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Mini Review

Indigenous Plants of Odisha having Anti-Diabetic Activity: A Database

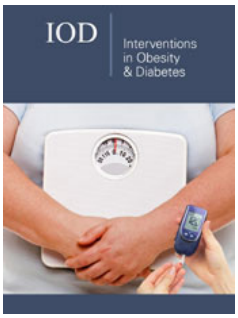
Pramathesh Mishra NT[1], Mishra MK*[2] and Mohapatra L[3]

[1]Mahatma Gandhi Institute of Pharmacy, Junabganj, Lucknow, Uttar Pradesh-227101, India

[2]Shambhunath Institute of Pharmacy, Jhalwa, Prayagraj, Uttar Pradesh-211015, India

[3]Amity Institute of Pharmacy, Lucknow, Amity University Uttar Pradesh, Noida -226010, India

ISSN: 2578-0263



***Corresponding author:** Manoj Kumar Mishra, Shambhunath Institute of Pharmacy, Jhalwa, Prayagraj, Uttar Pradesh-211015, India

Submission: April 07, 2021

Published: May 03, 2021

Volume 5 - Issue 2

How to cite this article: Pramathesh Mishra NT, Mishra MK, Mohapatra L. Indigenous Plants of Odisha having Anti-Diabetic Activity: A Database. Interventions Obes Diabetes 5(2). IOD. 000609. 2021.
DOI: 10.31031/IOD.2021.05.000609

Abstract

Diabetes mellitus consists of a group of syndromes characterized by hyperglycemia; altered metabolism of lipids, carbohydrates, and proteins; and an increased risk of complications from vascular disease. Diabetes mellitus, is associated with an increase in the blood sugar level beyond the threshold (hyperglycemia) and overflow in of excess sugar into urine (glycosuria). diabetes is the damage to micro capillaries (small blood vessels) of two vital organs-eyes & kidneys, leading to impaired vision and diseases of kidney. In this present review we are providing a brief descriptive data of various indigenous anti-diabetic plants grown at Odisha state, India.

Keywords: Diabetes mellitus; Hyperglycemia; Indigenous plants; Odisha; Antidiabetic

Introduction

Diabetes mellitus ("Madhumeha") consists of a group of syndromes characterized by hyperglycemia; altered metabolism of lipids, carbohydrates, and proteins; and an increased risk of complications from vascular disease. The ancient Ayurveda documentation had a detailed record of this clinical syndrome with its suggested control and cure since three thousand years. Diabetes is of two types: Diabetes insipidus & Diabetes mellitus; both associated with excess and frequent urination (polyuria), nonetheless vary with regards to the causal mechanism. The former type is due to the deficient secretion of the Anti-Diuretic Hormone (ADH) resulting in passage of a very large volume of very dilute urine. ADH is secreted from the posterior lobe of the pituitary gland and it controls the secretion of urine by the kidney and thus regulates the water and electrolyte balance of the body fluids. The more common form of Diabetes, otherwise named as Diabetes mellitus, is associated with an increase in the blood sugar level beyond the threshold (hyperglycemia) and overflow in of excess sugar into urine (glycosuria). The term diabetes mellitus hails its origin from a Greek word "diabainess" which means "to pass through" and a Latin word "mellitus" meaning "sweetened with honey". This disorder is due to the metabolic deficiency of insulin production in the body. The hormone insulin, which is a soluble protein with a molecular weight in solution of 48,000, is secreted from the β cells of Langerhans in the pancreas. It regulates the glucose concentration in the blood by (1) increasing the withdrawal of glucose from the body fluid and (2) decreasing the rate of addition of glucose to the body fluids. The possible causes of diabetes may be due to one or more of the followings:

a. Sedentary lifestyle

b. lack of regular physical exercises

c. rich food habit

d. obesity etc.

