An overview of novel herbal remedies with anti-diabetic and anti-mood disorder activity

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Abstract-

Diabetes mellitus is a growing global health concern, and the long-term use of synthetic drugs has led to an increased interest in alternative treatments with minimal side effects, such as herbal remedies. Over the past three decades, the use of herbal medicine has been rising significantly in both developing and developed countries. This review aims to provide a comprehensive overview of the antidiabetic properties of the following medicinal plants: Catharanthus roseus, Curcuma longa, Eugenia jambolana, Hibiscus rosa-sinensis, Moringa oleifera, Nigella sativa, Ocimum sanctum, Tinospora cardifolia, Trigonella foenum-graecum, Withania somnifera. In addition, some medicinal plants which can be used in the manageent of mood disorders of diabetic patients such as Hippophae rhamnoides(L.), Bacopa monnieri (L), Curcuma longa (L), Dioscorea bulbufera (L) have been discussed.

Keywords: *Diabetes mellitus, Medicinal plants, Hypoglycemic*

1. INTRODUCTION:

Type 2 Diabetes Mellitus (T2DM) is a chronic metabolic disorder characterized by the body's inability to produce or effectively utilize insulin, a hormone essential for converting sugar, starches, and other foods into energy. This insulin deficiency or resistance leads to persistent hyperglycemia and glucose intolerance. T2DM is among the oldest diseases known to humanity, historically referred to as the "black death" in the 14th century [Deepti B, et al., 2017].

The clinical manifestations of T2DM include frequent urination (polyuria), excessive thirst (polydipsia), increased hunger (polyphagia), recurrent infections, unintentional weight loss, severe fatigue, tingling sensations (paresthesias), rapid heart rate, low blood pressure, decreased body temperature, slow wound healing, blurred vision, and itching in the genital area [Baynest, et al., 2015]. Over time, T2DM can lead to significant complications, such as neuropathy, nephropathy, retinopathy, and cardiovascular diseases [Xu, L., et al., 2018].

The International Diabetes Federation (IDF) has highlighted T2DM as one of the fastest-growing global health emergencies of the 21st century, affecting 463 million people worldwide in 2019, with projections indicating this number could rise to 700 million by 2045. In India, the prevalence of diabetes is particularly concerning, with an estimated 77 million people living with the condition in 2019, translating to an 8.9% prevalence among adults. This makes India the second-largest population of individuals with diabetes, where one in six adults with diabetes worldwide is from India [IDF, 2019].

Plants have been a valuable source of hypoglycemic agents, and numerous plant-derived compounds have been utilized in diabetes treatment. Extensive research has been conducted on Indian plants for their potential benefits in managing diabetes, as documented in various scientific journals. Traditional medicinal systems such as Ayurveda have long described numerous plants used as herbal remedies for diabetes. These herbal treatments are favored due to their lower cost and fewer side effects compared to conventional medications. Active compounds in medicinal plants have been reported to regenerate pancreatic beta cells, stimulate insulin release, and combat insulin resistance [Welihinda J, et al., 2002].

Depression and type 2 diabetes have similar environmental and lifestyle risk factors, such as socioeconomic depression, social adversity, smoking, and decreased physical activity. Childhood adversity, such as abuse, deprivation, and neglect, has been linked to depression and self-reported diabetes onset in later life. In maturity, work stress is linked to an increased risk of type 2 diabetes and depression.

