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INVESTIGATIONS ON ANTI-DIABETIC MEDICINAL PLANTS USED BY TRIBES OF WAYANAD DISTRICT, KERALA

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ABSTRACT: The present study aims to explore the ethnomedicinal knowledge of the plants and their preparations used to cure diabetes by the tribes of Mananthavady, Bathery and Vythiri taluks of Wayanad district, Kerala. Preparation of ethnomedicine using various plant parts and other information related to tribes associated; habitat, habit and status of medicinal plants recorded are highlighted. Documentation of indigenous knowledge related to cure diabetes was made by interaction with traditional healers. A total of 23 species belonging to 17 families possessing antidiabetic property were recorded. The review of literature revealed that 16 species have already been proven to be antidiabetic through scientific analysis. However reports on antidiabetic properties of *Andrographis wightiana* T. Anderson & Thwaites, *Psilotrichum elliotii* Baker & Clarke, *Solanum violaceum* Ortega ssp. *multiflorum* (Clarke), *Justicia trinervia* L., *Dracaena terniflora* Roxb., *Elaeagnus conferta* Roxb. and *Kydia calycina* Roxb. are lacking. The present study is successful in identifying seven medicinal plants used by the tribes for possessing antidiabetic activity. Most of the herbal preparations for curing diabetes were prepared from the fruits followed by leaves and bark.

INTRODUCTION: Diabetes Mellitus (DM) is caused by the deficiency or ineffective production of insulin by pancreas which results in increase or decrease in concentrations of glucose in the blood. It is found to damage many of the body systems, particularly the blood vessels and nerves¹. It is defined on the basis of laboratory findings as a fasting venous plasma concentration greater than 140 mg/dl or 210 mg/dl two hours after a carbohydrate meal or two hours after the oral ingestion of the equivalent of 75mg of glucose.

DM is the common endocrine disorder that is projected to become one of the world's main disabler within next 25 years² and is considered to be a silent killer, affecting more in Asia and Africa with rise by two to three folds by 2030³. The modern medicines available for management of diabetes exert serious side effects such as hepatotoxicity, abdominal pain, flatulence, diarrhea and hypoglycemia⁴. Drug resistance to these medicines is also reported after prolonged treatment. Therefore, apart from currently available therapeutic options many herbal medicines have been recommended for treatment of DM⁵.

Collection of information and documentation of traditional knowledge plays an important role in scientific research on drug development⁶. A study of WHO depicts that over 80% of world's

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population depends on biological resources for their primary healthcare demands⁷. Over the centuries, Indian herbal drugs have served as a major source of medicines for the prevention and treatment of many diseases including Ethnobotany embraces a complex relationship between plants, people and culture and this relationship between plants and human cultures is not limited to the use of plants for food, clothing and shelter but also includes their use for religious ceremonies, ornamentation and health care. It is estimated that more than 800 species of plants exhibit hypoglycemic properties, including many common plants, such as bitter gourd and guduchi⁸.

Natural medicines are also used in the traditional Chinese medical system for therapy of DM⁹. In India, indigenous remedies have been used in the treatment of DM since the time of Charaka and Sushruta (6th century BC)¹⁰. Also ayurveda and other Indian traditional practices mention the use of plants in treatment of diabetes¹¹. However, traditional knowledge, derived empirically, has to be supported by scientific testing. Experimentally several reports have confirmed the efficacy of traditional preparations claimed to be effective in the treatment of diabetes¹² and several herbs have shown antidiabetic activity when assessed with the available experimental techniques¹³. Further screening of these plants revealed wide array of plant derived compounds with consistent antidiabetic activity and have proven their possible use in the treatment of DM¹⁴.

The main objective of this study was to assess the diversity of ethno medicinal plants used by the major tribes of Wayand and document the traditional medicinal practices followed in healing complications associated with diabetes and also to document the traditional knowledge that has been vanishing with diminishing tribal communities¹⁵.

In view of this, documentation of indigenous knowledge is vital for conservation of bioresources for their sustainable utilization and management of diabetes and its related complications. The exploration and field visits to Mananthavady, Bathery and Vythiri taluks of Wayanad district, Kerala was focused to unravel the traditional medicinal practices among the tribes.