The primary detectable effect (symptoms) is the increase volume of urine (to discharge glucose) causing excessive thirst. Nevertheless, the secondary effects on body chemistry are more serious and severe. Because glucose is not available for oxidation, fat is burnt as fuel instead for giving energy and hence the patient loses weight. Glucose is not being burnt; fat combustion (oxidation) stops halfway resulting in accumulation of intermediate products

(ketone bodies) in sufficient amount to become poisonous. This causes severe acidosis and finally coma leading to mortality. Besides, body proteins, like fats, are also burnt for energy as a result of which muscles and other tissues are weakened. Another dangerous effect of diabetes is the damage to micro capillaries (small blood vessels) of two vital organs–eyes & kidneys, leading to impaired vision and a form of Bright's disease of the kidney. Interference with blood supply may account for the degeneration of nerves of the limbs causing pain, tingling and numbness. Another common complication is a sharp drop in the body's resistance to combat diseases due to microbial infections.

Acacia farnesiana

Acacia farnesiana is commonly known as sweet acacia, Farnese wattle, dead finish, mimosa wattle, mimosa bush, prickly mimosa bush, prickly Moses, needle bush, north-west curara, sheep's briar, sponge wattle, sweet acacia, thorny acacia, thorny feather wattle, wild briar, huisache, cassie, cascalotte, cassic, mealy wattle, popinac, sweet briar, Texas huisache, aroma, cashia, opoponax, sashaw, Aroma amarilla, suntich, sassie-flower, iron wood, cassie flower, honey-ball, casha tree, casha, cassia, Ellington's curse, cushuh, huizache (Figure 1). The Components include anisaldehyde, benzaldehyde, cumin aldehyde, benzyl alcohol, cuminyl alcohol, farnesol, methyl salicylate, geranial, geraniol, geranyl acetate, linalool, linalyl acetate, a-terpineol, nerolidol, 3-methyldec-3-enol, 3-methyldec-4-enol, o-ionone, B-ionone, nonadecane, and myrcene. *Acacia farnesiana* possess anti-inflammatory and antinociceptive properties. It belongs to the family Fabaceae. Its local name is Bilati-babul. The bark part of this plant contents tannin. It is used by the decoction of bark (5g)+2 black pepper seeds once in a day for 5 days. (Anonis, 1988; Demole et al., 1969; EI-Hamidi and Sidrak, 1970; Lawrence, 1984).The AF increased glucose uptake by isolated hemidiaphragm at a relatively higher concentration (40µg/ml). These results suggest a direct stimulatory effect of the fraction on glucose uptake without the involvement of insulin [1].

Figure 1: *Acacia farnesiana.*

Achyranthes aspera

Achyranthes aspera is commonly known as prickly chaff flower, devil's horsewhip, apamarga. It is a species of plant in the Amaranthaceae family (Figure 2). It contents 27-Cyclohexylheptacosan-7-ol and 16-hydroxy-26-methylheptacosan-2-one 83 and 17- pentatriacontanol 84, β-sitosterol83,85, spinasterol a85, 3-Acetoxy-6 benzoyloxyapangamide 79, Strigmasta-5, 22- dien-3-β-ol, trans-13-docasenoic acid, n-hexacosanylndecaniate, n-hexacos-17-enoic acid and n-hexacos-11- enoic acid and a new aliphatic acid, n-hexacos-14-enoic acid86, a new aliphatic dihydroxyketone, characterized as 36,47-dihydroxyhenpentacontan-4-one and tritriacontanol87, 4 methylheptatriacont-1-en-10-ol and tetracontanol-2 88, hexatriacontane, 10-octacosanone, 10-triacosanone and 4-triacontanone89, betain, betalaine and achyranthine90-94, flavonoids and alkaloids95, oleanolic acid96-97, a number of oleanolic acid based saponins98-100 , saponin A and saponin B characterized as α-Lrhamnopyranosyl (1→4)-β-D-glucopyranosyl (1→4)-β-Dglucuronopyranosyl(1→3)-oleanolic acid and β-Dgalactoyranosyl (1→28) ester of saponin A101, β-Dglucopyranosyl ester of α-L-rhamnopyranosyl (1→4)-β-D-glucuronopyranosyl (1→3)-oleanolic acid and β-Dglucopyranosyl ester of α -L-rhamnopyranosyl (1→4)-β-D-glucopyranosyl (1→4) β-D-glucuronopyranosyl (1→3)-oleanolic acid, saponins102-103, sapogenin104, alkaloids105 and saponins106, bisdesmosidic triterpenoid saponins like β-d-glucopyranosyl-3β-[O-α-l-rhamnopyranosyl-(1→3)-Oβ-D-glucopyranuronosyloxy] machaerinate and β-dglucopyranosyl 3β-[O-β-d-galactopyranosyl-(1→2)-O-α-dglucopyranuronosyloxy]machaerinate107, ecdysterone108- 110, cardiac glycosides111 from different organs like leaves, shoots, roots, fruits, seeds The root part of the plant Achyranthes aspera contains triterpenoid saponins. It is used by the Paste of root (5g) before breakfast for 7 days (Abhijit Dey, July – August 2011).