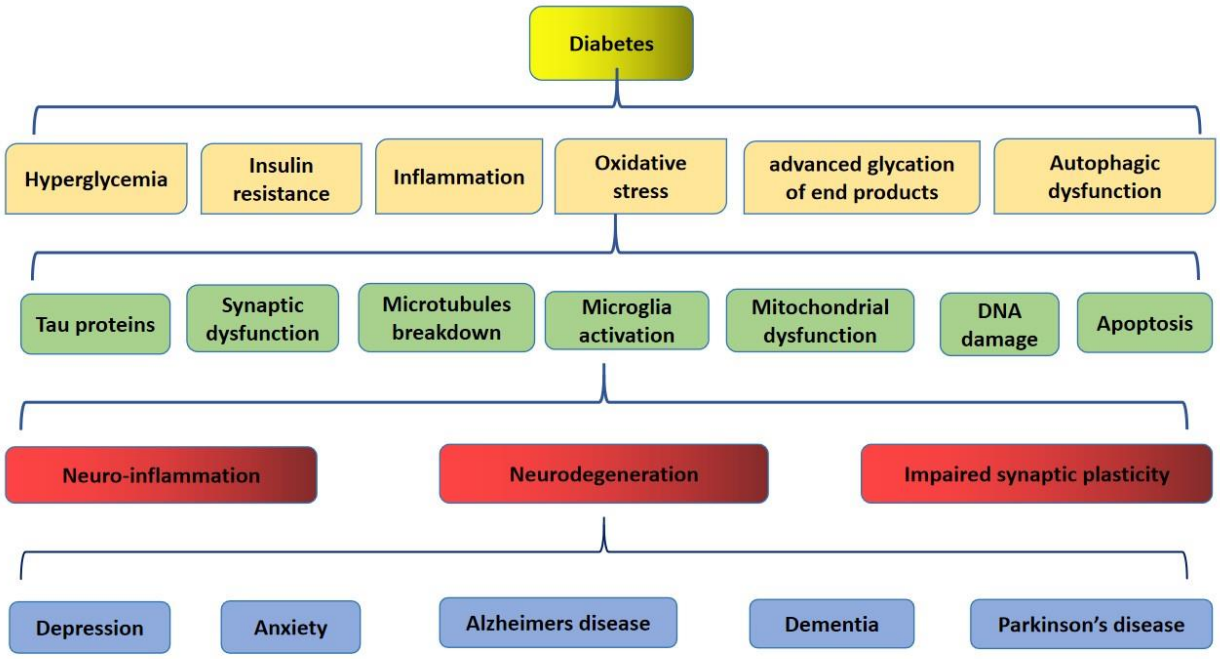

Figure 1: The various mechanisms involved in the development of mood disorders in diabetic patients.

The link between depression and diabetes has been recognized since the 17th century when British physician Thomas Willis observed that diabetes often appeared in individuals who had experienced significant life stresses or sadness [Willis T, 1971]. The prevalence of psychiatric disorders, particularly mood disorders like unipolar depression, bipolar disorder, anxiety, and stress-related disorders, is notably high among diabetic patients [Vancampfort D,

et al., 2015]. Figure 1, elaborates the mechanisms involved in development of mood disorders and mental health disturbance in diabetic patients.

Alzheimer's disease (AD), a neurodegenerative condition, presents in two primary forms: the more common sporadic form, with multifactorial causes, and the less common familial form, which is genetically inherited. Clinically, AD is characterized by episodic memory impairment, cognitive deficits, social behavior limitations, and, in advanced stages, difficulties with daily independent functioning [Chatterjee, S., 2018; Alonso, A.D., et al., 2018].

There is a well-established association between T2DM and an increased risk of cognitive disorders, including dementia and Alzheimer's disease. However, awareness of this link remains low, and there are limited recommendations for physicians on managing cognitive impairment in diabetic patients [Moheet et al., 2015; Srikanth et al., 2020].

Plants with anti-diabetic activities:

Natural products are essential for discovering potent candidates in drug development programs. Their ease of availability, minimal side effects, and low cost make herbal preparations particularly appealing, especially in rural areas where access to conventional therapies may be limited. This review aims to highlight several anti-diabetic plants and discuss the most pertinent data related to their therapeutic properties.

1 .Catharanthus roseus (L.)

Catharanthus roseus L., commonly known as periwinkle, is an evergreen herbaceous plant that can be annual or perennial. The name "Catharanthus" is derived from Greek, meaning "pure flower." Belonging to the Apocynaceae family, this plant features broad, glossy green leaves and flowers that range from white to pinkish hues. Periwinkle is well-recognized for its antidiabetic and cytotoxic properties. Traditionally, it has been utilized in the British West Indies for the treatment of diabetic ulcers [Sohani S. et al., 2020].

