

## Antidiabetic Leads from Ayurvedic Medicinal Plants

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**Abstract** India has a great ancient heritage of traditional medicine, which is based on various systems, including Ayurveda, Siddha and Unani (ASU). Ayurveda have rich traditional knowledge of medicinal herbs acting on various metabolic disorders including diabetes. Extensive researches are being carried out in last few decades to establish the claim made by ancient literature; still many remain to be evaluated. Though the information is scattered in various ancient Ayurvedic treatises and *Nighantus* (Ayurvedic Materia Medica), there is need to assemble it. Considering this, present report was attempted to document such information which can be used as ready reckoner for research as well as clinical purpose.

**Keywords** *Herbal medicine; Ayurveda; Diabetes Mellitus; Materia medica; Nighantu; antidiabetic; Hypoglycemic; Antihyperglycemic; Madhumeha*

### 1. Introduction

Currently, available conventional options for diabetes mellitus have certain limitations of their own. In past few years there has been an exponential growth in the field of herbal medicine and these drugs are gaining popularity both in developing and developed countries owing to their natural origin and less side effects. Ayurvedic medicinal plants are gaining popularity and practiced across the globe to combat several acute and chronic disorders including diabetes. World Health Organization has also substantiated the utilization of herbal remedies to combat diabetes [1].

Diabetes and pre-diabetes are known in Ayurveda with a precise description of the disease and its complications. Sanskrit literature from the time of 'Vedas' provides descriptions of diabetes mellitus under the *Madhumeha* which is one form of *Prameha* [2]. Ayurveda contain ample literature about *Madhumeha / Prameha* and its treatment with diverse variety of herbs and formulations; though, the information on such antidiabetic medicinal plants in ancient classics is scattered. Hence it is necessary to revisit and review the Ayurvedic literature and compile the rich medicinal plant knowledge in a document.

## 2. Methodology

Information was extracted from ancient Ayurveda classics, *Nighantus* (Ayurvedic Material Medica), and texts. Published reports from several articles, of which few review articles and cross references thereof were collected. Available records and articles in Pubmed, Medline, Scopemed, Dhara online and other allied databases covering fields of pharmacology, biomedicine and health were also rationally reviewed and taken into study for the report. The search criteria were restricted to the roles of Ayurvedic plants in diabetes related conditions, by probing the contemporary and Ayurvedic claims in this regard.

## 3. Results and Discussion

Antidiabetic herbs mentioned in various Ayurvedic *Nighantus* are compiled and detailed along with their scientific nomenclatures in Table 1 [3]. Total 74 various medicinal plants are found mentioned in these *Nighantus*. Many of such herbs are now investigated under several antidiabetic pharmacological and clinical screening, validating the ancient claims. There are many botanicals mentioned in other Ayurvedic classics, which are investigated in recent scientific reports. Though there are ample published reports available, here in this review 55 of such commonly used Ayurvedic antidiabetic herbs are detailed, including their English/scientific/common names, part used, and reported antidiabetic and beneficial effects (Table 2). The potential of such herbs in therapeutics are significant and indubitable, though integrated approach towards understanding the probable mode of action and elucidating mechanistic aspects of majority of these herb is lacking. Without routing mechanism of action, it will be difficult for modern medicine to accept herbal formulations in mainstream therapeutics. Therefore, approaches for studying the effect of herbs should include the whole system, and mechanistic studies elucidating the multiple pharmaco-dynamic targets. (Sharma R, Amin H, Galib R, Prajapati PK. Antidiabetic claims of *Tinospora cordifolia* (Willd.) Miers: critical appraisal and role in therapy. (Asian Pac J Trop Biomed 2015; 5(1): 68-78.)

Using various potent chemical compounds, dosage forms or even raw forms of Ayurvedic botanicals, various pharmaceutical market products have been produced by the different companies. Present review also encompasses the available Ayurvedic herbal products widely used in Indian market for preventive, health promotive and curative management of diabetes. Many of such popularly used effective formulations along with the herbal composition are enlisted in Table 3.