Figure 2: *Achyranthes aspera.*

Aegle marmelose

Aegle marmelos L., commonly known as bael, also Bengal quince, golden apple, Japanese bitter orange, stone apple or wood apple. Bael is the monotypic genus Aegle (Figure 3). It is a deciduous

shrub or small, upto 13m tall with slender drooping branches and rather shabby crown. The bael tree contains furocoumarins, xanthotoxol, methyl ester of alloimperatorin, flavonoids, rutin marmesin, essential oils [2-5]. Aegeline is a constituent that can be extracted from bael leaves. The phytochemicals such as lupeol, eugenol, citral, cineole and d-limonene present in A. marmelos possess antineoplastic effects. It is used by tender leaf juice (10ml) +2–3 drops of honey; twice daily on empty stomach. (Shahedur Rahman and Rashida Parvin, 2014 Feb)

Figure 3: *Aegle marmelose*.

Aervalanata juss

Aervalanata juss. (*Amaranthaceae*) locally known as 'bui'. The plant is diuretic, used in lithiasis. The root is demulcent, diuretic, useful in strangury (Figure 4). The roots are used in the treatment of headache. It is valued for cough also as a vermifuge for children. The chemical constituents present in the plant include alkaloids (ervine, methylervine, ervoside, aervine, methylaervine, aervoside, ervolanine, and aervolanine), flavanoids (kaempferol, quercetin, isorhamnetin, persinol, persinosides A and B), methyl grevillate, lupeol, lupeol acetate benzoic acid, β-sitosteryl acetate and tannic acid. *Aerva lanata* is a rich source of flavanoids such as kaempferol , quercetin , isorhamneti , methyl grevillate , lupeol , lupeol acetate benzoic acid, β-sitosteryl acetate and tannic acid. The Pharmacological effects of this plant are diuretic, anti-inflammatory, hypoglycemic, anti-diabetic, antiparasitic, antimicrobial, hepoprotective, anti-urolithiasis, antiasthmatic, antifertility and hypolipidemic [6-8]. This plant belongs to the family Amaranthaceous. It is used by Root paste (5g); twice daily for 10 days. (Manoj Goyal, Anil Pareek, B. P. Nagori, and D. Sasmal, 2011 Jul-Dec).

Figure 4: *Aervalanata juss*.

Ailanthus excelsa

Ailanthus excelsa Roxb. (Simaroubiaceae) commonly known as Mahanimb. Different parts of this plant are used widely in traditional medicine for a variety of diseases (Figure 5). The bark is used as bitter, astringent, appetizer, antihelmintic, dysentery, skin disease, troubles of the rectum, and fever due to tridosha and allays thirst. It is also used in gout, rheumatism, dyspepsia, bronchitis and asthma. Ailanthus is used to cure wounds and skin eruptions as mentioned in traditional medicine. Stem bark extracts showed potent antibacterial and antifungal activities. The alcohol extract from leaf and stem bark exhibits remarkably high anti-implantation and early abortifacient activity [9,10]. The plant reported to contain chemical Constituents like Quassinoids, excelsin, glaucarubin, ailanthone, glaucarubinone, Glaucarubilone. Quassinoids. It is used by decoction of bark (20g)+ginger (10g) for 7 days (Shamkuwar PB et al.).