MATERIALS AND METHODS:

The study area Wayanad district (**Fig.1**) is located in Kerala. It lies between north latitude 11° 27' and 11° 58'35" and the east longitudes 75° 47'50" and 76° 26' 35". It has a salubrious climate. Since the Wayanad plateau lies at an average height of 900-1200 m above the mean sea level, it enjoys humid tropical climate, with almost uniform temperature throughout the year. The mean annual temperature is 23.8 °C.

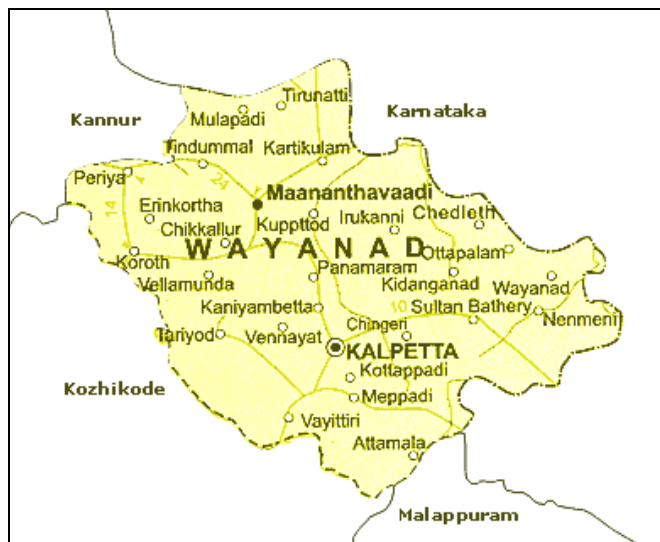


FIG. 1: MAP OF WAYANAD DISTRICT

The total survey was focused on the interviews with tribal medical practitioners of tribal pockets of Mananthavady, Bathery and Vythiri taluks of Wayanad district, Kerala. Data was collected through interaction and interview with traditional healers and questionnaires. The exploration in these areas was focused to unravel the traditional medicinal practices among the tribes. Details of medicinal plants used, mode of treatment, methods of preparation and administration were documented. Information was also obtained from patients regarding the ethno-medicines used. The plants were identified and voucher specimens were deposited in Department of Studies in Environmental Science, University of Mysore, Mysore, Karnataka, India.

RESULTS AND DISCUSSION:

A total of 23 plant species belonging to 17 families were documented and identified as herbal remedies for diabetes (**Table 1**). Most of the species belonged to Zingiberaceae followed by

Acanthaceae, Solanaceae and Cucurbitaceae. However, plants like *Alangium salvifolium*, *Andrographis paniculata*, *Aporosa lindleyana* and *Gymnema sylvestre* were more frequently used by the people in the area. Many remedies were

prepared as mixtures of multiple ingredients. From the data, it was observed that 60% of the tribal medicine was prepared from fresh plant materials followed by dried and boiled plant materials (40%) for treatment.