**Table 1:** Antidiabetic herbs mentioned in various Ayurvedic *Nighantus*

S. no.	Medicinal plants	Latin name	MN	RN	DS	BP	DN	KN	MD	SN
1.	<i>Arkapuspi</i>	<i>Holastemone annularis</i>	+	-	-	+	-	-	-	-
2.	<i>Ashmantaka</i>	<i>Bauhinia tomentosa</i>	-	+	-	-	+	-	-	-
3.	<i>Aragbadh</i>	<i>Cassia fistula</i>	-	+	-	-	+	+	-	-
4.	<i>Amra</i>	<i>Mangifera indica</i>	+	-	-	-	-	+	-	-
5.	<i>Amalaki</i>	<i>Emblica officinalis</i>	-	+	-	+	-	-	-	-
6.	<i>Aruk</i>	<i>Prunuspersica</i>	+	+	-	-	+	-	-	-
7.	<i>Indrayana</i>	<i>Citrullus colocynthis</i>	-	-	-	+	-	+	-	-
8.	<i>Eranda</i>	<i>Ricinus communis</i>	-	-	-	-	-	+	-	-
9.	<i>Katphala</i>	<i>Myrica esculanta</i>	+	-	-	+	+	+	-	-
10.	<i>Agnimantha</i>	<i>Premna integrifolia</i>	-	-	-	-	-	-	-	+
11.	<i>Kasheruk</i>	<i>Scirpus kaysoor</i>	-	-	-	-	-	+	-	-
12.	<i>Karanja</i>	<i>Pongamia pinnata</i>	+	-	+	+	-	-	+	-
13.	<i>Karavellaka</i>	<i>Momordica charantia</i>	+	-	-	-	-	+	-	-

14.	<i>Kapitthpatri</i>	<i>Limonia crenulata</i>	+	-	-	-	-	-	-	-
15.	<i>Koshataki</i>	<i>Luffa acutangula</i>	+	-	-	-	-	+	-	-
16.	<i>Kantakari</i>	<i>Solanum suratanse</i>	-	-	-	-	-	+	-	-
17.	<i>Kampilaka</i>	<i>Mallotus philippinensis</i>	-	-	-	+	-	+	-	-
18.	<i>Kapitthpatra</i>	<i>Limonia acidissima</i>	-	-	-	-	-	+	-	-
19.	<i>Kusmanda</i>	<i>Benincasa hispida</i>	-	+	-	-	-	-	-	-
20.	<i>Khadira</i>	<i>Acacia catechu</i>	+	-	-	-	-	+	+	+
21.	<i>Gojihwa</i>	<i>Onosma bracteatum</i>	+	-	-	+	-	+	-	-
22.	<i>Kutki</i>	<i>Picrorhiza kurroa</i>	-	-	-	+	-	+	-	-
23.	<i>Gopalkarkati</i>	<i>Cucumis melo</i>	-	+	-	-	-	-	-	-
24.	<i>Gokshura</i>	<i>Tribulus terrestris</i>	+	+	-	+	+	+	-	-
25.	<i>Guggulu</i>	<i>Commifora wightii</i>	+	-	-	+	-	+	+	+
26.	<i>Guduchi</i>	<i>Tinospora cordifolia</i>	-	+	-	-	+	+	-	-
27.	<i>Gajakarni</i>	<i>Leea microphylla</i>	-	-	-	-	-	+	-	-
28.	<i>Chilli</i>	<i>Chenopodium murale</i>	-	+	-	-	-	-	-	-
29.	<i>Jatiphala</i>	<i>Myristica fragrans</i>	-	+	-	-	-	-	-	-
30.	<i>Tinduka</i>	<i>Diospyros peregrine</i>	+	-	-	-	-	+	-	-
31.	<i>Tuvaraka</i>	<i>Hydnocarpus laurifolia</i>	+	-	-	-	-	+	-	-
32.	<i>Tinisha</i>	<i>Ougeinia dalbergioides</i>	-	-	-	+	-	+	-	-
33.	<i>Daruharidra</i>	<i>Berberis aristata</i>	-	+	-	-	+	-	-	-
34.	<i>Durva</i>	<i>Cynodon dactylon</i>	-	-	-	-	-	-	+	-
35.	<i>Devadaru</i>	<i>Cedrus deodara</i>	-	+	-	+	+	+	-	-
36.	<i>Devadali</i>	<i>Luffa echinata</i>	+	-	-	-	-	-	-	-
37.	<i>Dhanwayasa</i>	<i>Fagonia cretica</i>	-	+	-	-	+	-	-	-
38.	<i>Nimba</i>	<i>Azadirachta indica</i>	+	-	+	+	-	+	+	-
39.	<i>Pippali</i>	<i>Piper longum</i>	+	-	-	+	-	+	-	-
40.	<i>Palasha</i>	<i>Butea monosperma</i>	+	-	+	+	-	+	+	-
41.	<i>Pasanbheda</i>	<i>Bergenia ligulata</i>	+	+	-	+	-	+	-	-
42.	<i>Pindalu</i>	<i>Dioscorea alata</i>	-	+	-	-	-	+	-	-
43.	<i>Paribhadra</i>	<i>Erythrina indica</i>	-	-	-	-	-	-	+	-
44.	<i>Bakuchi</i>	<i>Psoralea corylifolia</i>	+	-	-	+	-	+	-	-
45.	<i>Brahmi</i>	<i>Bacopa monnieri</i>	+	-	-	+	-	-	-	-
46.	<i>Bijaka</i>	<i>Pterocarpus marsupium</i>	+	-	-	-	-	+	-	-
47.	<i>Bhudhatri</i>	<i>Phyllanthus niruri</i>	-	+	-	-	-	-	-	-
48.	<i>Bhallataka</i>	<i>Semecarpus anacardium</i>	+	+	-	-	-	-	-	-
49.	<i>Mundi</i>	<i>Sphaeranthus indicus</i>	-	+	-	-	-	-	-	-
50.	<i>Kakamachi</i>	<i>Solanum nigrum</i>	+	-	-	-	-	+	-	-
51.	<i>Mahanimba</i>	<i>Melia azedarach</i>	-	-	-	+	-	-	-	-
52.	<i>Mesasringi</i>	<i>Gymnema sylvestre</i>	-	-	-	-	-	+	-	-
53.	<i>Murva</i>	<i>Marsdenia tenacissima</i>	+	+	-	+	+	+	-	-
54.	<i>Manjistha</i>	<i>Rubia cordifolia</i>	+	+	-	+	+	+	-	-
55.	<i>Rajadan</i>	<i>Mimusops hexandra</i>	-	+	-	-	-	-	-	-
56.	<i>Rudanti</i>	<i>Capparis moonii</i>	-	+	-	-	-	-	-	-
57.	<i>Rasona</i>	<i>Allium sativum</i>	+	-	+	-	-	+	-	+
58.	<i>Latakaranja</i>	<i>Caesalpinia crista</i>	+	-	-	+	-	-	-	-
59.	<i>Vasa</i>	<i>Adhatoda zeylanica</i>	+	-	-	+	-	+	-	-
60.	<i>Varahikanda</i>	<i>Puraria tuberosa</i>	+	+	+	+	-	-	+	+
61.	<i>Vidhara</i>	<i>Argyreia speciosa</i>	+	-	-	+	+	+	-	-
62.	<i>Vansha</i>	<i>Bambusa arundinacea</i>	-	+	-	-	-	-	-	-
63.	<i>Vidanga</i>	<i>Embeli aribes</i>	-	-	-	-	-	+	-	-
64.	<i>Betrak</i>	<i>Calamustenuis</i>	-	-	-	-	-	+	-	-
65.	<i>Shalaparni</i>	<i>Desmodium gangeticum</i>	-	+	-	-	+	+	-	-

