Study of Medicinal plants used in Ayurveda for the treatment of Diabetes

Dr.Remeshkumar.S[1*], Dr.Biju.C[1] and Dr.Jayalekshmi.R[2]

[1*]Department of Botany, VTMNSS College, Dhanuvachapuram, Thiruvananthapuram
[1]Department of Botany, Sree Narayana College, Varkala, Thiruvananthapuram
[1]Department of Botany, MMNSS College, Kottiyam, Kollam

ABSTRACT

Ayurveda, the ancient Indian system of medicine, follows a holistic approach that emphasizes treating the patient as a whole rather than focusing solely on the disease. This distinctive methodology gives Ayurveda a special status among traditional healthcare systems. The present study explores the significance of twelve medicinal plants widely used in Ayurvedic formulations for the treatment of diabetes. These plants, in their entirety or through specific parts, are utilized in various therapeutic preparations. The rising global interest in Ayurvedic medicine is largely attributed to its minimal side effects and natural healing potential. For the people of Kerala, Ayurveda is an integral part of their cultural heritage, and their bodies are often more receptive to its remedies. This study aims to highlight the medicinal value of these plants and raise public awareness, which is essential for their conservation and sustainable use. In conclusion, Ayurvedic treatment offers a promising and natural alternative for managing diabetes, potentially benefiting the broader ailing population.

Key words : Ayurveda, treatment of diabetes, medicinal plants

INTRODUCTION

Plants have been used for medicinal purposes long before prehistoric period. Ancient Unani manuscripts Egyptian papyrus and Chinese writings described the use of herbs. Evidence exist that Unani Hakims, Indian Vaids and European and Mediterranean cultures were using herbs for over 4000 years as medicine. Indigenous cultures such as Rome, Egypt, Iran, Africa and America used herbs in their healing rituals, while other developed traditional medical systems such as Unani, Ayurveda and Chinese Medicine in which herbal therapies were used systematically.
Traditional systems of medicine continue to be practised on account of population rise, inadequate supply of drugs, side effects of many synthetic drugs and development of resistance to currently used drugs for infectious diseases. These facts led to increased emphasis on the use of plant materials as a source of medicines for a wide variety of human ailments.

Among ancient civilizations, India has been known to be rich repository of medicinal plants. Medicinal plants have been an integral part of the ethnobotanical aspects of the people of Asia for centuries. Since indiscriminate use of synthetic drugs and antibiotics may cause health hazards and toxicity to the human, people are more favourable to use natural compounds obtained from plants. Thus plants remain a major source of medicinal compounds and the Indian traditional system of medicine use more than 200 species of plants on their pharmacopoeias. (Hussain, 1991). The plants also provide nourishment and protective substances for the good health of human beings. Because of this fact people have been using plant products as medicines for curing variety of diseases since time immemorial (Pagare, 2007).

Approximately 80% of the total populations of developing countries depend on plant derived medicines for their primary health care(Farnsworth et al, 1985).In India, over 7500 species of plants are estimated to be consumed by 4635 ethnic communities for health care needs. Over 1700 species of plants are fully documented in terms of their biological properties and over 10000

herbal drug formulations are recommended for a range of health conditions (Shankar et al 1997). About 85% of the world's flora of higher plants remains to be screened for medicinal activities (Spjut, 1985). As a result of the increase in the human population and destructive harvesting, medicinal genetic resources are getting depleted rapidly. Estimates suggests that over a half a million tones of dry raw material are indiscriminately and destructively collected from the wild each year.

Records of early civilization in all parts of the world reveals that a considerable number of drugs used in modern medicine were in use even in ancient times. The use of plants for curing various human ailments figured in ancient manuscripts such as the Bible, the Rig-Vedas, the Iliad and the Odyssey and the history of Herodotus. In India the ayurvedic system of medicine has been in use for over 3000 years. Charaka and Susrutha, two of the earliest Indian authors had sufficient knowledge of the properties of the Indian medicinal plants. Their medicinal works viz. Charaka samhita and Sushrutha samhita are esteemed even today as treasures of literature on Indigenous medicine.