TABLE 1: THE ETHNO MEDICINES USED BY THE TRIBES FOR THE TREATMENT OF DIABETES

Sl. No.	Botanical name	Local name used by the tribe	Family	Habit	Parts used	Mode of administration	Tribes associated	Taluk	Status
1	<i>Alangium salvifolium</i> (L.f.) Wang.	Ankolanga	Alangiaceae	Shrub	Fruit	The fruit juice is antidiabetic	KR	MTDY VTRY	Common
2	<i>Alium sativum</i> L.	Veluthulli	Amaryllidaceae	Herb	Bulb	The boiled bulbs eating cure diabetics.	KR	MTDY	Common
3	<i>Alpinia galanga</i> (L.) Sw.	Chittaratha	Zingiberaceae	Herb	Rhizome	The juice of underground part is antidiabetic.	All	MTDY	Common
4	<i>Andrographis paniculata</i> (Burm.)	Kiriyathu Kattukiriyath	Acanthaceae	Herb	Leaf	The dried and powdered leaf is soaked in water and the supernatant is taken orally to reduce diabetes. The dried leaves boiled in water and consumed it is antidiabetic.	All	MTDY	Common
5	<i>Andrographis wightiana</i> T. Anderson & Thwaites	Kattu Nilaveppu	Acanthaceae	Herb	Whole plant	The dried plant is boiled in water, cooled and drink. It is antidiabetic.	KR	MTDY	Endemic
6	<i>Aporosa lindleyana</i> (Wight) Baill.	Aechil. Aechilumara	Euphorbiaceae		Root	Root powder is hypoglycemic	KU KR	MTDY	Common
7	<i>Catharanthus roseus</i> (L.) G. Don	Nithyakalliani	Apocynaceae	Herb	Leaf	Eating 4 to 6 leaves daily to cure diabetes	KR KT	MTDY	Common
8	<i>Coccinia grandis</i> (L.) Voight	Kovakka	Cucurbitaceae	Climber	Fruit	The fruits eaten daily to cure diabetes	KR	MTDY	Common
9	<i>Costus speciosus</i> (Koenig) J.E. Smith	Unnithandu	Zingiberaceae	Herb	Leaf	By applying the juice on the forehead reduces headache. It is antidiabetic.	AL	MTDY	Common
10	<i>Curcuma longa</i> L.	Nattumanjal	Zingiberaceae	Herb	Rhizome	The dried and powdered rhizome is soaked in water and the supernatant is taken orally to reduce diabetes	AL	MTDY	Common
11	<i>Diospyros malabarica</i> (Desr.) Kostel.	Panachi	Ebenaceae	Herb	Fruit	The fruit juice cures abdominal pain. It is antidiabetic	KU KR KT	MTDY	Common
12	<i>Diplocyclos palmatus</i> (L.) C. Jeffrey.	Kattukoval Ayiviral	Cucurbitaceae	Climber	Fruit	The fruit dish is antidiabetic.	AD	MTDY	Common
13	<i>Dracaena terniflora</i> Roxb.	Kurunarippullu	Dracaenaceae	Herb	Whole plant.	Drinking the fresh juice of this plant reduces blood sugar.	KR	MTDY	Common
14	<i>Elaeagnus conferta</i> Roxb.	Kattumunthiry, Keramba	Elaeagnaceae	Shrub	Fruit	The fruit juice is antidiabetic	KR AD KT	MTDY	Common

15	<i>Ficus auriculata</i> Lour.	Athi	Moraceae	Tree	Fruit Bark Root	The grinded fruit, bark and root of <i>Ficus</i> is mixed with the grinded bark of <i>Kydia kalycina</i> , grinded leaves of <i>Brideliascandens</i> , <i>Eupatorium</i> , grinded bark and root of <i>Bombax ceiba</i> , bark and root of <i>syzygium tamilnadensis</i> , grind together with required quantity of water. Taken internally to reduce blood sugar.	KR	VTRY	Common
16	<i>Gymnema sylvestre</i>	Chakkarakkolli	Asclepiadaceae	Climber	Leaf	The dried and powdered leaf is soaked in water and the supernatant is taken orally to reduce diabetes	KR	MTDY	Common
17	<i>Helicterus isora</i> L.	Edampiri Edampirinjuvalam pirinju	Sterculaceae	Shrub	Fruit	The fruit juice is antidiabetic	KT	MTDY	Common
18	<i>Justicea trinervia</i> L.	Odichukuthi	Acanthaceae	Herb	Leaf	The leaf decoction for arthritis and antidiabetic.	KR	MTDY	Common
19	<i>Kydia kalycina</i> Roxb.	Vellachadachi	Malvaceae	Tree	Bark.	Bark of vellachadachi mixes with fruit, bark and leaves of athi, leaves of Nenthravalli, bark & root of poolamaram & Njaval. Add required quantity of water grind & Mix together. The drink is antidiabetic.	KR	BTRY	Common
20	<i>Polyalthia longifolia</i> (Sonner.)Thw.	Aranamaram	Annonaceae	Tree	Brk	The bark juice is antidiabetic.	KR	MTDY	Common
21	<i>Psilotrichum elliotii</i> Baker & Clarke	Pancharachedi	Amaranthaceae	Herb	Leaf	The grinded leaf juice intake reduces blood sugar	KR	MTDY	Common
22	<i>Solanum torvum</i> Sw.	Puthary chunda	Solanaceae	Shrub	Seed	The seed powder mixed with honey and applied orally. It is anti diabetic	KU	BTRY	Common
23	<i>Solanum violaceum</i> Ortega ssp. <i>multiflorum</i> (Clarke)	Cheruvazhuthina	Solanaceae	Herb	Fruits	Antidiabetic	KR	MTDY	Endemic

