hours. More or less the consumption of powder reduces significantly blood glucose level of the patients. The continuous utilization of powder for 3-4 months gives good relief from the harmful effects of disease and keeps the patients well in healthy condition.
55.	<i>Phyllanthus niruri</i> , Stone breaker, <i>Bhuiamla</i> , Phyllanthaceae, Annual herb	The shoot extract (20-30 ml) is taken twice daily for one month.
56.	<i>Piper nigrum</i> , Black pepper, <i>Kalimirch / Golmirch</i> , Piperaceae, Climbing shrub	A teaspoonful of fruit powder is mixed properly with water and the mixture is regularly consumed twice a day as an effective herbal medicine of diabetes.
57.	<i>Pistia stratiotes</i> , Water lettuce, <i>Chhotajalkumbhi</i> , Araceae, Floating aquatic herb	10-15ml fresh juice of young plant is mixed with equal part of coconut milk and the mixture is regularly consumed once a day.
58.	<i>Pongamia pinnata</i> , Indian beech / Pongame oil tree, <i>Karnaj</i> , Fabaceae, Medium tree	The decoction of bark / flower is regularly taken once a day.
59.	<i>Pterocarpus marsupium</i> , Bastard teak, <i>Bijasar / Bijasal</i> , Fabaceae, Deciduous tree	A cup of heartwood infusion is regularly drunk twice everyday.
60.	<i>Punica granatum</i> , Pomegranate, <i>Anar</i> , Punicaceae, Shrub	The root bark and fruit rind are mixed together in equal proportions (1:1) and the mixture is crushed to make paste. The paste is consumed daily in morning and evening for two weeks in the doses recommended by local herbalists.
61.	<i>Ricinus communis</i> , Castor oil plant, <i>Arandi</i> , Euphorbiaceae, Perennial shrub / Small tree	Fresh leaf extract(5ml) is frequently taken twice everyday by the patients to alleviate fasting glucose level in blood.

S. No.	Botanical name, Common name, Vernacular name, Family, Habit	Mode of Utilization
62.	<i>Saraca asoca</i> , Ashok tree, <i>Ashok</i> , Caesalpiniaceae, Evergreen tree	A glass of leaf decoction is drunk daily in the empty stomach in morning.
63.	<i>Scoparia dulcis</i> , Licorice weed, <i>Mithapatta</i> , Plantaginaceae, Annual herb	Half cup of leaf extract is consumed once everyday by the patients over one month to reduce fasting blood glucose level.
64.	<i>Senna occidentalis</i> , Coffee senna, <i>Bari kasondi / Sennai</i> , Caesalpiniaceae, Woody herb	Often 5-6 fresh leaves are chewed or their decoction is taken only 4-5 days in morning and evening for fast lowering of elevated glucose level in blood. The consumption of cooked leaves as vegetable also proves very effective in the therapy of diabetes.
65.	<i>Senna tora</i> , Sickie senna, <i>Chakunda / Pamaar</i> , Caesalpiniaceae, Herb or undershrub	A cup of root (10-15g) decoction is drunk once a day for 15-30 days.
66.	<i>Sida cordifolia</i> , Heart-leaf sida, <i>Bariyar</i> , Malvaceae, Annual herb	A glass of leaf decoction is drunk daily for one month.
67.	<i>Syzygium cumini</i> , Java plum / Black plum, <i>Jamun</i> , Myrtaceae, Evergreen tree	Half to full teaspoonful powder of bark or seed as per recommendation of local herabalists is regularly swallowed with water or honey after lunch and dinner. Moreover, the use of bark or seed power of wild varieties is preferred considering it to be a very efficacious herbal drug of diabetes. Fresh fruits are eaten after taking food whereas 3-4 teaspoonful fresh fruit juice is taken after light breakfast in the therapy of diabetes.
68.	<i>Tamarindus indica</i> , Tamarind, <i>Imli</i> , Caesalpiniaceae, Evergreen tree	Half cup of fruit pulp extract is taken twice everyday for post-prandial hypoglycemic effect.
69.	<i>Tinospora cordifolia</i> , Heart-leaved moonseed, <i>Guranch / Giloy</i> , Menispermaceae, Climbing shrub	100-200 ml decoction of stem is regularly drunk once or twice per day in the empty stomach as an effective control measure against diabetes. The old stem containing more quantity of bioactive compounds is preferred for better therapeutic action and relief from the disease.
70.	<i>Trachyspermum ammi</i> , Lovae / Ammi, <i>Ajwain</i> , Apiaceae, Aromatic herb	Overall 9-10g mature fruits (known as <i>ajwain</i>) are consumed by a diabetic patient per day @ 1.5-2.0g per dose. The mode of administration follows chewing of fruits or drinking of <i>ajwain</i> water (slightly roasted fruits mixed with warm water).
71.	<i>Trianthema portulacastrum</i> , Giant pigweed / Black pigweed, <i>Pindooa / Santhi</i> , Aizoaceae, Prostrate wild annual herb	The cooked leaves are eaten as green vegetable by both normal (non-diabetic) and diabetic people as preventive and therapeutic measure respectively in the remedy of diabetes