In "Ayurveda" there is special importance to medicinal plants and its usage. Its importance can be easily understood through these words.

" Naa Oushadha bootham Jagathi Kinjith
Dravyamastivi Vidardha Prayoga Vasadha".

Veda.

The phytochemicals identified from traditional medicinal plants have enormous opportunities for the development of new types of therapeutics. Several treatments are there in various medical fields such as Allopathy, Ayurveda, Unani, Siddha etc. Even still the value of herbs is increasing. So the present work has more relevance in this situation. The use of medicinal plants for the treatment had a major advantage that they are natural and known to have less side effects.

Diabetes mellitus is a syndrome that is characterised by hyperglycemia, change in the metabolism of lipids, carbohydrate and proteins. Diabetes mellitus is the most common chronic and metabolic disease characterised by an increase in glucose levels due to absolute or relative insulin deficiency. The disease is associated with eye, renal, cardiovascular and neurological complications in the long term. The disease is also associated with symptoms such as polyuria, fatigue, weight loss, delayed wound healing, blurred vision, increase in urine glucose levels etc.. Destruction of beta cells of the Islets of Langerhans in the pancreas and consequently development of insulin dependent diabetes is one of the impairments of the regulation of the immune system. There are currently more than 150 million people with diabetes across the world which seems to reach 300 million by 2025.

The present study is concentrated on plants used for the treatment of Prameha (Diabetes mellitus) in our traditional Ayurvedic treatments. Diabetes mellitus is a metabolic disorder where the human body does not produce or properly uses insulin, a hormone which is required to convert sugar, starches and other food materials into energy. The problem could be that our body do not make insulin or do not use insulin properly. Diabetes mellitus is characterised by constant levels of blood glucose(sugar). Human body has to maintain the blood glucose level at a very narrow range, which is done with insulin and glucagon. The function of glucagon is to release glucose from the liver to the blood stream so that it can be transported to the body tissues and cells for the production of energy.

Antidiabetic plants were widely distributed in six continental regions and some specific regions around the world. The most common and effective antidiabetic medicinal plants of Indian origin are Bael (*Aegle marmelos*), Ivy gourd(*Coccinia indica*), Cluster Fig (*Ficus racemosa*), Guava (*Psidium guajava*), Garlic (*Allium sativum*), Bitter gourd (*Momordica charantia*), Jamun (*Syzygium cumini* (Linn**)**) Skeels, Fenugreek seeds **(***Trigonella foenum graecum),* Indian Kino tree

(*Pterocarpus marsupium*), Turmeric **(***Curcuma longa***),** Cow plant **(***Gymnema sylvestre***)** and Goose berry **(***Phyllanthus emblica Linn***).**

Most plant contains carotenoids, flavonoids, turpenoids, alkaloids, glycosides and can often have antidiabetic effects. The anti hyperglycaemic effects resulting from treatment with plants are usually attributed to their ability to improve the performance of pancreatic tissue, which is done by increasing insulin secretions or by reducing the intestinal absorption of glucose. Herbal medicines and plant components with insignificant toxicity and no side effects are notable therapeutic options for the treatment of diabetes.

There are three main types of diabetes Type I, Type II and gestational diabetes. Type I diabetes is an auto immune disease that leads to the destruction of insulin producing pancreatic beta cells. Insulin is an essential anabolic hormone that exerts multiple effects on glucose, lipid, protein and mineral metabolism as well as growth. Insulin allows glucose to enter muscle and adipose cells, stimulates the liver to store glucose as glycogen and synthesize fatty acids, stimulates the uptake of amino acids, inhibits the breakdown of fat in adipose tissue and stimulates the uptake of potassium into cells. People suffering from this disease require life long insulin replacement therapy.

Type II diabetes is a metabolic disorder that causes the blood sugar level to increase (Hyperglycaemia). This is a common metabolic condition that develops when the body fails to produce enough insulin or when insulin fails to work properly, which is referred to as insulin resistance. People usually develop type II diabetes after the age of 40 years. The disease often develop as a result of overweight, obesity and lack of physical activity and diabetes prevalence is on the rise world wide as these problems become more wide spread.