The antidiabetic compounds found in Catharanthus roseus include vindoline and vindogentianine. Vindoline has been shown to enhance insulin levels in the mouse insulinoma cell line (MIN6), with concentrations above 50 µM significantly increasing insulin secretion [Yao X, et al., 2013]. Additionally, a combination of Catharanthus roseus ethanolic extract and ursolic acid has demonstrated substantial insulin production. Specifically, an equal mixture of the extract and ursolic acid (25 mg each) increased insulin levels from 5.93 µU/ml to 13.65 µU/ml in diabetic rats, indicating the potential of this combination as an alternative therapeutic approach [Alkreathy HM, et al., 2020].

2. Curcuma longa (L.)

Curcuma longa L., commonly known as turmeric, is a moderately tall perennial plant with underground rhizomes, cultivated in tropical regions such as Pakistan, China, Peru, and India. The curcuminoids bisdemethoxycurcumin, curcumin, and demethoxycurcumin, isolated from C. longa, have been shown to exhibit alpha-glucosidase inhibitory activity [Lekshmi PC, et al., 2012]. Additionally, volatile oils extracted from both fresh and dried turmeric rhizomes demonstrate potent glucosidase inhibitory activity in a dose-dependent manner, with dried rhizomes significantly enhancing this activity. Aromatic-Turmerone, the primary volatile component in turmeric rhizomes, exhibits strong alpha-glucosidase and alpha-amylase inhibitory effects [Lekshmi PC, et al., 2012].

Curcumin, a key component of turmeric, has been proven to offer protective effects against oxidative damage. It reduces lipid peroxidation by normalizing antioxidant enzyme levels, such as superoxide dismutase, catalase, and glutathione peroxidase [Sukandar E, et al., 2010]. Furthermore, the administration of tetrahydrocurcumin (80 mg/kg of body weight) over 45 days resulted in a 55% decrease in fasting blood glucose levels and enhanced antioxidant defenses in STZ-induced diabetic rats [Jiménez-Flores, et al., 2014].

3. Eugenia jambolana (L.)

In India, a decoction made from the kernels of Eugenia jambolana, commonly known as jamun, is a traditional remedy for diabetes and is a significant component of many herbal formulations for this condition. Studies have shown that both aqueous and alcoholic extracts, as well as lyophilized powder from jamun, exhibit antihyperglycemic effects by reducing blood glucose levels. The extent of reduction varies with the severity of diabetes: in mild diabetes (plasma sugar >180 mg/dl), there is a 73.51% reduction; in moderate diabetes (plasma sugar >280 mg/dl), a 55.62% reduction; and in severe diabetes (plasma sugar >400 mg/dl), a 17.72% reduction.

In streptozotocin-induced diabetic mice, the hypoglycemic activity of jamun pulp extract was observed within 30 minutes of administration, whereas the seed extract required 24 hours to show effects. Oral administration of the jamun extract increased serum insulin levels in diabetic rats. Furthermore, incubation of the plant extract with isolated islets of Langerhans from both normal and diabetic animals stimulated insulin secretion. These extracts also inhibited insulinase activity in the liver and kidney [Karthikesan, K. et al., 2010].

4. Hibiscus rosa-sinesis (L.)

Hibiscus rosa-sinensis, commonly known as Gudhal or China rose, belongs to the Malvaceae family and is a common perennial flowering shrub found in Indian gardens. The flowers of this plant have demonstrated significant antidiabetic effects in a dose- and time-dependent manner [Venkatesh S, et al., 2008]. Ethanol extracts of the flowers at doses of 250 and 500 mg/kg significantly reduced blood glucose levels in both acute and subacute treatments in alloxan-induced diabetic rats [Sankaran M, et al., 2011]. Additionally, fractions isolated from the ethanol extract of the leaves have shown antidiabetic and antihyperlipidemic properties [Moqbel FS, et al., 2011].

5. Moringa oleifera (L.)

The alcoholic extract of Moringa oleifera leaves, enriched with antidiabetic phytocompounds such as glycosides, steroids, tannins, flavonoids, and alkaloids, is considered effective for treating diabetic complications. Notably, kaempferol and quercetin, two major phytoconstituents isolated from M. oleifera, significantly reduced serum glucose levels by 33.34% and increased serum insulin levels in diabetic rat models over a period of four weeks [Gupta R, et al., 2012].