S. No.	Botanical name, Common name, Vernacular name, Family, Habit	Mode of Utilization
72.	<i>Trigonella foenum-graecum</i> , Fenugreek, <i>Methi</i> , Fabaceae, Annual herb	The seed powder (30-35g) is consumed twice per day over one month as a natural remedy of diabetes.
73.	<i>Withania somnifera</i> , Indian winter cherry / Indian Ginseng, <i>Ashwagandha</i> , Solanaceae, Evergreen shrub	Root decoction (15-20 ml) is consistently taken twice everyday as a household remedy of diabetes.
74.	<i>Zingibe officinale</i> , Ginger, <i>Adrakh / Aadi</i> , Zingiberaceae, Perennial herb	10-20ml extract of rhizome is taken orally for instant relief from the ill effects of disease.
75.	<i>Ziziphus jujuba</i> , Jujube, <i>Ber</i> , Rhamnaceae, Large shrub / Small spiny tree	A cup of leaf extract is drunk daily for 2-3 months to get relief of hypoglycemic effect.

Study Area

The area of investigation Bihar state (24°20'10" - 27°31'15" NL and 83°19'50" - 88°17'40" EL, 173 feet MSL) is located in East India. It shares its borders with Nepal in north and other sides with its neighbouring states (South: Jharkhand, West: Uttar Pradesh and East: West Bengal). It forms the part of Indo-Gangetic plain, covers an area of 94,163 km² and comprises 38 districts. It is separated into two distinct parts (*viz.*, North and South) due to flowing of the River Ganges in west to east direction. North Bihar is entirely alluvial cum flat whereas South Bihar has patches of hills and hillocks. The soil of South Bihar is mainly red sandy to loamy or alluvial at certain places. The climate all over the state is of monsoon type and is characterised by three distinct seasons (namely summer, rainy and winter).

Materials and Methods

The search drive for medicinal angiosperms being commonly used in the therapy of diabetes in Bihar executed for three years (July 2022 – June 2025). During this period, the diverse parts of the state particularly urban areas of seven districts (*viz.*, Begusarai, Bhagalpur, Darbhanga, Gaya, Muzaffarpur, Patna and Siwan) were visited in each season for collection of information related to the role of medicinal angiosperms in therapy of diabetes. A new site in each district was surveyed during every expedition to get complete information from ground level. The detailed information on the use of antidiabetic plants for control of diabetes was gathered through interviews and discussions as per semi-structured questionnaires. For effective communication with urban folks, common local languages such as Hindi, Bhojpuri, Angika, Magahi, Maithili and other colloquial languages were used taking the help of bilingual persons as per need of study site.

At least five persons including diabetic patients, local herbalists / healers (*Vaidya, Kaviraj, Hakim*) and native persons interested in use of medicinal angiospermic plants were essentially interrogated at each site with sole purpose of getting accurate information.

The plant or plant part specimens were collected from herbalists / healers and /or diabetic patients. All the collected specimens of plant or plant parts were pressed and dried properly to prepare herbarium following the standard methods^{16,20}. The plant or plant parts specimens were strictly examined and correctly identified using various floras^{4,13,15,39}. Voucher specimens were housed in the Herbarium, Department of Botany, G. D. College, Begusarai, Bihar.