66.	<i>Simsapa</i>	<i>Dalbergia sissoo</i>	+	-	-	-	-	-	-	-
67.	<i>Suvarchala</i>	<i>Gynandropsis Pentaphylla</i>	+	-	-	+	-	+	-	-
68.	<i>Sthalkamala</i>	<i>Ionidium suffruticosum</i>	-	+	-	-	-	-	-	-
69.	<i>Snuhi</i>	<i>Euphourbia neriifolia</i>	-	+	-	-	-	+	+	+
70.	<i>Sprukka</i>	<i>Delphinium zalil</i>	-	+	-	-	-	-	-	-
71.	<i>Sariva</i>	<i>Hemidesmus indicus</i>	-	+	-	-	+	-	-	-
72.	<i>Haritaki</i>	<i>Terminalia chebula</i>	+	-	-	+	+	+	-	+
73.	<i>Haridra</i>	<i>Curcuma longa</i>	+	+	-	+	+	+	-	+
74.	<i>Kshiravidari</i>	<i>Ipomoea digitata</i>	-	+	-	-	-	-	-	-

+ mentioned; - not mentioned; MN: Madanpal Nighantu, RN: Raj Nighantu; DS: Dravyagun Sangrah; BP: Bhavapraksh Nighantu; DN: Dhanvantari Nighantu; KN: Kaidev Nighantu; MD: Madhava Dravyaguna; SN: Shodhala Nighantu