Gestational diabetes means high blood sugar levels during pregnancy. The disease is more dangerous for pregnant women and her foetus. In many women it is a temporary condition that goes away after birth. However, if the women are at risk of developing gestational diabetes, they should work with the doctor to manage their blood sugar levels throughout pregnancy. They can look for an easy high blood sugar during pregnancy meal plan and exercise regularly to maintain healthy blood sugar levels. Maintaining blood sugar levels during pregnancy keeps your pregnancy and baby away from several health related complications.

MATERIALS AND METHODS

The present study focused on twelve medicinal plants commonly used in Ayurvedic preparations for Diabetes in the form of Kashaya, Kwatham, Gutika, Choornam, Arishta, Rasayanam etc. (Dwarakanath, 1958). Plants studied were listed with Malayalam name, Sanskrit name, Scientific name, and Family below in table I.

Table 1. Ayurvedic medicinal plants used for the treatment of Diabetes mellitus.

Sl.No	Scientific name	Family	Malayalam name	Sanskrit name
1	*Aegle marmelos* (L) Corr.Serr.	Rutaceae	Koovalam	Bilwa
2	*Syzygium cumini* (L) Skeels.	Myrtaceae	Njaval	Jamboo
3	*Trigonella foenum graecum* (L.)	Fabaceae	Uluva	Medhika
4	*Pterocarpus marsupium. (*Roxb)	Fabaceae	Venga	Asana
5	*Coccinia indica* (L.) Voigt.	Cucurbitaceae	Koval	Bimbika
6	*Curcuma longa* (L.)	Zingiberaceae	Manjal	Haridra
7	*Gymnema sylvestre* (R.Br.)	Asclepiadaceae	Chakkarakolli	Madhulika
8	*Phyllanthus emblica* (Linn.)	Euphorbiaceae	Nellikka	Amalaki
9	*Ficus racemosa* (Linn.)	Moraceae	Athi	Sadaphalah
10	*Allium sativum* (Linn.)	Liliaceae	Veluthulli	Ugragandha
11	*Momordica charantia* (Linn.)	Cucurbitaceae	Paval	Caravalli
12	*Psidium guajava* (Linn.)	Myrtaceae	Perakka	Perukam

RESULTS

Literature review shows that Diabetes is a chronic disease which is described in all authentic texts of Ayurveda (Dwarakanath, 1958). Even though many modern drugs are available in the market, they are not competent enough to manage this serious health hazard, more over they can produce adverse effects also. So scientists in the field of medicine are in search of alternative remedies to manage the disease. Here comes the importance of Ayurveda and the present study.

The data collected during the study were based on enquiries with Ayurveda Physicians. We collected informations regarding the different parts of plants used in different preparations of Ayurvedic medicines by Ayurveda Physicians. The morphological features of all plants selected for the present study were studied by referring authentic books available . The data regarding the medicinal plants were described below.

***Aegle marmelos* (L) Corr. Serr.**

Sanskrit name -- Bilwa
Malayalam name -- Koovalam
Family --- Rutaceae
Distribution -- Throughout India

Plant – A medium sized armed deciduous tree upto 80m high with straight sharp axillary forms and yellowish brown shallowly furrowed corky bark, leaves trifoliate, aromatic and alternate . Leaflets are ovate, ovate lanceolate, crenate, pellucid and punetate. The lateral sub sessile and the terminal long petioled flowers greenish white, sweet scented in axillary panicles, fruits globose, woody berry with yellowish rind, seeds numerous oblong, compressed embedded in orange brown sweet gummy pulp.

Parts Used—Roots and fruits

Leaf extract of this plant is being used in Ayurveda as a medicine for diabetes. Methanolic extract of this plant is found to reduce blood sugar in alloxan diabetic rats. (Sabu. M.C. and Ramadasankuttan, 2004)

***Syzygium cumini* (L) Skeels.**

Sanskrit name -- Jamboo
Malayalam name -- Njaval
Family --- Myrtaceae
Distribution—

Throughout India, in forests upto 1800m usually along river banks and moist localities, also cultivated as shade trees along road sides.