Results and Discussion

The identified antidiabetic / antihyperglycemic / hypoglycemic angiosperms were recorded in alphabetical order of their botanical name followed by common name (in english), vernacular name (in italics), family name, habit and uses, *i.e.*, identity of plant part(s) / product(s) and mode(s) of oral administration as well as certain specification (Table-1). Altogether 75 species of angiosperms that belong to 69 genera and 44 families, are commonly used in the medication of diabetes prevalent in different urban areas of Bihar. All of these medicinal angiosperms are known to have proved their utility in the therapy of diabetes all over India^{3,8,9,12,14,18,19,22,25,29,33-35,37}. Some of these medicinal angiosperms are very useful non-dietary antihyperglycemic ones. These are *Aloe vera*, *Azadirachta indica*, *Cassia fistula*, *Catharanthus roseus*, *Gymnema sylvestre*, *Helicteres sisor*, *Ocimum tenuiflorum*, *Phyllanthus niruri*, *Pterocarpus marsupium*, *Ricinus communis*, *Scoparia dulcis*, *Senna occidentalis*, *Syzygium cumini*, *Tinospora cordifolia* and *Withania*

somnifera. The most valuable dietary angiosperms with hypoglycemic properties include *Allium cepa*, *Allium sativum*, *Beta vulgaris*, *Cinnamomum zeylanicum*, *Coccinia indica*, *Curcuma domestica*, *Linum usitatissimum*, *Momordica charantia*, *Moringa oleifera*, *Murraya koenigii*, *Phaseolus vulgaris*, *Piper nigrum*, *Trachyspermum ammi*, *Trigonella foenum-graecum* and *Zingiber officinale*.

All medicinal angiosperms recorded in this study are known to possess certain bioactive compounds that confer antidiabetic / hypoglycaemic / antihyperglycemic properties to them^{2,6,10,21,23,26,28,30-32,38}. Depending on the nature of their bioactive compounds, the antidiabetic angiosperms show differential actions as alleviation of fasting or post-prandial blood glucose level, instant or delayed hypoglycaemic effect, etc. Only some antidiabetic angiosperms (*Allium cepa*, *Ipomoea aquatica*, *Ricinus communis*, *Scoparia dulcis*) alleviate fasting blood glucose level (BGL) while many among the remaining ones reduce post-prandial blood glucose level (BGL). The instant hypoglycaemic effect shown by *Cinnamomum zeylanicum*, *Moringa oleifera* and *Zingiber officinale* seems to be somehow beneficial for the persons with diabetes. More or less all the recorded antidiabetic angiospermic species have been found to be efficacious in the therapy of diabetes throughout the province. However, the major concerns as dose uncertainty, consumption frequency, intake time, efficacy level, etc of folklore medicines are inevitable.

The modifications in dietary constituents can be amenable to an extent for the concerns of herbal medicines used in the medication of diabetes particularly in the case of Type 2DM^{1,24,25,27,40}. It is well known that

the dietary angiosperms have been playing an important role in the control of Type 2DM since time immemorial. Type 2DM is more common form of diabetes and it alone constitutes the major diabetic population (i.e., around 90%). The different part(s) / product(s) of dietary angiosperms are becoming more useful and popular as folk medicines for the remedy of diabetes prevalent in Bihar. Overall, the use of angiospermic medicinal plants is gaining momentum in the medication of diabetes and the dietary angiosperm having antidiabetic potential are emerging as a viable option for the therapy of Type 2DM in Bihar. This may be treated as the follow up of the fact that the traditional herbal drugs due to their natural hypoglycaemic properties, cost-effective virtue and fewer side effects are emerging as alternative drugs to synthetic one in the therapy of diabetes across the world^{5,7,11,17,36}.

Conclusion

This paper considers that the medicinal angiosperms having antidiabetic potential are of great relevance in the therapy of diabetes affecting urban people of Bihar. Although both dietary and non-dietary angiosperms are commonly used in the therapy of diabetes, the consumption of dietary angiosperms is supposed to be the easiest and safest for this purpose. The antidiabetic angiosperms are applicable in lowering of fasting BGL and post-prandial BGL cum immediate lowering of BGL so as to get instant relief from the discomfort of diabetes. The practice of instant hypoglycemic effect followed by maintenance of alleviated blood glucose level may prove as one of the best therapeutic measures for the control of diabetes.