Figure 5: *Ailanthus excelsa*.

Alangium salvifolium

Alangium salvifolium has been used traditionally for treatment of various ailments. Almost every part of *Alangium salvifolium* including roots, leaves, stem and bark are used in the Ayurveda and Siddha systems of medicines for the treatment of various diseases (Figure 6). In modern scientific literatures, the plant has been reported to have potential efficacy against diabetes , peptic ulcer, arthritis, inflammation and anthelminthic activities etc. *Alangium salvifolium* is reported to contain various biologically active phytochemicals such as alangine, ankorine, tubulosine, alangicine, salsoline etc. *Alangium salvifolium* belongs to the family *Alangiaceae*. *Alangium salvifolium* has been used as traditionally laxative, antiepileptic, astringent, antiulcer, pungent, purgative, alleviates spasms, anthelmintic, emetic, antiprotozoa, hypoglycemic agent, skin diseases, leprosy, scabies and as contraceptives for pigs. Stem and root barks of *Alangium salvifolium* were screened for their helicon bactericidal activity. The root barks of *Alangium salvifolium* were used externally as an antidote against snake/ scorpion, rabbit, rat, dog bites. It contains primary metabolites like cephaeline, tubulosine, isotobulosine, psychotrine and alangiside in roots. Alkaloids A & B, Alangicine, dimethylpsychotrine, marckine, marckidine, lamarckinine in bark. Alangimarkine, ankorine, deoxytobulosine, alangiside, alangine, sterols and three

triterpenoids cepheline, N-methylcephaeline, deoxytobulosine and alangiside in fruits and alangimarine, alamaninalangimaridine, emetine, cephaeline, psychotrine in seeds. Leaf leachate is used (twice daily). (Suresh ShravyaBalakrishnan Nair Vinod Christudas Sunil, December 2017).

Figure 6: *Alangium salvifolium.*

Allium sativum

Allium sativum is commonly known as Garlic (Rasuna). It belongs to the family *Amaryllidaceae*. It is having multiple beneficial effects such as antimicrobial, antithrombotic, hypolipidemic, antiarthritic, hypoglycemic and antitumor activity (Figure 7). Garlic's principal medicinal uses are to lower blood pressure and cholesterol, fight infections, and prevent cancer. The active constituents are sulfur-containing compounds that are rapidly absorbed and metabolized. Numerous studies suggest that garlic lowers total cholesterol concentrations by approximately 10%, favorably altering HDL/LDL ratios mild antihypertensive, lowering blood pressure by 5-7%, antidiabetic, blood sugar level, prevent some solid tumors. Therefore garlic is also effective in the cancer prevention. The other proposed uses of garlic include the hepatoprotective, antihelmentics, anti-inflammatory, antioxidant, antifungal and wound healing. The bulb part is used after boiled in water & drink (twice daily). (Karin Ried and Peter Fakler, 2014 Dec).

Figure 7: *Alium sativum.*

Allium cepa

Allium cepa is commonly known as *Allium ascalonicum* L. (onion). It belongs to the family *Liliaceae*. It contain a good number of phytochemicals, most of which are hydrocarbons and their derivatives (Figure 8). These include: Dipropyl disulphide (which is used as a flavour compound), Allicin (which has antidiabetic, antihypertensive, antibiotic and antithrombotic activities), diathyl sulphide (which is of insecticidal property), Dimethyl disulphide (which is used as a gas odorant and in chemical synthesis), Mercaptopropane or propylmercaptan [11-13]. It contents polyphenols, yellow onions have the highest total flavonoid content. Red onions have considerable content of anthocyanin pigments. It is used by making the Juice of bulb (120gm) & drink twice a day. (Shinkafi SA et al., Sch. J. App. Med. Sci., 2013).