Plant -- A medium sized to large tree, 15-30m height with smooth light grey bark having dark patches, leaves simple, opposite, variable in shape, about 2.5cm broad and 8- 15cm long, acuminate, nerves joining in a distinct intra marginal nerve gland, gland dotted, smooth and shiny, flowers greenish white in trichotomous panicles, fruits oblong or ovoid- oblong, dark purple with pinkish juicy pulp, one seeded.

Parts Used—Bark, leaves and fruits.

Jamun is believed to be of special use in the treatment of diabetes. The leaves, bark, and seeds are the most useful parts among which the seeds are popular for their anti diabetic action. The key ingredient that shows anti diabetic action is jamboline in the seeds. Extracts of the bark, seeds and leaves have been found to cause a marked prolonged decrease in blood sugar and glycouria(Sugar in urine).(Sagrawat et al. 2006)

***Trigonella foenum graecum* (L.)**

Sanskrit name -- Medhika
Malayalam name -- Uluva
Family --- Fabaceae

Distribution—Wild in Kashmir, Punjab and upper Gangetic plains, also cultivated in many other parts of India as a pot herb.
Plant—An aromatic erect annual, 30--60cm height, leaves pinnate, 3-foliate, leaflets toothed, flowers white or yellowish, fruit axillary, pods 5-8cm long with a deep groove across one corner.
Parts used—Leaves and seeds.

The seeds of fenugreek have antidiabetic properties that help in the prevention and treatment of diabetes. Fenugreek seeds are high in soluble fiber that modulates postprandial blood glucose levels by delaying the absorption of sugar in the intestines. These seeds lower blood sugar levels by slowing down digestion and absorption of carbohydrates. Fenugreek seeds can improve metabolic symptoms associated with type I and Type II diabetes by lowering blood glucose levels and improving glucose tolerance.

***Pterocarpus marsupium*.(Roxb.)**

Sanskrit name -- Asana
Malayalam name -- Venga
Family --- Fabaceae
Distribution- Throughout India in deciduous and evergreen forests.

Plant—A medium sized to large tree , 15-30m in height with dark brown or grey bark having shallow cracks, exfoliating in thin flakes and exuding a red gummy substance on injury. Leaves compound, imparipinnate, leaflets coriaceous, oblong, obtuse, emarginated or even bilobed at apex, glabrous on both surfaces, main nerves numerous, prominent, flowers yellow in terminal panicles, corolla with wisped margins, fruits nearly circular, glabrous, flat, winged pods, convexly curved between stipe and style, seeds 1-2 convex bony.
The heart wood is stony tough, very hard and moderately heavy and is golden brown or reddish brown on exposure with darker streaks. Aquous extract of the wood is yellowish blue and fluorescent.

Parts used—Heart wood, Leaves, flowers and gum.

Ancient time *Pterocarpus marsupium* tumbler to drink water for diabetic persons. This can lower down the blood sugar level . The heart wood of the Indian Kino tree is used for *Pterocarpus marsupium* tumbler. The water kept for a number of hours in the tumbler results in the release of its essence to the water. Using this water can reduce the blood sugar levels drastically.

***Coccinia indica* (L.)Voigt.**

Sanskrit name -- Bimbika
Malayalam name -- Koval
Family --- Cucurbitaceae

Distribution- Wild in many parts of India. Cultivated in Assam, West Bengal, Bihar, Orissa, Maharashtra, Andhra Pradesh, and Tamil Nadu.

Action carminative, antipyretic, galactogogue. Powder of root is taken with water to stop vomiting. Juice of the leaves are antispasmodic and expectorant. Applied externally in eruptions of the skin, Root antiprotozoal, fruit, leaf and root antidiabetic. Various plant parts are used in slow pulse and convulsions, also against infective hepatitis. The Ayurvedic pharmacopoeia of India recommends the whole plant for oedema, anaemia, disorders due to vitiated blood, cough and dyspnoea.The fruit yielded beta amyrin and its acetate lupeol and cucurbitacin B. The ethanolic leaf extract of this plant has strong antidiabetic activity and can be meaningfully utilized in the management of diabetes

***Curcuma longa* (L.)**

Sanskrit name -- Haridra
Malayalam name -- Manjal
Family --- Zingiberaceae

Distribution- . Cultivated all over India particularly in West Bengal, Tamil Nadu, and Maharashtra.