References

1. Adokwe JB, Waeyeng D, Suwan K, Camsanit K, Kaiduong C, Nuanrat P, Pouyfung P, Yimthiang S, Petchoo J, Satarug S, Khamphaya T. Plant-based diet and glycemic control in Type 2 diabetes: Evidence from a Thai health-promoting hospital. *Nutrients*. 2024; **16** : 619. <https://doi.org/10.3390/nu16050619>.
2. Anshika, Pandey RK, Singh L, Kumar S, Singh P, Pathak M, Jain S. Plant bioactive compounds and their mechanistic approaches in the treatment of diabetes: A review. *Fut. J. Pharm. Sci*. 2022; **8** : 52. <https://doi.org/10.1186/s43094-022-00443-3>.
3. Babar A, Jadhav V, Gole V. A review of medicinal plants with potential antidiabetic effect. *J. Med. Pl. Stud*. 2025; **13** : 275-282.
4. Babu CR. Herbaceous Flora of Dehra Dun. Publication & Information Directorate, CSIR, New Delhi. 1977: p721.
5. Bhattacharya P, Basak S, Sen DDJ and Mahanti DB. Traditional herbal drugs: An emerging alternative for diabetes. *WJPLS*. 2021; **7** : 171-181.
6. Chouhan HS, Swarnkar G, Jogpal B. Medicinal properties of *Ricinus communis*: A review. *Int. J. Pharma. Sci. Res*. 2021; **12** : 3632-3642.
7. Coman C, Rugina OD, Socaciu C. Plants and natural compounds with antidiabetic action. *Not Bot. Horti*.

Agrobo. 2012; **40** : 314-325.

8. Das J, Acharya BC, Mallick S N. Traditional ethno-medicinal plants used for treatment of diabetes by Bhuyan tribes in Sundargarh district of Odisha, India. *Plant Sci. Today.* 2023; **10** : 58-67.
9. Deb CR, Sharma. TI, Jamir N. Ethno-medicinal anti-diabetics plants of North east India: A review. *JPP.* 2023; **12** : 86-110. <https://doi.org/10.22271/phyto.2023.v12:i3b.14668>.
10. Dimple, Kumar A, Kumar V, Tomar V. Traditional medicinal systems for treatment of diabetes mellitus: A review *Int. J. Pharm. Pharm. Sci.* 2018; **10** : 7-17. <http://dx.doi.org/10.22159/ijpps.2018v10i15.25374>.
11. Dwivedi C, Paspal S. Antidiabetic herbal drugs and polyherbal formulation used for diabetes: A review. *J. Phytopharmacol.* 2013; **2** : 44-51.
12. Grover JK, Yadav, Vats V. Medicinal plants of India with antidiabetic potential. *J. Ethnopharmacol.* 2022; **81** : 81-100.
13. Haines HH. The Botany of Bihar and Orissa. Botanical Survey of India, Calcutta.1961: p1272.
14. Hazarika P, Pandey BK, Tripathi YC. Traditional knowledge for antidiabetic herbs from Majuli island (Assam), India. *Int. J. Herb. Med.* 2020; **8** : 47-58.
15. Hooker JD. Flora of British India. Bishen Singh Mahendra Pal Singh, Dehradun.1973: p842.
16. Jain SK Rao RR. A Handbook of Field and Herbarium Methods. Today & Tomorrow's Printers & Publishers, New Delhi.1977: p107.
17. Jacob B, Narendhirakannan RT. Role of medicinal plants in the management of diabetes mellitus: a review. *Biotech.* 2019; **9** : 4. <https://doi.org/10.1007/s13205-018-1528-0>.
18. Jha SK, Singh U. Ethnobotanical survey of antidiabetic medicinal plants of Madhubani (Bihar): *NeBio.* 2013; **4** : 30-32.
19. Kumar A, Aswal S, Chauhan A, Semwal RB, Kumar A, Semwal DK. Ethnomedicinal investigation of medicinal plants of Chakrata region (Uttarakhand) used in the traditional medicine for diabetes by Jaunari tribe. *Nat. Prod. Bioprospect.* 2019; **9** : 175-200. <https://doi.org/10.1007/s13659-019-0202-5>.
20. Lawrence GHM. Taxonomy of Vascular Plants. MacMillan Co., New York.1951: p823.
21. Mahmoud KB, Wasli H, Mansour RB, Jemai N, Selmi S, JammaliA, Riadh K. Antidiabetic, antioxidant and chemical functionalities of *Zizyphus jujuba* (Mill.) and *Moringa oleifera* (Lam.) plants using multivariate data treatment. *South Afr. J. Bot.* 2022; **144** : 219-228. <https://doi.org/10.1016/j.sajb.2021.08.017>.
22. Malviya N, Jain S, Malviya S. Antidiabetic potential of medicinal plants. *Act. Pol. Pharma. Drug Res.* 2010; **67** : 113-118.
23. Mankar SD, Sonawane MSBP, Shelke M. A review on black pepper as antidiabetic agent: Black-Not always bad. *Res. J. Pharmacogn. Phytochem.* 2022; **14** : 26-28.
24. McMacken M, Shah S. A plant-based diet for prevention and treatment of type 2 diabetes. *J. Geriatr. Cardiol.* 2017; **14** : 342-354. <https://doi.org/10.11909/j.issn.1671-5411.2017.05.009>.
25. Modak M, Dixit P, Londhe J, Ghaskadbi S, Devasagayam TPA. Indian herbs and herbal drugs used for the treatment of diabetes. *J. Clin. Biochem. Nutr.* 2007; **40** :163-173. <https://doi.org/10.3164/jcbrn.40.163>.
26. Ojo OA, Gyebi GA, Ezenabor EH, Iyobhebhe M, Emmanye DA, Adelowo OA, Olujinmi FE, Ogunwale TE, Babatunde DE, Ogunlakin AD, Ojo AB, Adeyemi OS. Exploring beet root (*Beta vulgaris* L.) for diabetes mellitus and Alzheimer's disease dual therapy: *In vitro* and computational studies. *RSC Adv.* 2024; **14** : 19362-19380. <https://doi.org/10.1039/d4ra036389>.
27. Oza MJ, Laddha AP, Gaikwad AB, Mulay SR, Kulkarni YA. Role of dietary modifications in the management of type 2 diabetic complications. *Pharmacol. Res.* 2021; **168** : 105602. <https://doi.org/10.1016/j.phrs.2021.105602>.
28. Panchal CV, Dhupal SD, Patil SS. A comprehensive review on: Shatavari (*Asparagus racemosus*). *Int. J. Nov. Res. Dev.* 2022; **7** : 96-111.