In another study, quercetin, moringinine, and chlorogenic acid, notable phytochemicals from M. oleifera, were administered to diabetic rat models to assess their antidiabetic efficacy. The results demonstrated a reduction in serum glucose, total cholesterol, and triacylglycerol levels at a dose of 150 mg/kg after 21 days of treatment. Additionally, the normal histological structure of the pancreas was restored in diabetic rats [Ali FT, et al., 2015].

Further research has shown that kaempferol stimulates glucose uptake in the rat soleus muscle via the PI3K and PKC pathways. When administered orally, kaempferol significantly

reduced fasting blood glucose levels and serum HbA1c levels, and improved insulin resistance. Moreover, quercetin was found to block the transport of fructose and glucose by GLUT2 in the brain and enhance the translocation and expression of GLUT4 in skeletal muscle [Villarruel-Lopez A, et al., 2018].

Additionally, a randomized controlled trial demonstrated that a capsule processed from M. oleifera leaves significantly inhibited the rise in serum glucose levels two hours after a 75g oral glucose intake in individuals aged 18-55 years [Sandoval MAS, et al., 2013].

6. Nigella sativa (L.)

Administering an ethanol extract of Nigella sativa seeds orally to streptozotocin-induced diabetic rats at a dosage of 300 mg/kg body weight per day for 30 days led to significant reductions in elevated blood glucose and lipid levels. Moreover, it improved plasma insulin levels and normalized altered levels of lipid peroxidation products, such as TBARS and hydroperoxides. Additionally, the extract enhanced the activity of antioxidant enzymes like catalase, superoxide dismutase, reduced glutathione, and glutathione peroxidase in the liver and kidney. These findings confirm the antidiabetic activity of N. sativa seed extract [Kaleem M, et al., 2006].

7. Ocimum sanctum (L.)

The leaves of Ocimum sanctum, commonly known as holy basil or tulsi, have been traditionally used for treating diabetes. In a study involving albino rabbits, consuming doses of O. sanctum leaves at 2 grams per kilogram body weight for 30 days resulted in a notable decrease in glucose levels. Additionally, the levels of antioxidant enzymes and glutathione increased, while lipid peroxidation decreased with the use of the plant leaves. This suggests that the hypoglycemic activity of the plant may be attributed to the regulation of the cellular antioxidant system [Sethi J, et al., 2004].

In another study, the ethanolic extract of O. sanctum leaves demonstrated a significant reduction in blood glucose levels in both normal and alloxan-induced diabetic rats [Vats V et al., 2002].

8. Tinospora cordifolia (L.)

The antidiabetic potential of Tinospora cordifolia extract, as well as various dosage forms of Guduchi mentioned in traditional medicine systems, has been scientifically validated in numerous experimental and clinical studies [Satija S, et al., 2015]. T. cordifolia, commonly known as Guduchi, is extensively utilized in Indian Ayurvedic medicine for the management of diabetes mellitus [Stanely M, et al., 2001].

Oral administration of an aqueous extract of T. cordifolia root to alloxan-induced diabetic rats resulted in a significant reduction in blood glucose levels and brain lipids. However, while the aqueous extract at a dose of 400 mg/kg demonstrated significant anti-hyperglycemic effects in various animal models, its efficacy was equivalent to only one unit/kg of insulin [Dhaliwal, et al., 1999]. Additionally, daily administration of either alcoholic or aqueous extracts of T. cordifolia has been reported to decrease blood glucose levels and improve glucose tolerance in rodent models [Gupta SS, et al., 2009].

9. Trigonella foenum-graecum (L.)

The bioactive compounds most extensively studied in Trigonella foenum-graecum (fenugreek) with documented hypoglycemic effects include diosgenin (3b-hydroxy-5-

spirotene), 4-hydroxyisoleucine, and the soluble dietary fiber fraction of fenugreek seeds [Fuller S, et al., 2011].