(KU; Kuruma, KT; Kattunaika, PN; Paniya, AD; Adiya, KR; Kurichia tribes. BTRY; Bathery, VTRY; Vythiri, MTDY; Mananthavady taluks)

Wayanad district is famous for the medicinal practices adopted by the tribal people. There are famous tribal practitioners who have good knowledge in diagnosing diabetes based on acceptable clinical symptoms such as frequent thirst and urination, body weakness, swollen

diaphragm and white foamy urine, where as they have least knowledge on possible causes of this disease. Among the different plants documented fruits of *Alangium salvifolium*, *Diospyros malabarica*, *Elaeagnus conferta*, *Helicterus isora* and *Solanum violaceum*, rhizome of *Alpinia*

galanga, dried leaves of *Andrographis paniculata*, root powder of *Aporosa lindleyana*, whole plant of *Dracaena terniflora* and seed powder of *Solanum torvum* are commonly used by the different tribes.

It was also observed that different parts of the plants are exploited as cure for diabetes, out of which fruits (35%) were major ingredients in preparation of herbal formulations followed by leaves which constituted 22%, while bulbs, whole plant, rhizome, root, seed and bark were rarely used. The commonest method of herbal preparation was infusion. This is made by boiling pulverized or loose plant materials in water. Application of the herbal remedies was generally by drinking, usually on daily basis for long period of time. *Andrographis paniculata* and *Dracaena terniflora* were frequently mentioned and highly recommended by all the traditional healers and rural dwellers. Review of literature revealed that biological activities of *A. paniculata* is already available where as *D. terniflora* need to be subjected for further experiments to prove its efficacy.

Andrographis paniculata has been effectively used in traditional Asian medicines for centuries. It's perceived "blood purifying" property results in its use in diseases where blood abnormalities are considered to be cause for diseases such as skin eruptions, boils, scabies and chronic undetermined fevers¹⁶. Immuno-modulatory activity, antioxidant activity, anti-inflammatory activity, cytotoxic activity, antidiabetic activity, antimalarial, antihypertensive, antimicrobial, antifertility activities and also the adverse reactions through toxicity assay of this plant has been thoroughly reviewed by Dey *et al.*,¹⁷. Even the thorough review on genus *Andrographis* and pharmacologically relevant compounds of different species of *Andrographis* characterized so far is available¹⁸. *Dracaena terniflora* is recently reported for its use against bed sore¹⁹.

Thorough review of literature revealed that among 23 plants used by the tribes, 16 have been proven antidiabetic through further experiments (**Table 2**), where as reports on antidiabetic nature of *Andrographis wightiana*, *Dracaena terniflora*, *Elaeagnus conferta*, *Kydia calycina*, *Justicia trinervia*, *Psilotrichum elliotii* and *Solanum*

violaceum is not available. The present study hence is successful in identifying six candidate plants which can be exploited further for antidiabetic treatment and also pharmacological studies to identify the molecules responsible for the desired activity.

TABLE 2: PLANTS USED BY THE TRIBES REPORTED TO POSSESS ANTIDIABETIC ACTIVITY IN VITRO AND IN VIVO.