29. Prakash O, Kumar R, Srivastava R, Tripathi P, Mishra S, Ajeet. Plants explored with anti-diabetic properties: A review. *Ann. J. Pharmacol. Sci.* 2015; **3** : 55-66.
30. Przeor M. Some common medicinal plants with antidiabetic activity, known and available in Europe (A mini review). *Pharmaceuticals* (Basel). 2022; **15** : 65. <https://doi.org/10.3390/ph15010065>.
31. Rahman MM, Dhar PS, Sumaia, Anika F, Ahmad L, Islam MR, Sultana NA, Cavalu S, Pop O, Rauf A. Exploring the plant-derived bioactive substances as antidiabetic agent: An extensive review. *Biomed. Pharmacother.* 2022; **152** : 1-20. <https://doi.org/10.1016/j.biopha.2022.113217>.
32. Sabu MC, Kuttan R. Anti-diabetic activity of medicinal plants and its relationship with their antioxidant property. *J. Ethnopharmacol.* 2002; **81** : 155-160.
33. Singh A, Singh MK, Singh R. Traditional medicinal flora of the district Buxar (Bihar, India). *J. Pharmacogn. Phytochem.* 2013; **2** : 451-49.
34. Singh CB, Pandit N. Ethnomedicinal studies on Bhagalpur district, Bihar. *J. Econ. Taxon. Bot.* 2015; **39** : 315-322.
35. Singh CB, Pan TK, Pandit N. Ethnomedicinal plants used as antidiabetic by Santhal and Paharia tribes of Santhal Parganas, Jharkhand. *Ethnobotany.* 2015; **27** : 69-72.
36. Sitobo Z, Navhaya LT, Makhoba XE. Medicinal plants as a source of natural remedies in the treatment of diabetes. *ITPS.* 2024; **7** : 1885. <https://doi.org/10.36922/itps.1885>.
37. Thakur AK, Mahendru N, Shine C, Sharma N, Kumar G, Jena N, Kumar S. Antidiabetic medicinal plants of India. *Medico- Biowealth of India.* 2025; **20** : 1-13.
38. Tran N, Phan B, Le Y. Bioactive compounds in anti-diabetic plants: From herbal medicine to modern drug discovery. *Biology.* 2020; **9** : 252. <https://doi.org/10.3390/biology9090252>.
39. Varma SK. Flora of Bhagalpur (Dicotyledons). Today & Tomorrow's Printers & Publishers, New Delhi. 1981: p414.
40. Yedjou CG, Grigsby J, Mbemi A, Nelson D, Mildort B, Latinwo L, Tchounwou PB. The management of diabetes mellitus using medicinal plants and vitamins. *Int. J. Mol. Sci.* 2023; **24** : 9085. <https://doi.org/10.3390/ijms24109085>.