Action- Anti-inflammatory, cholagogue, hepatoprotective, blood purifier, anti oxidant, detoxifier and regenerator of liver tissue, antiasthmatic, antitumour, anticutaneous, antiprotozoal, stomachic, and carminative. Reduces high plasma cholesterol. Antiplatelet activity offers protection to heart and vessels. Also protects against DNA damage in lymphocytes. The rhizomes have curcuminoides, the mixture known as curcumin and monodesmethoxy curcumin. Turmeric and curcumin increase the mucin content of the stomach and exert gastro protective effects against stress, alcohol, drug-induced ulcer formation. The ethanolic extract of the rhizome exhibited blood sugar lowering activity in alloxan-induced diabetic rats.

***Gymnema sylvestre*. R.Br.**

Sanskrit name -- Madhulika

Malayalam name -- Chakkarakolli

Family --- Asclepiadaceae

Distribution- . Central and peninsular India.

Action- Plant-diuretic and antibilious, leaf-antidiabetic. Stimulates the heart and circulatory system, activates the uterus. Used in parageusia and furunculosis. Root- emetic, expectorant, astringent and stomachic. Gymnemagenin, the main sapogenin in the leaves, yield gymnemic acid. Gymnemic acids are antisweet principles and exhibit inhibitory effect on levels of plasma glucose. The extract of dried leaves, given to diabetic rats was found to bring about blood glucose homoeostasis by increasing serum insulin levels. Increased glycoprotein level and the resultant nephropathy, retinopathy and micro-and macro-angiopathy were also controlled. The leaf extract when orally administered to experimentally induced hyperlipidaemic rats, reduced the elevated serum triglyceride and total cholesterol in a dose-dependent manner. In homoeopathy, a drug obtained from the leaves and roots is prescribed for both diabetes mellitus and insipidus. Gymnemic acid is reported to inhibit melanin formation in vitro.

***Phyllanthus emblica.* Linn.**

Sanskrit name -- Amlaki

Malayalam name -- Nellikka

Family --- Euphorbiaceae

Distribution- Native to tropical Southeast Asia; distributed throughout India; also planted in public parks.

Action- Fruit, antianaemic, anabolic, antiemetic, bechic, astringent, antihaemorrhagic, antidiarrhoeal, diuretic, antidiabetic, carminative and antioxidant. Used in jaundice, dyspepsia, bacillary dysentery, eye trouble and as a gastrointestinal tonic. Juice with turmeric powder and honey is prescribed in diabetes insipidus. Seed antibilious and antiasthmatic used in bronchitis. Bark, astringent. Leaf, juice is given in vomiting. A decoction of powdered pericarp is prescribed for peptic ulcer. The fruit is an important source of vitamin C, minerals and amino acids. The edible fruit tissue contains protein concentration three fold and vitamin C (ascorbic acid) concentration more than those of apple. The fruit also contains considerably higher concentration of most minerals and amino acids than apple. Fruit juice, its sediment and residue are antioxidant due to gallic acid.

***Ficus racemosa*(Linn.)**

Sanskrit name -- Sadaphalah

Malayalam name -- Athi

Family --- Moraceae

Distribution- Distributed throughout India.

A moderate to large sized spreading laticiferous deciduous tree without much prominent aerial roots. Leaves dark green, ovate or elliptic. Fruit receptacles 2.5cm in dia.sub globose or

pyriform in large clusters on short leafless branches arising from main trunk or large branches. Figs are smooth or rarely covered with minute soft hairs, when ripe they are orange dull reddish or dark crimson. They have a pleasant smell resembling that of Cidar apples.
The bark is astringent, rusty brown with a fairly smooth and soft surface, the thickness varies from 0.5-2cm according to the age of the trunk or bark, surface with minute separating flakes of whitish tissue. Texture homogenous leathery.
Parts used- Root, bark, leaves, fruits and latex.