Figure 8: *Allium cepa.*

Aloe barbadensis

Aloe barbadensis is commonly known as Aloe vera (Gheenkumari). It belongs to the family Aloaceae (Figure 9). The fresh gel mainly consists of water, mesophyll cells, mannose, arabinose, xylose, mannose, galactose, glucose .Mucopolysaccharides are mainly present as acemannan calcium magnesium malic acemannan, isocitrate, raw materials ash content aloin. It is used as psoriasis vulgaris, skin moisturizer, type 2 diabetes, malignancies and immunodeficiency viruses, oral lichen planus infections, angina pectoris, ulcerative colitis, kidney stones, alveolar osteitis. Water extract of 150mg/kg of leaf is used for treatment (Oliver Grundmann, September 2012).

Figure 9: *Aloe barbadensis.*

Alstonia scholaris

Alstonia scholaris is commony known as Indian devil tree (saptaparna). It belongs to the family *Apocyanaceae*. The plant contains Iridoids, alkaloids, coumarins, flavonoids, leucoanthocyanins, reducing sugars, simple phenolics, steroids, saponins and tannins. *Alstonia scholaris* is a traditionally important medicinal plant (Figure 10). This evergreen tree is native to the Indian subcontinent and Southeast Asian countries. The plant is used in traditional, Ayurvedic, Unani, Homoeopathy and Sidhha/ Tamil types of alternative medicinal systems against different ailments such as asthma, malaria, fever, dysentery, diarrhea, epilepsy, skin diseases, snakebite etc. Among the phytochemicals, alkaloids are mostly reported. The plant has been reported extensively as anticancerous, antimicrobial, molluscicidal, anxiolytic and antipsychotic agent. *Alstonia scholaris* is useful in treating malaria, abdominal disorders, dyspepsia, leprosy, skin diseases, tumors, chronic and foul ulcers, asthma, bronchitis, helminthiasis, agalactia, and debility. Preclinical studies have shown that it possesses anti-microbial, anti-diarrhoeal, anti-plasmodial, anti-oxidant, anti-inflammatory hepatoprotective, nootrophic, anti-stress, anti-fertility, immunomodulatory, analgesic, anti-ulcer, wound healing, anti-cancer, chemopreventive, radiation protection, radiation sensitization, and chemosensitization activities. Its bark is used by decoction of 60gm dried stem bark & 120ml given twice daily. (Khyade and Vaikos, NP November, 2009).

Figure 10: *Alstonia scholaris*.

Azadiracta indica

Azadiracta indica is commonly known as *Melia azadirachta* (nimba). It belongs to the family *Meliaceae*. The plant product or natural products show an important role in diseases prevention and treatment through the enhancement of antioxidant activity, inhibition of bacterial growth, and modulation of genetic pathways (Figure 11). The most important active constituent is azadirachtin and the others are nimbolinin, nimbin, nimbidin, nimbidol, sodium nimbinate, gedunin, salannin, and quercetin. Leaves contain ingredients such as nimbin, nimbanene, 6-desacetylnimbinene, nimbandiol, nimbolide, ascorbic acid, n-hexacosanol and amino acid, 7-desacetyl-7-benzoylazadiradione, 7-desacetyl-7-benzoylgedunin, 17-hydroxyazadiradione, and nimbiol. Quercetin and ß-sitosterol, polyphenolic flavonoids, were purified from neem fresh leaves and were known to have antibacterial and antifungal properties and seeds hold valuable constituents including gedunin and azadirachtin. It's 7 tender leaves are taken daily by decoction (60gm) of dried stem bark. (Alzohairy MA. 2016 Mar).

Figure 11: *Azadiracta indica*.

Materials & Method

Study area

Odisha is situated on the coast surrounded by the Bay of Bengal & i.e. 482km stretch of coastline with golden beaches, serpentine rivers, waterfalls, forest-clad blue hills of Eastern Ghats with rich wildlife. Odisha covers an area of 1, 55,707sq.Kms. It is the ninth largest state of India located in the south-eastern fringes of the country. It also houses the largest coastal lake in India-Chilka lake. Odisha has historically been an agricultural state and is a leading producer of agricultural products in India [14-17]. Common plant species in the state include: *Azadiracta indica*, Curcuma longa, *Gymnema sylvestre*, *Aegle marmelose*, Vinca rosea, *Murraya koenigii* etc.