**Table 2: Medicinal plants with antidiabetic and related beneficial properties**

S. No.	Latin name	Sanskrit name	English/common/regional name	Part used	Antidiabetic and other beneficial effects	Reference
1.	<i>Acacia arabica</i> (Leguminosae)	<i>Babbul</i>	Guar gum, Gum Arabic	Seeds	Hypoglycemic, stimulate pancreatic $\beta$ -cells for insulin release	[4]
2.	<i>Acorus calamus</i> (Araceae)	<i>Vacha</i>	Sweet flag or Calamus	Radix	Hypoglycemic, increased glucose consumption, decrease in triglyceride, free fatty acid, insulin sensitizer	[5,6]
3.	<i>Aloe vera</i> (Liliaceae)	<i>Kumari</i>	True or medicinal aloe	Aloe leaves gel,	Hypoglycemic, hypolipidemic, antioxidant, increases glucose tolerance, stimulation of synthesis and/or release of insulin from pancreatic $\beta$ -cells, enhanced insulin transport, anti-inflammatory	[7-12]
4.	<i>Anethum graveolens</i> (Umbelliferae)	<i>Shatapushpa</i>	Dill	Leaves	Hypoglycemic, antioxidant, decrease in serum insulin level	[13]
5.	<i>Annona squamosa</i> (Annonaceae)	<i>Shubha</i>	Sugar apple	Leaves	Hypoglycemic, antihyperglycemic, antioxidant, increased plasma insulin level	[14-17]
6.	<i>Areca catechu</i> (Palmae)	<i>Puga</i>	Betel nut, supari	Fruit	Hypoglycemic	[18]
7.	<i>Astragalus membranaceus</i> (Leguminosae)	<i>Katira</i>	Yellow leader	Root	Hypoglycemic, hypolipidemic, decrease in insulin resistance, potential insulin sensitizer, decreased expression	[19]

					of protein tyrosine phosphatase 1B (PTP1B)	
8.	<i>Averrhoa bilimbi</i> (Oxalidaceae)	Karmaraka/ Karamaranga	Bilimbi, cucumber tree or Leaves tree sorrel	Leaves	Hypoglycemic, hypolipidemic	[20,21]
9.	<i>Azadirachta indica</i> (Meliaceae)	Nimba	Neem	Leaves, seeds	Antihyperglycemic, antioxidant, antibacterial, antimalarial, antifertility, hepatoprotective	[22-25]
10.	<i>Barleria lupulina</i> (Acanthaceae)	<b>Vishalyakrani</b>	-	Aerial parts	Antihyperglycemic	[26,27]
11.	<i>Berberis aristata</i> (Berberidaceae)	Daru Haridra	Barberries or Pepperidge bushes	Root	Antihyperglycemic, antioxidant	[28]
12.	<i>Beta vulgaris</i> (Chenopodiaceae)	Palakya	Chukkander, beetroot	Root	Increase in glucose tolerance	[29]
13.	<i>Bixa orellana</i> (Bixaceae)	Sinduri/ <b>Kampillaka</b>	Achiote, aploppas	Leaves	Concentration-independent inhibition of human pancreatic $\alpha$ -amylase	[30]
14.	<i>Brassica juncea</i> (Brassicaceae)	Rajika	Mustard greens, indian mustard	Leaves	Hypoglycemic, antioxidant	[31,32]
15.	<i>Butea monosperma</i> (Papilionaceae)	Palasha	Palasa, flame of the forest	Bark, leaves, flower	Hypoglycemic, antihyperglycemic, antioxidant, thyroid inhibitory effect	[33-35]
16.	<i>Camellia sinensis</i> (Theaceae)	Syamaparni	Tea	Leaves	Anti hyperglycemic, antioxidant	[36,37]
17.	<i>Capparis spinosa</i> (Capparaceae)	Himsra	Caper bush	Fruit	Antihyperglycemic, no change in basal insulin level	[38]
18.	<i>Carum carvi</i> (Apiaceae)	Krishna Jiraka	Caraway, meridian fennel	Fruit	Antihyperglycemic, no change in basal insulin level	[38]
19.	<i>Casearia esculenta</i> (Salicaceae)	Svarnamulaha/ Saptachakra	-	Root	Antihyperglycemic, antihyperlipidemic, antioxidant	[39,40]
20.	<i>Cassia auriculata</i> (Caesalpinaceae)	Avartaki	Ranawara or avaram, avaram senna	Leaves, flowers	Antihyperglycemic and hypolipidemic activity, $\alpha$ -glucosidase inhibitory activity	[41,42]