Properties and uses- Roots are useful in treating dysentery, bark is astringent, antidiabetic, refrigerant and useful as a wash for wounds. Highly efficacious in threatened abortions and also recommended in uropathy. Powdered leaves mixed with honey are given in vitiated conditions of pitta . A decoction of the leaves is a good wash for wounds and ulcers. Figs are used in vitiated conditions of pitta, diarrhoea, dyspepsia and haemorrhages. Ripe fruits are astringent, stomachic, refrigerant and carminative and are useful in menorrhagia and haemoptysis. Latex aphrodisiac and is administered in haemorrhoids and diarrhoea.

***Allium sativum*. Linn.**

Sanskrit name -- Ugragandha
Malayalam name -- Veluthulli
Family --- Liliaceae
Distribution- Native to Central Asia .Cultivated throughout India.

Action—Antibiotic, bacteriostatic, fungicide, anthelmintic, antithrombic, hypotensive, hypoglycaemic, hypocholestrolaemic , also used for upper respiratory tract infections and catarrhal conditions.

Key application—As a supportive to dietary measures for elevated levels of lipids in blood, as a preventive measure for age dependent vascular changes.

Antidiabetic activity

The presence of allicin, garlic has significant hypoglycaemic action and this effect is thought due to increased hepatic metabolism or increased release of insulin and insulin sparing effect.(Capasso, 2013). Garlic was effective in reduction of blood glucose in streptozotocin as well as alloxan induced diabetes mellitus in rats and mice(Sheela et al. 1995, Ohaeri,2001).

***Momordica charantia.(*Linn.)**

Sanskrit name -- Caravalli
Malayalam name -- Paval
Family --- Cucurbitaceae
Distribution- Mainly distributed in the tropical and subtropical regions of the world.

The plant is an annual climbing herb or vine usually possess stem tendrils. Stem is herbaceous, pentangular with ridges and furrows and contains two rings of bicollateral vascular bundles. Tap root system. The plant bears simple alternate leaves across, with three to seven deeply separated lobes with reticulate venation. Flowers yellow in axillary cymose or the flowers solitary. Flowers are bracteate, pedicellate, dichlamydous, unisexual, regular, actinomorphic , pentamerous cyclic and epigynous.
Fruits pepo or capsule and green seeds are flat, numerous with straight embryo, non endospermous.

The fruit is short, spindle shaped , green colored with bitter taste. Fruit is used for the treatment of diabetes and related conditions. It has significant antidiabetic as well as hypolipidemic activity so that it can be used as an adjuvant along with allopathic treatment of medicine to treat diabetes as well as to delay the complications of diabetes.
The plant is suggested for hyperglycaemia treatment due to its ability to reduce glucose levels in the body. Some of the bioactive compounds have antidiabetic effect.
The plant is also used for preventing and treating various diseases. The pulp of the fruits are used in treating asthma, cough, fever, skin diseases, ulcers and wound.

The major compounds present in this plant are triterpenes, alkaloids, glycosides , Vitamin C, steroids and protein.

Psidium guajava. **(Linn.)**

Sanskrit name -- Perukam

Malayalam name -- Perakka

Family --- Myrtaceae

Distribution- The plant has been greatly extended through cultivation and it is now wide spread throughout the tropics and sub tropics.

The plant is a fast growing evergreen tree . It has a shallow root system. The plant produces low drooping branches from the base and suckers from the roots. Young twigs are pubescent. The leaves grow in pairs opposite to each other. Leaf blade is elliptic to oblong in shape. The flowers are white in colour, solitary or 2—3 flower clusters born at the axils of newly emerging lateral shoots. Fruit is a fleshy berry. Fruit contains variable number of seeds and its mesocarp is characterized by the presence of small and hard fibrous structures called stone cells which may cause damage to processing machinery.

The plant is found to be effective in diabetes, diarrhoea, dysentery, gastroenteritis, hypertension, pain relief, cough, oral ulcers and to improve locomotors coordination and liver damage inflammation. People use guava leaf for stomach and intestinal conditions, pain, diabetes and wound healing.