Ethnobotanical survey

The use of plants in treatment of Diabetes has been noted in many of the ancient Indian literature. In the last few decades, the studies performed on the plants mentioned in the literature or were used traditionally for diabetes have been documented in this paper. A varying degree of anti-glycaemic activity was observed in all of the plants.

Result and Discussion

These enumerate the data obtained from different plant parts for Diabetes Mellitus. A total of 49 plant species belonging to 36 families have been recorded in the present study (Table 1). Plants like Aloe vera, *Azadirachta indica*, *Momordica charantia*, *Gymnema sylvestre* etc were more frequently used by the people. Bitter melon has been used in various Asian and African traditional medicine systems for a long time. It was found that *Momordica charantia* fruit powder is helpful in treating hyperglycemic rats in diabetes mellitus type II. Charantin has been extracted from the plant, which had hypoglycaemic effect on normal and diabetic rabbits. The usage of plant part Leaves -21 , Whole plant - 1, Seed -6 , Fruit -8 , Flower -5 , Bark -7 , Bulb -2are shown in Figure 12. From the data (Figure 12), it could be inferred that for a greater number of remedies are obtained from fresh leaf materials followed by fruits & amp; bark. However, plant parts like Flower, Whole plant and Bulb were less frequently used by the people.

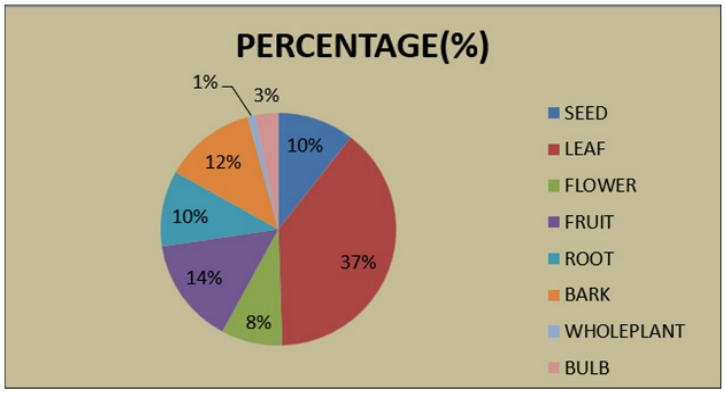


Figure 12: Chart showing the analysis of remedies obtained from different plant parts..

Table 1: Analysis of remedies obtained from different plant parts for Diabetes Mellitus.