21.	<i>Cassia glauca</i> ( <i>Caesalpinia</i> <i>ceae</i> )	Peeta Aragvadh	-	Leaves, bark	Antihyperglycemic, antihyperlipidemic	[43]
22.	<i>Cinnamomum verum</i> ( <i>lauraceae</i> )	Tvak	True cinnamon, Ceylon cinnamon	Leaves	Concentration- dependant inhibition of human pancreatic $\alpha$ - amylase	[30]
23.	<i>Citrullus vulgaris</i> ( <i>Cucurbitac</i> <i>eae</i> )	Dindisha	Water melon	Peel of fruit	Hypoglycemic, antihyperlipidemic, amelioration of thyroid dysfunction, inhibit lipid peroxidation	[44]
24.	<i>Citrus sinensis</i> ( <i>Rutaceae</i> )	Naranga	Sweet orange	Peel of fruit	Antihyperglycemic, antiperoxidative, antithyroid, insulin stimulating property, hypolipidemic, cardioprotective	[45-48]
25.	<i>Citrus paradisi</i> ( <i>Rutaceae</i> )	Karuna	Grape fruit	Seeds	Hypoglycemic, hypolipidemic, decrease in cardiovascular risk factors	[49]
26.	<i>Coscinium fenestratum</i> ( <i>Menisperm</i> <i>aceae</i> )	Krishnacana	-	Stem	Antidiabetic, hypolipidemic	[50]
27.	<i>Costus igneus</i> ( <i>Costaceae</i> )	Pushkarmula	Fiery costus or spiral flag	Leaves	Hypoglycemic	[51]
28.	<i>Costus speciosus</i> ( <i>Costaceae</i> )	Kemuka	Crape ginger	Root	Antihyperglycemic, antihyperlipidemic and antioxidative effects	[52]
29.	<i>Curcuma longa</i> ( <i>Zingiberac</i> <i>ae</i> )	Haridra	Turmeric	Rhizome	Concentration- dependant inhibition of human pancreatic $\alpha$ -amylase	[30]
30.	<i>Emblica officinalis</i> ( <i>Euphorbiac</i> <i>eae</i> )	Amalaki	Amla, dhatrphala	Fruit	Hypoglycemic, antioxidant, decrease in lipid peroxidation, antibacterial, antiulcerog enic, hepatoprotective, gastroprotective	[53-55]
31.	<i>Ficus bengalensis</i> ( <i>Moraceae</i> )	Vata	Banyan, bargad, bur	Aerial root, stem bark	Hypoglycemic, antioxidant, concentration dependant inhibition of human pancreatic $\alpha$ - amylase	[56,57]
32.	<i>Ficus carica</i> ( <i>Moraceae</i> )	Falgu	Common fig	Leaves	Hypoglycemic, hypolipidemic	[58-60]
33.	<i>Ficus</i>	Udumbara	Cluster fig tree	Bark	Strong hypoglycemic	[61]

	<i>racemosa</i> ( <i>Moraceae</i> )		or goolar		effect	
34.	<i>Gymnema montanum</i> ( <i>Asclepiadaceae</i> )	<i>Madhunashini</i>	-	Leaves	Antihyperglycemic, antihyperlipidemic, decrease in lipid peroxides, inhibition of apoptotic pathway	[62,63]
35.	<i>Hedychium spicatum</i> ( <i>Zingiberaceae</i> )	<i>Shankhini</i>	Spiked ginger lily, sandharlika	Rhizome	Antihyperglycemic, inhibition of intestinal $\alpha$ -glucosidase activity	[64]
36.	<i>Helicteres isora</i> ( <i>Sterculiaceae</i> )	<i>Avartani</i>	-	Root, fruit, bark	Hypoglycemic, antihyperlipidemic, insulin sensitizer	[65-67]
37.	<i>Hygrophila auriculata</i> ( <i>Acanthaceae</i> )	<i>Kokilaksa</i>	Marsh barbell	Aerial parts	Hypoglycemic, antioxidant, decreased lipid peroxidation	[68]
38.	<i>Lagerstroemia speciosa</i> ( <i>Lythraceae</i> )	<i>Syandana</i>	Giant crape-myrtle, queen's Leave crape-myrtle, banaba plant for philippines	Leave	$\alpha$ -glucosidase inhibitor	[69]
39.	<i>Linum usitatissimum</i> ( <i>Linaceae</i> )	<i>Alsi</i>	Flax or common flax or linseed	Seeds	Inhibition of pancreatic amylase activity	[70]
40.	<i>Matricaria chamomilla</i> ( <i>Asteraceae</i> )	<i>Babuna</i>	German chamomile	Aerial part	Antihyperglycemic, antioxidant, protection of $\beta$ -cells	[71]
41.	<i>Morus alba</i> ( <i>Moraceae</i> )	<i>Tuda</i>	Mulberry, white mulberry	Leaves	Inhibition of $\alpha$ -glucosidase, sucrose, maltase, inhibit porcine pancreatic $\alpha$ -amylase activity and reduced starch hydrolysis	[72]
42.	<i>Murraya koenigii</i> ( <i>Rutaceae</i> )	<i>Surabhinimba</i>	Curry patta, curry tree	Leaves	Antihyperglycemic, enhances glycogenesis and reduce glycosylated Hb, gluconeogenesis, urea, uric acid, creatinine and glycogenolysis, concentration-independent inhibition of human pancreatic $\alpha$ -amylase	[73,74]
43.	<i>Musa sapientum</i> ( <i>Musaceae</i> )	<i>Kadali</i>	Banana	Flower	Antihyperglycemic, antioxidant	[75-77]