Sl. No.	Plant	References
1.	<i>Andrographis paniculata</i>	17-18
2.	<i>Alangium salvifolium</i>	43-50
3.	<i>Allium sativum</i>	51-58
4.	<i>Alpinia galanga</i>	59
5.	<i>Aporosa lindleyana</i>	60-63
6.	<i>Catharanthus roseus</i>	54, 64-65
7.	<i>Coccinia grandis</i>	66-68
8.	<i>Costus speciosus</i>	69-72
9.	<i>Curcuma longa</i>	73-76
10.	<i>Diospyros malabarica</i>	77
11.	<i>Diplocyclas palmatus</i>	78
12.	<i>Ficus auriculata</i>	79-81
13.	<i>Gymnema sylvestre</i>	82-84
14.	<i>Helicteres isora</i>	85-87
15.	<i>Polyalthia longifolia</i>	88-90
16.	<i>Solanum torvum</i>	91

Elaeagnus conferta is an edible herb found in Vietnam, Malaysia, India and South China. Its roots, leaves and fruits have been used in traditional Tibetan, Mongolian and Uygur medicine for the treatment of indigestion²⁰. The potential use of dry fruit of this plant for activating hepatic alcohol dehydrogenase, aldehyde dehydrogenase and accelerating blood alcohol clearance was reported by Wu *et al.*,²¹. Total phenolic content and its antioxidant activity were reported by Singh *et al.*,²².

Kydia calycina is distributed in tropical Himalayas from the Indus eastwards to Myanmar (Burma) and in peninsular India. Traditionally it is used to treat jaundice, skin diseases, ulcers, body pains, arthritis and lumbago^{23, 24}. The leaves of the plant showed analgesic and anti-inflammatory effect^{25, 26}. Similar such studies on the leaves have been proven to possess hepatoprotective potential²⁷. The use of stem bark and leaf paste for skin diseases and ulcers by Chenchus were reported by Ramarao and Henry²⁸. Flowers of *K. calycina* are rich in potassium and iron and were found inhibitory to *Streptococcus mutans*²⁹. Recently methanolic extract was reported to possess significant

antioxidant activity³⁰, where as its antidiabetic activity has not been reported by earlier workers. Antidiabetic activity of leaves and root extracts of *Justicia adhatoda* was reported by Gulfranz et al.,³¹. In our investigation it was found that *Justicia trinervia* is being used by the tribes for treating diabetes which was not reported by earlier workers till date.

Antibacterial and antifungal activity of *Psilotrichum elliotii*³² and anticholinesterase³³, antioxidant and antimicrobial activity of *Solanum violaceum*³⁴ is available, whereas use of this plant for treatment of diabetes by the tribal people is reported for the first time from the present study.

The use of herbal medicines for the treatment of diabetes mellitus has gained importance throughout the world. The World Health Organization also recommended and encouraged this practice especially in countries where access to the conventional treatment of diabetes is not adequate³⁵. Hypercholesterolemia and hyper triglyceridemia are common complications of diabetes mellitus in addition to hyperglycemia^{36, 37}. The frequency of hyperlipidemia in diabetes is indeed very high, depending on the type of diabetes and its degree of control³⁸. There is an increased demand to use natural products with antidiabetic activity due to the side effects associated with the use of insulin and oral hypoglycemic agents since 1990³⁹⁻⁴¹. The available literature revealed that there are more than 400 plant species having hypoglycemic activity. Though some of these plants have great reputation in the indigenous system of medicine for their antidiabetic activities, many remain to be scientifically established including seven plants identified in the present study.

Similar ethnobotanical survey of medicinal plants used by traditional healers in Wayanad to treat type 2 diabetes was conducted by Kumar and Janardhana⁴². The study conducted by them revealed 47 plant species belonging to 44 genera of 29 families. The comparative evaluation with the present study revealed that only *Gymnema sylvestre* is common among both the studies, where as the difference is seen with the plant part used, the present study indicates leaf where as the earlier reports use of crushed root, which is also used in combination with *Syzygium* sp. and *Salacia* sp.

Among *Solanum* sp., the earlier report indicates *S. indicum*, where as the present study reveals antidiabetic usage of *S. torvum* and *S. violaceum*. It is also observed that the earlier work reports more tree species where as the present study indicates more herbs and shrubs.

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