No	Botanical Name	Synonym	Family	Local Name	Part Used (Active principle)	Mode of Use
1	*Acacia farnesiana*	*Mimosa farnesiana*	*Mimosaceae*	Bilati-babul	Bark	Decoction of bark (5g)+2 black pepper seeds once in a day for 5 days
2	*Achyranthes aspera*	Prickly chaff flower	*Amaranthaceae*	Apamaranga	Root	Paste of root (5g) before breakfast for 7 days
3	*Aegle marmelose*	Bilva	*Rutaceae*	Bela	Leaf	Tender leaf juice(10ml)+2-3 drops of honey; twice daily on empty stomach
4	*Aerva lanata*	*Aerva floribunda*	*Amaranthaceae*	Paunsia	Root	Root paste (5g); twice daily for 10 days
5	*Ailanthus excels*	Tree of Heaven	*Simaroubaceae*	Mahalimba	Bark	Decoction of bark (20g)+ginger(10g) for 7 days
6	*Alangium salvifolium*	*Amelanchier lamarckii*	*Alangiaceae*	Ankula	Leaf	Leaf leachate (twice daily)
7	*Alium sativum*	Garlic	*Amaryllidaceae*	Rasuna	Bulb	Bulbs are boiled in water & drink twice daily
8	*Allium cepa*	*Allium ascalonicum L.*	*Liliaceae*	Piyaj	Bulb	Juice of bulb 120gm & drink twice a day
9	*Aloe barbadensis*	Aloe vera	*Aloaceae*	Gheenkumari	Leaf	Water ext. 150mg/kg
10	*Alstonia scholaris*	Indian devil tree	*Apocyanaceae*	Saptaparna	Bark	Decoction of 60gm dried stem bark & 120ml given twice daily
11	*Azadiracta indica*	*Melia azadirachta*	*Meliaceae*	Nimba	Leaf, seed, bark	7 tender leaves; daily/Decoction 60gm of dried stem bark
12	*Bacopa monnieri*	Herpestis monnieri	*Scrophulariaceae*	Panikundi	Leaf	Decoction of leaf
13	*Calotropis gigantean*	Milkweed	*Asclepiadaceae*	Arakha	Flower	
14	*Capsicum annuum*	Capsicum	*Solanaceae*	Simla Lanka	Fruit	Taken as a food in curry
15	*Carica papaya*	Brahma irandah	*Caricaceae*	Amrutabhanda	Green fruit, Seed, Leaf	Green fruit boiled & paste+ pinch of salt&jeera powder for 6 months
16	*Cassia auriculata*	Charmaranga	*Caesalpiniaceae*	Tarwar	Leaf	Decoction is prepared with 60mg of leaf
17	*Cinnamomum verum*	Cinnamon	*Lauraceae*	Dalchini	Inner Bark, root	Paste of Inner bark (5g)+roots (10g); once in a day for 5 days in early stage
18	*Clerodendrum fragrance*	*Clerodendrum philippinum*	*Labiateae*	Brajamalli	Leaf	Decoction of leaf
19	*Clerodendrum phlomidis*	*Clerodendrum multiflorum*	*Verbenaceae*	Ganiary	Leaf	Decoction of leaf
20	*Clerodendrum viscosum*	*Clerodendrum infortunatum*	*Verbenaceae*	Gengguti	Leaf	Decoction of leaf