In an investigation of the anti-diabetic activity of ethanol extract from Trigonella foenum-graecum (Fabaceae) seeds, doses of 2 g/kg, 0.5 g/kg, and 0.1 g/kg were administered orally to diabetic rats. It was observed that the extract exhibited a significant capacity to lower blood glucose levels. Among all the tested dose levels, 1 g/kg orally was found to be the most effective in reducing blood glucose levels compared to other doses [Mowla A, et al., 2009].

10. Withania somnifera (L.)

Withania somnifera, commonly known as Ashwagandha, is a perennial plant belonging to the family Solanaceae. Both the root and leaves of W. somnifera have been found to exhibit hypoglycemic and hypolipidemic effects in diabetic rats [Kumar RU, et al., 2009]. Additionally, it is utilized in Ayurvedic and Unani systems of medicine for the treatment of tumors and tubercular glands.

An aqueous extract of W. somnifera, administered at doses of 200 and 400 mg/kg body weight, has demonstrated hypoglycemic activity in streptozocin-induced diabetic rats. These pharmacological effects of W. somnifera are attributed to the presence of withanolides [Anwar T, et al., 2008].

Table 1: Plants showing anti-diabetic properties.

Plant name	Plant use	Type of extract	Activity	References
Agel mormelos	Leaf, bark	Alkaloids	Antihyperglycemic	Ayodhya S, et. al., 2010
Aloe barbadensis	Leaves	Ethanolic	Antidiabetic	Junaid A. Malik, et. al., 2021
Acacia catechul	Bark	Tannins procatechinic acid,	Antidiabetic	Burnett BP, et. al., 2007
Allium sativum	Bulb	Ethanolic	Antidiabetic	Wesam Kooti, et. al., 2016
Allium cepa	Bulb	Ethanolic	Antidiabetic	Omid Reza Tamtaji, et al., 2017
Anacardium occidentale	Bark	Alanine	Antidiabetic	Inzuchi S. et. al. 2003
Annona squamosal	Leaves	Aqueous	Hypoglycemic, Antidiabetic	Gupta RK, et al., 2005
Azadirachta indica	Leaves, bark	Alcoholic	Hypoglycemic	Rawat Mukesh, et al., 2013
Berberis aristata	Stem	Alkaloids	Hypoglycemic, Hypolipidemic	Upwar N, et al., 2011
Berberis vulgaris	Root	Aqueous	Hypoglycemic	Meliani N, et.

				al., 2011
Brassica juncea	Sead	Aqueous	Hypoglycemic	Thirumalai T, et al., 2011
Cassia auriulata	Flower	Methanol Ethanol	Antidiabetic Antihyperglycemic	Jyothi GS, et al., 2012
Chaenomeles sinensis	Fruit	Ethylacetate	Antidiabetic	Sancheti S, et al., 2015
Cinnamom zeylaniucum	Dried bark	Alkaloids	Antidiabetic	R.S. Beji, et al., 2018
Cocus nucifera	Leaf	Hydro-methanol	Antihyperglycemic	Naskar S, et al., 2011
Coccinia indica	Leaf	Alkaloids	Antidiabetic	J. Anupam, et al., 2018
Ficus bengalensis	Root, bark	Phenolic acid, Alkaloids	Antidiabetic	P. Deepa, et al., 2018
Gymnema sylvestre	Leaf	Phytochemical	Antidiabetic, antioxidant	L. Suparna, et al., 2019
Mangifera indica	Leaf, bark	Aqueous Alcoholic	Antidiabetic	Ojewole, et al., 2005
Morus alba	Leaves	Alkaloids	Hypoglycemic	Zhang M, et al., 2009
Momordica charantia	Fruit, seed	Phytochemical	Antidiabetic, hypoglycemic	Joseph B, et al., 2013
Nelumbo nucifera	Rhizome	Alkaloids	Antidiabetic	Nyugen KH, et al., 2012
Petrocarpus marsupium	Stem	Alkaloids	Antidiabetic	G.Venkatesh, et al., 2017
Psidium guajava	Leaves	Ethanolic	Antidiabetic	R. Manikandan et al ., 2016
Ricinus communis	Seed	Ethanolic	Antidiabetic	Rao MU, et al., 2010
Rubia cordifolia	Root	Phytochemical	Antidiabetic	Hammeso WW, et al., 2019
Salacia reticulate	Root	Phenolic acid	Hyperglycemic	M. Bagnazari, et al., 2016
Solanum nigrum	Leaves	Flavonoids and polyphenols	Antidiabetic	M.Rajathi 2015
Tamarindus indica	Stem bark	Alcoholic	Antioxidant activity	Agnihotri A, et al./, 2013