44.	<i>Olea europaea</i> ( <i>Oleaceae</i> )	<i>Jaitun</i>	Olive tree	Leaves	Hypoglycemic, antioxidant, antihypertensive, anti-inflammatory, antiatherogenic, hypocholesterolemic	[78]
45.	<i>Paspalum scrobiculatum</i> ( <i>Poaceae</i> )	<i>Kodrava</i>	Koda millet, kodo millet, or kodra millet	Grains	Antihyperglycemic, increase in serum insulin level, hypolipidemic	[79]
46.	<i>Phaseolus vulgaris</i> ( <i>Fabaceae</i> )	<i>Rajmaash</i>	Hulga, white kidney bean, common bean	Seeds	Hypoglycemic, hypolipidemic, inhibition of $\alpha$ -amylase activity, antioxidant, alternation in level of insulin receptor and GLU-4 mRNA in skeletal muscle, enhanced production of adiponectin, decreased TNF- $\alpha$ level	[80-83]
47.	<i>Punica granatum</i> ( <i>Lythraceae</i> )	<i>Daadima</i>	Anar	Flower, peel of fruit	Antioxidant, antihyperglycemic effect, inhibit TNF- $\alpha$ -stimulated free fatty acid release and attenuated TNF- $\alpha$ inhibition of adiponectin secretion, prevent diabetes via binding with PPAR- $\gamma$ receptor, production of NO, inhibition of lipid peroxidation, inhibition of $\alpha$ -glucosidase activity	[84-87]
48.	<i>Raphanus sativus</i> ( <i>Brassicaceae</i> )	<i>Mulaka</i>	Japanese radish	Root, sprout	Hypoglycemic, improved lipid metabolism	[88-90]
49.	<i>Swietenia mahagoni</i> ( <i>Meliaceae</i> )	<i>Mahagani</i>	West Indian mahogany	Bark	Antidiabetic, antioxidant	[91]
50.	<i>Syagrus romanzoffiana</i> ( <i>Arecaceae</i> )	<i>Guvka/Kalpa Vriksha</i>	Queen palm or cocos palm	Seeds	Inhibition of $\alpha$ -glucosidase, reduce post-prandial blood glucose level	[92]
51.	<i>Syzygium cumini</i> ( <i>Myrtaceae</i> )	<i>Jambu</i>	Jamun	Seeds	Concentration-dependent inhibition of human pancreatic $\alpha$ -amylase	[30]
52.	<i>Terminalia catappa</i> ( <i>Combretaceae</i> )	<i>Kshudrabija</i> , <i>Desabada</i>	-	Fruit	Hypoglycemic	[93]



	<i>ee)</i>	<i>ma</i>				
53.	<i>Tridax procumbens</i> (Asteraceae)	<i>Jayanti Veda</i>	Dhaman grass	Whole plant	Antihyperglycemic, hypoglycemic, correction in body weight	[94]
54.	<i>Withania somnifera</i> (Solanaceae)	<i>Ashvagand ha</i>	Winter cherry	Root	Hypoglycemic, diuretic and hypocholesterolemic, antioxidant, suppresses metformin-induced hypothyroidism	[95]
55.	<i>Aegle marmelos</i> (Rutaceae)	<i>Bilva</i>	Bengal quince	Fruit	Antihyperglycemic, antioxidant, improves functioning of pancreatic $\beta$ -cells	[96-98]