21	*Coccinia grandis*	Cephalandragrandis	*Cucurbitaceae*	Kunduri	Leaf,Fruit, Flower	Aq. Decoction of leaf 12gm; twice daily
22	*Coriandrum sativum*	*Coriandrum diversifolium*	*Umbelliferae*	Dhania	Leaf	Aq. Decoction of leaf 12gm; twice daily
23	*Gymnema sylvestre*	Gemnema Melicida	*Asclepiadaceae*	Gudmari	Leaf	Aq. decoction of leaf 120gm, twice daily
24	*Helicteres isora*	Avarttani	*Sterculiaceae*	Mudimudika	Bark, Root, fruit	One teaspoon bark powder; once daily for 15 days before breakfast
25	*Hibiscus sabdariffa*	*Roselle*	*Malvaceae*	Mandara	Flower (petals)	Infusion of petal (5-10ml)
26	*Hybanthus enneaspermus*	Ionidiumsuffruticosum	*Violaceae*	Madanmastaka	Whole plant	Paste of 20g of whole plant+3 black pepper; empty stomach one month.
27	*Mangifera indica*	Mango tree	*Anacardiaceae*	Amba	Leaf	Basal part of leaf petioles
28	*Mentha piperitae*	Mentha balsamea	*Lamiaceae*	Podina	Leaf	Taken as a food as Chutney in meal
29	*Momordica charantia*	karella	*Cucurbitaceae*	Kalara	Fruit, leaf	Decoction of fruit; morning in empty stomach for 1 month
30	*Murraya koenigii*	Curry patta	*Rutaceae*	Kadipatta	Leaf	7 fresh leaves; every morning for 3 months
31	*Ocimum sanctum*	Tulsi	*Lamiaceae*	Tulasi	Leaf, root	Decoction of leaf/root; daily evening for one month
32	*Phyllanthus embilica*	*Embllica officinalis*	*Euphorbiaceae*	Amla	Fruit	Paste of fresh leave
33	*Pistia stratiotes*	Water lettuce	*Araceae*	Borajhanji	Leaf	The juice (10mL) of young plant mixed with equal amount of green coconut milk
34	*Psidium guajava*	Guava	*Myrtaceae*	Pijuli	Bud	Juice of buds; daily once in evening for 1 month
35	*Pterocarpus marsupium*	Indian kino	*Fabaceae*	Piyasal	Heart wood	H.wood soaked overnight in water &filtrate (10ml); daily for 1 month.
36	*Santalum album*	Indian sandal wood	*Santalaceae*	Chandan	Heart wood	Paste of heartwood (5g)+water
37	*Saracaasoca*	Saracaasoca indica	*Caesalpiniaceae*	Asoka	Flower	Leachates of flower+5g old jiggery+50ml of cow milk; morning for 1 month
38	*Sida cordifolia*	Country mallow	*Malvaceae*	Bajramuli	Root	Root powder(2-3g)+1 glass milk; daily
39	*Stevia rabaudiana*	Eupatorium rebaudianum	*Asteraceae*	Stevia	Leaf	Aq. Ext. of Leaf
40	*Syzigium cumini*	Jamun	*Myrtaceae*	Jamukoli	Seed	Seed powder (4-24g tds)
41	*Tamarindus indica*	Chincha	*Caesalpiniaceae*	Tentuli	Seed	Crushed seeds soaked overnight, aq. Extract (10ml)+curd (20ml); once a day for 7days.
42	*Terminalia arjuna*	Pentapteraarjuna	*Combretaceae*	Akhagachha	Bark	Decotion of Bark powder
43	*Terminalia bellirica*	Bibhitakah	*Combretaceae*	Bahada	Fruit	Fruit taken as empty stomach early in morning
44	*Tinospora cordifolia*	Guduchi	*Menispermaceae*	Guluchi	Stem	15-20ml stem juice with 2 drops of honey; twice a day for 15 days
45	*Trigonela foenum*	Methi	*leguminoseae*	Fenugreek	Seed	Seed powder in empty stomach of early morning.
46	*Vinca rosea*	*Catharanthus roseus*	*Apocyanaceae*	Sadabihari	Leaf	Aq. Decoction of root 60gm; twice daily
47	*Xanthium indicum*	*Xanthium strumarium*	*Asteraceae*	Bana-gokhara	Fruit	
48	*Curcuma longa*	*Curcuma domestica*	*Zingiberaceae*	Haladi	Rhizome	15-20ml of fresh juice of rhizome+equal amount of juice of Amla; thrice a day for 15 days
49	*Lawsonia inermis*	*Lawsonia alba*	*Lythraceae*	Manjuati	Flower,seed	Decoction of equal quantity of flower & seed (2-5g) each; once a day for 1 month.

Conclusion

Though many plants have shown promising results as anti-diabetic agents, their efficacy varies from patient to patient. As a result, clinical studies must be carried out in large populations (phase III trials) before any plant-based product can be introduced into clinical practice. Studies shall be designed to identify and determine any undesirable side effects that result from their consumption. Given that natural plant extracts are compositionally-complex , great efforts towards the isolation, identification and purification of bioactive constituents must be undertaken. Other than an improved understanding, such knowledge will help to better identify and potentially predict incompatibilities if being used in combination with synthetic drugs. Finally, the use of plant products as adjutant to, or replacements for, synthetic drugs may substantially help in reducing the costs associated with treatment of DM. The results of our study demonstrated the persistence of folk medicine practices in Odisha , especially in rural people are still dependent on indigenous knowledge for health care that are being influenced by culture and socioeconomic aspects, providing a cheaper and accessible alternative to the high cost pharmaceutical remedies. In spite of the overwhelming influence and our dependence on modern medicine and tremendous advances in synthetic drugs, many people still relyon herbal drugs the reason is that, if the herbal medicines are used properly they don't have any side effects. Hence, the survey need to be subjected to pharmacological studies in order to discover their true potential, as it is very difficult to judge the effectiveness of the herbal medicine. The main purpose is not to be prescribing any remedies for any of the disease but to be document the use and draw the attention of pharmacologist, botanist, phytochemist and pharmocognosist for further scientific research in the field.

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