Zingiber officinal	Rhizome	Ethanolic	Antihyperglycemic	AL-Amin ZM, et al., 2018

Given the rising incidence of mood disorders (such as bipolar disorder, obsessive-compulsive disorder, anxiety, and depression) among individuals with diabetes, herbal treatment approaches offer potential benefits. Table 2 enumerates several herbal plants utilized for managing mood disorders in diabetic patients.

Hippophae rhamnoides(L.)

Hippophae rhamnoides L. (HR), commonly known as sea buckthorn (family: Elaeagnaceae), originates from Europe and Asia [Rousi 1971]. It is widely recognized globally for its nutritional and medicinal properties, with all parts of the plant valued as rich sources of numerous bioactive compounds. HR leaves contain significant amounts of flavonoids, tannins, and triterpenes [Kallio et al., 2002]. Studies have explored its potential for treating cognitive dysfunction in Alzheimer's disease, cognitive impairment in schizophrenia, and its antidepressant-like effects in various animal models [Wesolowska & Niliforuk 2007].

Bacopa monnieri (L)

Bacopa monnieri (L.) Pennell, commonly known as "Brahmi" in India, is a perennial creeping plant belonging to the family Scrophulariaceae. It is native to the United States and East Asia [S.C.H. Barrett et al., 2005]. *Bacopa monnieri* is renowned as a brain tonic and is extensively utilized in numerous Ayurvedic herbal preparations for its memory-enhancing and cognition-boosting effects [M.D. Nemetchek et al., 2017]. It has also been documented to exhibit anti-ulcerogenic, antioxidant, antidepressant, hepatoprotective, neuroprotective, and anxiolytic properties. *Bacopa monnieri* contains various phytochemicals, with the most notable ones being triterpenoid saponins known as bacosides [Aguiar S et al., 2013].

Curcuma longa (L)

Curcumin, a polyphenol found in turmeric, is primarily responsible for its therapeutic properties, which encompass antioxidant, anti-inflammatory, antimutagenic, and antimicrobial activities. Due to its molecular structure and ability to penetrate the blood-brain barrier, curcumin holds promise for neuroprotection [M. Guariglia et al., 2023]. Research has demonstrated beneficial effects of curcumin on central nervous system functions, including neuroprotective effects against depression-like behavior in animal models [Da Silva Morrone M. et al., 2016].

Dioscorea bulbufera (L)

Dioscorea bulbifera, commonly known as air potato or varahikand, is valued for its antidiabetic and antidepressant properties [Rgo Tde S, 2014 & Ghosh S, et al., 2012]. This plant possesses two types of storage organs: bulbils found in the leaf axils of the stem and tubers. Traditionally, bulbils have been employed as a folk remedy for ailments such as diarrhea and conjunctivitis, while extracts from the plant exhibit anti-tumor activity. The mannose-binding lectin isolated from bulbils of D. bulbifera has been investigated for its potential clinical applications in HIV and cancer research [Sharma M, et al., 2017].

Various extracts derived from the bulbs of the plant have been documented for their diverse pharmacological activities, including antihyperlipidemic, antitumor, antioxidant, anorectic, analgesic, antihyperglycemic, and antidepressant effects [T.B. Nguelefack, 2011 & Z. Ahmed et al., 2009]. Different species of Dioscorea have traditionally been utilized for treating

memory-related disorders and neurodegenerative diseases such as Alzheimer's disease [Yang MH et al., 2009].