**Table 3:** Various Antidiabetic herbal formulations in Indian market

S. No.	Brand name	Manufacturer	Ingredients
1.	BGR-34	Aimil Pharmaceuticals	<i>Berberis aristata</i> , <i>Pterocarpus marsupium</i> , <i>Gymnema sylvestre</i> , <i>Rubia cordifolia</i> , <i>Trigonella foenum-graecum</i> , <i>Tinospora cordifolia</i> , Purified Shilajatu
2.	Diabecon	Himalaya	<i>Gymnema sylvestre</i> , <i>Pterocarpus marsupium</i> , <i>Glycyrrhiza glabra</i> , <i>Casearia esculenta</i> , <i>Syzygium cumini</i> , <i>Asparagus racemosus</i> , <i>Boerhavia diffusa</i> , <i>Sphaeranthus indicus</i> , <i>Tinospora cordifolia</i> , <i>Swertia chirata</i> , <i>Tribulus terrestris</i> , <i>Phyllanthus amarus</i> , <i>Gmelina arborea</i> , <i>Gossypium herbaceum</i> , <i>Berberis aristata</i> , <i>Aloe vera</i> , <i>Triphala</i> , <i>Commiphora wightii</i> , shilajeet, <i>Momordica charantia</i> , <i>Piper nigrum</i> , <i>Ocimum sanctum</i> , <i>Abutilon indicum</i> , <i>Curcuma longa</i> , <i>Rumex maritimus</i>
3.	Diasulin	-	<i>Cassia auriculata</i> , <i>Coccinia indica</i> , <i>Curcuma longa</i> , <i>Emblica officinalis</i> , <i>Gymnema sylvestre</i> , <i>Momordica charantia</i> , <i>Scoparia dulcis</i> , <i>Syzygium cumini</i> , <i>Tinospora cordifolia</i> , <i>Trigonella foenum graecum</i>
4.	Pancreatic tonic 180 cp	Ayurvedic supplement	<i>Pterocarpus marsupium</i> , <i>Gymnema sylvestre</i> , <i>Momordica charantia</i> , <i>Syzygium cumini</i> , <i>Trigonella foenum graecum</i> , <i>Azadirachta indica</i> , <i>Ficus racemosa</i> , <i>Aegle marmelos</i> , <i>Cinnamomum tamala</i>
5.	Ayurveda alternative herbal formula to Diabetes:	Chakrapani Ayurveda	<i>Gurmar</i> ( <i>Gymnema sylvestre</i> ) <i>Karela</i> ( <i>Momordica charantia</i> ) <i>Pushkarmool</i> ( <i>Inula racemosa</i> ) <i>Jamun Gutli</i> ( <i>Syzygium cumini</i> ) <i>Neem</i> ( <i>Azadirachta indica</i> ) <i>Methika</i> ( <i>Trigonella foenum graecum</i> ) <i>Guduchi</i> ( <i>Tinospora cordifolia</i> )
6.	Bitter gourd Powder	Garry and Sun natural Remedies	<i>Bitter gourd</i> ( <i>Momordica charantia</i> )
7.	Dia-care	Admark Limited	<i>Sanjeevan Mool</i> ; <i>Himej</i> , <i>Jambu beej</i> , <i>Kadu</i> , <i>Namejav</i> , <i>Neem chal</i> .
8.	Diabetes-Daily Care	Nature's Supply	<i>Alpha Lipoic Acid</i> , <i>Cinnamon 4% Extract</i> , <i>Chromax</i> , <i>Vanadium</i> , <i>Fenugreek 50% extract</i> , <i>Gymnema sylvestre 25% extract</i> <i>Momordica 7% extract</i> , <i>Licorice Root 20% extract</i>
9.	Gurmar powder	Garry and Sun natural Remedies	<i>Gurmar</i> ( <i>Gymnema sylvestre</i> )
10.	Epinsulin	Swastik Formulations	<i>vijaysar</i> ( <i>Pterocarpus marsupium</i> )