DISCUSSION

In the present study, twelve plants from different locations were selected based on their use in Ayurvedic medicines for Diabetes. It includes *Aegle marmelos*, *Coccinia indica*, *Ficus racemosa*, *Psidium guajava*, *Allium sativum*, *Momordica charantia*, *Syzygium cumini, Trigonella foenum graecum , Pterocarpus marsupium*, *Curcuma longa***,** *Gymnema sylvestre* and *Phyllanthus emblica* .

The present study was concentrated on antidiabetic action and morphological features of the above twelve medicinal plants used in Ayurveda. Ayurveda is not merely a system of medicine in the ordinary sense of the term. No medicinal system even its widest sense can fully embrace that field of knowledge and activity which Ayurveda covers. On analysing the data collected from twelve medicinal plants fresh plant parts viz. stem, bark, root, leaves etc. were used for the treatment of diabetes. Most of these plants were not only used for the treatment of diabetes but also for many other diseases in Ayurveda (Dwarakanath,1958). Plants selected were charted below based on their useful parts for diabetes treatment (Table II).

The most important pharmacological activity of the leaves of *Aegle marmelos* has been found to be its antidiabetic activity but the mechanism of hypoglycaemic action of leaves is not clear and may be the result of improvement in the functional status of beta cells, and by reversing the histologic and ultra structural changes in the pancreas and liver of rats with streptozotocin-induced diabetes.(Das et al. 1996).

Diabetes management through the use of *Syzygium cuminii* has been demonstrated. Jamun fruits reduces the sugar in the blood and is very good in the control of diabetes. Its seeds contain Glucoside, Jamboline and El-lagic acid, which are reported to have the ability to check the conversion of starch into sugar, in case of excess production of glucose. Various traditional practitioners in India use the different parts of the plant for treating diabetes. (Chaudhary and Mukhopadhyay. 2012).

The antidiabetic properties of the seeds of fenugreek have been investigated the most and reports are suggestive to the fact that the protective effects are seen in both laboratory animal and humans (Koupy et al. 2015).

The leaves of guava are traditionally used for reducing the blood glucose level in alloxan induced diabetic rats. The antidiabetic and antioxidant activities of leaf extracts of guava were deeply analysed by Simamora et al .2018.

Table 2. Plants charted based on their useful parts for the treatment of Diabetes

Sl. No	Parts used	Scientific name of plants
1	Bark	*Syzygium cumini* (L) Skeels.
2	Fruit	*Syzygium cumini* (L) Skeels. *Momordica charantia*(Linn.) *Allium sativum* (Linn.) *Ficus racemosa* (Linn.) *Phyllanthus emblica* (Linn.) *Aegle marmelos* (L.) Corr.Serr.
3	Seed	*Trigonella foenum greacum* (Linn.)
4	Leaves	*Psidium guajava* (Linn.) *Aegle marmelos* (L.) Corr.Serr. *Gymnema sylvestre*.R.Br. *Coccinia indica* (L.)voigt *Syzygium cumini* (L) Skeels.
5	Rhizome	*Curcuma longa* (Linn.)
6	Heart wood	*Pterocarpus marsupium* (Roxb.)

SUMMARY AND CONCLUSION

Ayurveda has a different approach that the patient is treated as a whole and not the disease alone. This holistic approach gives a special status to it. The present study deals with the importance of twelve medicinal plants in Ayurveda used for the treatment of diabetes. Whole plant or different parts of these plants were used for making Ayurvedic preparations. Today the significance of Ayurvedic medicines is increasing tremendously because of its less side effects. For Keralites Ayurveda is our natural system of treatment and so their body will respond quickly. The present study surely light little knowledge towards the importance of these medicinal plants and provide awareness to the common people which help for the conservation of these plants in future. To conclude Ayurvedic treatment could be a blessing to the ailing community.