Table 2: Plant having antidepressant activity (Mood Disorder):

Plant name	**Parts used**	**Extract**	**Uses/ Activity**	**References**
Phyllanthus amarus	Leaves	Petroleum et her, chloroform, ethanolic	Stomachic, a digestive; rejuvenate, for promoting memory and intellect, for skin disorders, and as an antiepileptic, antipyretic, and analgesic	Wasnik U, et. al., 2014
Phyllanthus amarus	Leaves	Methanolic	Central nervous syste m (CNS) disorders	Santosh P, et al., 2011
Jasminum sambac	Leaves	Methanolic	Antidepressant, antise ptic, aphrodisiac, sedative, antimicrobial, cytotox ic and expectorant	Thaakur K. A, et. al., 2014
Eicchornia crassipes	Plant le avs and sho ots	Aqueous, chloroform	Nervine tonic, antidepressant(traditio nal) anti inflammatory activity	Kumar et. al., 2015
Asparagus recemosu	Seeds	Methanolic	Antidepressant it help s with nervousness, pain, restless sleep, disturbing drea ms and people with weak emotional and physical heart.	Krishna.K.S. et. al., 2013
Cucurbita pepo	Seeds	Aqueous , alcoholic	Antidepressive, anti helminthic activity an d antimicrobial activity	Umadevi P, et. al., 2011
Nardostachys jatama nsi	Roots	Ethanolic	Nervous headache, low and high blood pr	Meenakshi S.M, e t. al., 2016

			essure	
Uncaria lanosa wallich var. appendiculata ridsd	Stem and hooks of plants	Ethanolic	Anti Parkinsonian, Anti Alzheimer's disease.	LiehChin et. al. 2012
Pogostemon cablin	Leaves	Aqueous, ethanolic	Anti stress, Antioxidant anti inflammatory	Thaakur K. A, et al., 2014
Hedranthera barteri	Roots	Dichloromethane	The management of certain nervous system challenge	Zhao Z, et. al., 2008
Rosmarinus officinalis	Fresh juice	Hydroalcoholic	Antioxidant, healing activity, alzheimer's disease	Machado DG, et. al., 2009
Salvia elegans	Leaves	Hydroalcoholic	Anxiety	Mora S, et. al., 2006
Gingko biloba	Leaves	Lipophilic	Memory enhancer, dementia	Sakakibara H, et. al., 2021
Areca catechu	Areca nut	Dichloromethane, ethanolic	Anemia, schizophrenia	Dar A, et al., 1997
Curcuma longa	Root (rhizome)	Aqueous	Alzhiemer's disease	Yu ZF, et. al., 2002
Zingiber officinalle	Rhizome	Hydroalcoholic	Headache, nausea, hypotensive effect,	Tiwari P et al, 2012
Morinda officinalis	Root	Ethanolic	Antihypertensive, laxative	Zhang ZQ, et. al., 2021
Withania somnifera	Aerial part	Chloroform	Anti stress, immunomodulator	Bhattacharya S.K. et al. 2000
Cynanchum Otophyllum	Roots	Chloroform	Nervous system and mental, depression and Menier's syndrome	Li , Luo Y, rt. Al., 2016
Alpinia zerumbet	Leaves	Ethanolic	Antihypertensive	Bevilaqua F, et al., 2015
Fructus Akebiae	Fruits	Ethanolic	Treating mental disorders and cognitive and behavioral deficits, including insomnia	Zhou D, et. al., 2010

			and dreaminess, loss o f memory, paraphasia, phobia, and depressive disord er	
Toona ciliata Roem. var. yunnanensis	Leaves	n hexane	Improving memory , improving cognitive performance and brai n degeneration	Dongmei D, et. al., 2015

Conclusion:

The global prevalence of diabetes mellitus is on the rise, often linked to decreased insulin production or resistance to its action. However, certain plant-derived medicines show promise for cost-effective diabetes management through dietary interventions, nutrient supplementation, and combination therapies with conventional drugs in the short term. They may even serve as standalone medications sourced from natural origins in the long term. The presence of bioactive chemicals posseesing anti-inflammmatory, anti-oxidant action, and sugar lowering tendency can be used for the management of mental health in diabetic patients. While several noteworthy antidiabetic plants have been discussed previously, further research is necessary to understand the mechanisms of action underlying the effects of medicinal plants with antidiabetic properties.

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