11.	Diabecure	Nature santé	beaute	<i>Juglans regia</i> , <i>Berberis vulgaris</i> , <i>Erythrea centaurium</i> , <i>Millefolium</i> , <i>Taraxacum</i>
12.	Diabeta	Ayurvedic Ayurvedic Health Products	cure Herbal	<i>Gymnema sylvestre</i> , <i>Vinca rosea</i> (Periwinkle), <i>Curcuma longa</i> (Turmeric), <i>Azadirachta indica</i> (Neem), <i>Pterocarpus marsupium</i> (Kino Tree), <i>Momordica charantia</i> (Bitter Gourd), <i>Syzygiumcumini</i> (Black Plum), <i>Acacia arabica</i> (Black Babhul), <i>Tinospora cordifolia</i> , <i>Zingiber officinale</i> (Ginger)
13.	Syndrex	Plethico Laboretaries		<i>Germinated Fenugreek seed extract</i>
14.	Madhumeha Kusumakara Rasa	Shree Dhoothapapeshwar Limited		<i>Vasant Kusumakar Rasa</i> (Suvarnayukta), <i>Mamajjaka ghana</i> (Dried Aq. extract of <i>Enicostemma littorale</i> ), <i>Haridra</i> ( <i>Curcuma longa</i> ), <i>Amalaki</i> ( <i>Emblca officinalis</i> ), <i>Shuddha Shilajatu</i> (Processed asphaltum), <i>Guduchi</i> ( <i>Tinospora cordifolia</i> ), <i>Yashada bhasma</i> (Zinc bhasma), <i>Bilva patra swaras</i> ( <i>Aegle marmelos</i> ), <i>Asana kwath</i> ( <i>Pterocarpus marsupium</i> )
15.	Zpter	Om Pharmaceuticals Limited		<i>Vijayasara</i> , <i>Dalchini</i> , <i>Haridra</i> , <i>Haritaki</i> , <i>Bibhitaki</i> , <i>Amalaki</i> , <i>Chtrak</i> , <i>Jasad Bhasma</i> , <i>Guduchi</i> ( <i>Tinospora cordifolia</i> ) and <i>Madhunashini</i> ( <i>Gymnema sylvestre</i> )
16.	HypoNIDD	Charak Pharma		<i>Yashad Bhasma</i> (Zinc Calx), <i>Shilajit</i> (Purified Asphaltum), <i>Karela</i> ( <i>Momordica charantia</i> , bitter gourd), <i>Haridra</i> ( <i>Curcuma longa</i> , turmeric), <i>Tarwar</i> ( <i>Cassia auriculata</i> , <i>Avarakkai</i> , <i>Indian broad-beans</i> ), <i>Amalaki</i> ( <i>Amla</i> , <i>Indian Gooseberry</i> , <i>Emblca officinalis</i> ), <i>Raja Jambu</i> ( <i>Eugenia jambolana</i> ), <i>Mamejavo</i> ( <i>Enicostemma littorale</i> ), <i>Meshashringi</i> ( <i>Gymnema sylvestre</i> ), <i>Vijaysaar</i> ( <i>Pterocarpus marsupium</i> ), <i>Guduchi</i> ( <i>Tinospora cordifolia</i> ), <i>Neem</i> ( <i>Melia azadirachta</i> ), <i>Kirat Tikta</i> ( <i>Swertia chirata</i> )
17.	Dabur Madhu Rakshak	Dabur		<i>Amla</i> ( <i>phyllanthus emblica</i> ), <i>Tejpatra</i> ( <i>Cinnamomum tamala</i> ), <i>Vijaysar</i> ( <i>Pterocarpus marsupium</i> ), <i>Gurmar</i> ( <i>Gymnema sylvestre</i> ), <i>Jamum seed</i> ( <i>Eugenia jambolana</i> ), <i>Kali marich</i> ( <i>piper nigrum</i> ), <i>Neem leaves</i> ( <i>azadiracheta indiaca</i> ), <i>Methi</i> ( <i>trigonella foenum-graecum</i> ), <i>Bahera</i> ( <i>Terminalia belerica</i> ), <i>Bhavana Dravyas</i> , <i>Shudh Shilajit</i> , <i>karela fruit</i> ( <i>momordica charantia</i> ), <i>Hareetaki</i> ( <i>Terminalia chebula</i> )
18.	Ojamin	Tates remedies		<i>Aegle Marmelos</i> , <i>Trigonella Foenum Graecum</i> , <i>Carum Carvi</i> , <i>Emblca Offcinails</i> , <i>Terminalia Chebula</i> , <i>Terminalia Belarica</i> , <i>Swertia Chirata</i> , <i>Tinospora Cordifolia</i> , <i>Eugenia Jambolana</i> , <i>Picrorhiza Kurroa</i> , <i>Gymnema Sylvestre</i> , <i>Salacia Chinensis Linn</i> , <i>Curcuma Longa</i> , <i>Melia Azadirachta</i>
19.	Madhumehari Granules	Baidyanath		<i>Gudmar</i> ( <i>gymnema sylvestre</i> ), <i>Jamun guthali</i> ( <i>syzygium cumini</i> ), <i>Gulvel</i> ( <i>Tinospora cordifolia</i> ), <i>Kkarela Beej</i> ( <i>Momordica charantia</i> ), <i>Khadir Chuma</i> ( <i>Acacla Catechu</i> ), <i>Haldi</i> ( <i>Curcuma Longa</i> ), <i>Amia</i> ( <i>Emblca-officinalis</i> ), <i>vijaysar</i> ( <i>Pterocarpus Marsupium</i> ), <i>Tejpatra</i> ( <i>cinnamomum-Tamala</i> ), <i>Shilajit</i> ( <i>Asphaltum</i> ), <i>Gularphal Chuma</i> ( <i>Ficus Glomerata</i> ), <i>Kutki</i> ( <i>Picrorhiza Kurroa</i> ), <i>Chitrak</i> ( <i>plumbago Zeylanica</i> ), <i>Methi</i> ( <i>Trigonella-foenum graecum</i> ), <i>Bhavna of Neem Patti</i> ( <i>Azadirachta - Indica</i> ), <i>Bilwa Patra</i> ( <i>Aegle Marmelos</i> )

#### 4. Conclusion

Present review spotlights the antidiabetic claims of various classical Ayurvedic herbs and validation of few of them by contemporary researches. Evidences from reported studies suggest its multi-faceted effects to combat diabetes and related pathologies. Ayurvedic medicinal plants have drawn attention of scientific fraternity owing to their huge therapeutic potential; nevertheless, in depth clinical trials should be conducted to ascertain and validate the biological roles and therapeutic effects.

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