REFERENCES

1. Capasso. A. Antioxidant action and therapeutic efficacy of *Allium sativumm*. L.Molecules. 2013; 2013; 18: 690-700.
2. Chaudhary, B and Mukhopadhyay, K. 2012. *Syzygium cumini* (L.) Skeels: A potential source of nutraceuticals. Int. J. Pharm. and Biol. Sci. 2(1) : 46- 53.
3. Das A.V., Padayatti P.S., Paulose C.S: Effect of leaf extract of *Aegle marmelos* (L.) Correa ex Roxb. on histological and ultra structural changes in tissues of streptozotocin induced diabetic rats. *Indian J Exp Biol.* 1996; 34(4), 341-348.
4. Deyno, S., Eneyew, K., Seyfe, S., et al. (2021). *Efficacy, safety and phytochemistry of medicinal plants used for the management of diabetes mellitus in Ethiopia: A systematic review.* Clinical Phytoscience, 7, 16
5. Dwarakanadh. C. 1958. Text book of 'The Fundamental Principles of Ayurveda and Introduction to Kayachikitsa'.
6. Farnsworth, N.R, Akerele,O. and Bigel, A.S.1985. Medicinal plants in therapy. *Bull World Organize.* 63: 965-981.
7. Hussain. A.1991. Economic aspects of exploitation medicinal plants. Pp.124-138 In: *The conservation of medicinal plants.* Akerele, O,Heywood and Synge,H.(Eds.)Cambridge University Press, Cambridge, New York.
8. Hussain, S. A., Namilikonda, G., Chandra, T. K., & Pasha, M. A. (2020). *A review on medicinal plants with anti-diabetic activity.* International Journal of Advanced Research, 8(3), 902–917– Comprehensive overview of Indian medicinal plants with antidiabetic properties.

9. Koupy.D, Kotolova ,H. and Rudakucerova. J. 2015. Effectiveness of phytotherapy in supportive treatment of type II diabetes mellitus II. Fenugreek(*Trigonella foenum graecum*). Ceskaslov Farm. 64(3): 67-71.
10. Ohaeri. O.C. Effect of garlic oil on the levels of various enzyme in the serum and tissue of streptozotocin diabetic rats. Biosci. Rep. 2001; 21: 19-24.
11. Pagare. P.K. 2007. Medicinal plants. APH Publishing Cooporation.Pp: 205.
12. Sabu. M.C. and Ramadasankuttan. Antidiabetic activity of *Aegle marmelos* and its relationship with its antioxidant properties. Indian J Physiol Pharmacol. 2004; 48(1):81-88.
13. Sagrawat,H., Mann, A.S. and Kharya, M.D.2006. Pharmacological potential of *Eugenia jambolana:* a review. *Pharmacognosy Magazine*. 2: 96-105.
14. Shankar,D., Ved. D.K., Tandon, V., Ramesh.S.R., Kareem,A. and Singh. P. 1997.
15. Conserving a National Resource- Need for a National Policy and National Programme on Medicinal Plant Conservation. Pp. 103-117. In: *Boidiversity and Tropical Forests- The Kerala Scenario*.Pushpangadhan, P. And Nair. K.S.S(eds.)STEC, Kerala Pavithra, P., Vasantha, B., & Totad, M. (2022). *An open label, single arm prospective clinical study on the effectiveness of Pugaarimeda Kashaya in Madhumeha (Type 2 Diabetes Mellitus).* Journal of Ayurveda and Integrated Medical Sciences**,** 7(8), 01–07. Published October 2, 2021
16. Sheela .C.G,Kumud. K, and Augusti. K.T. Antidiabetic effect of onion and garlic sulfoxide amino acids in rats. *Planta Medica.* 1995; 61: 356-7.
17. Simamora. A, Paramita. L., Nur Azreen Binti Mohamad. H., Widodo Santoso. A., and Kris Herawan. T. Antidiabetic and Antioxidant Activities of *Psidium guajava* leaves extracts. ndones Biomed.J. 2018; 10(2): 156-64.
18. Spjut, R.W. 1985. Limitations of a random screening: Search for new anticancer drugs in higher plants. *Econ. Bot*._39:266-288.
19. Wasana K. G. P. et al. (2021). *Efficacy and Safety of an Ayurveda Herbal Formulation in Uncomplicated Type 2 Diabetes Mellitus.* Phytomedicine**,** 81, 153431. Epub December 2020; PubMed PMID: 33352495