**Original Research Article****DOI: 10.26479/2019.0502.15****ETHNOMEDICINAL PLANTS USED FOR THE TREATMENT OF DIABETES MELLITUS IN SIDDAPUR TALUK OF UTTARA KANNADA DISTRICT, KARNATAKA, INDIA****Smita Bhat\*, G. S. Mulgund**

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**ABSTRACT:** A survey of medicinal plants was conducted in different localities of Siddapur to document the folk knowledge of local healers for the treatment of diabetes. The survey revealed medicinal uses of 18 plants belong to 15 families for diabetes and also 16 herbal preparations were recorded. The quantitative data like family importance value and relative frequency citations are given for each plant species. Roots are the major parts used for preparation and all the preparations are administered through oral route. The highest value of FIV was recorded from Apocynaceae, Celastraceae and Miliaceae (35.71% each).

**KEYWORDS:** Ethnobotany, Medicinal plants, Traditional knowledge, Diabetes.

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**1. INTRODUCTION**

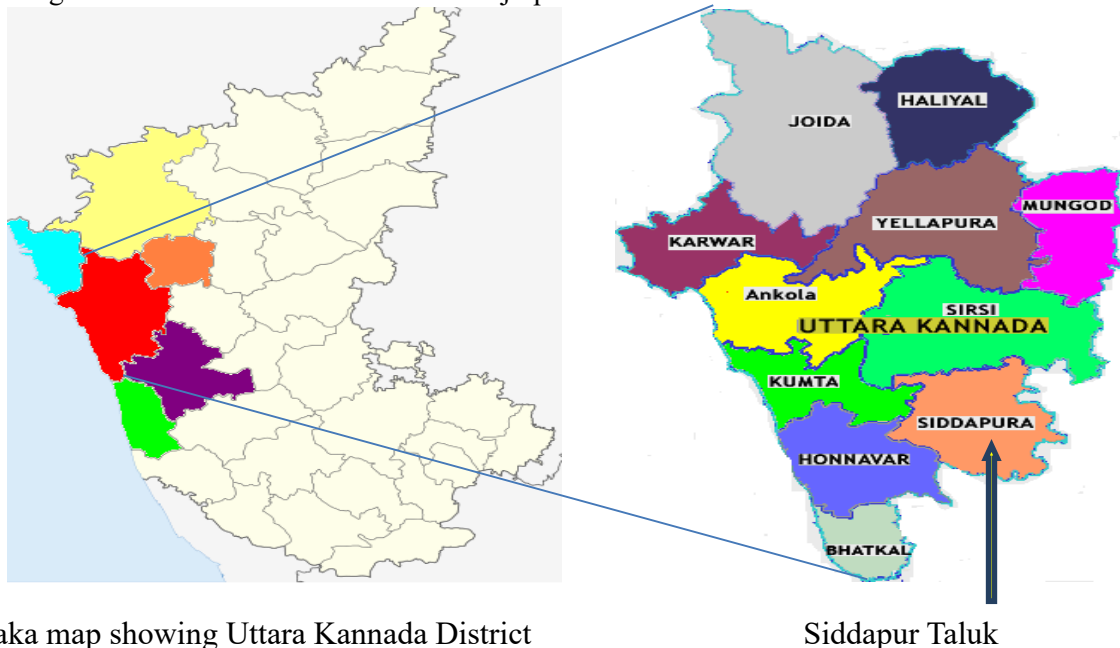
Plants are serves as major source of therapeutic drug and play a key role in treatment of various human ailments all over the world. It is reported that about 80% of the world population still use herbal remedies to meet their primary health care needs [16]. Many of currently used drugs which are available in the market are derived directly or indirectly from plants. Although number of synthetic drugs available in the market, in most of developing countries people depends on herbal drug. In India, especially Western Ghats is rich in diversity of medicinal plants and one of the most important hotspot in the world. Majority of traditional healers inhabit in the thick evergreen forests of Uttara Kannada. The documentation of ethnomedicinal plants knowledge has been done by many workers for the treatment of various ailments. Several studies have been made to document the

medicinal plant wealth in Uttara Kannada with respect to tribal community [5,7,8] and also on veterinary ailments [6,17], skin diseases [9,10], reproductive health [18] and poisonous snake bites [4]. These are evidence for the local people of Uttara Kannada still depend on the traditional system of medicine for various ailments. Diabetes mellitus is a chronic metabolism disorder caused by a deficiency of pancreatic hormone insulin in the body, which remains as major health issue all over the world. Diabetes mellitus is generally classified into Type I and Type II. Among this Type II is the most common form, which constitutes the 90% of total diabetic population. According to an estimate 33 million adults are diabetic in India, which is projected to be increases to 57.2 million in 2025 [37]. Diabetes is mainly due to neither improper secretion of insulin by beta cells of pancreas nor the cells of the body not responding to the insulin produced. The most common diagnostic symptoms are weight loss, increased thirst, increased hunger and increased urination. In the local language particularly in Uttara Kannada, diabetes is commonly termed as *Madhumeha*. Majority of the people of this area mostly depend on traditional herbal methods for the management of diabetes because of constrained therapeutic efficacy of the modern synthetic medicines. In India, several workers documented the use of medicinal plants for the treatment of diabetes [33,37]. The present study is focused on documentation of ethnomedicinal knowledge of the traditional practitioners from different communities of Siddapur taluk, Uttara Kannada district for the treatment of diabetes.

## 2. MATERIALS AND METHODS

### Study area

The present study was carried out in Siddapur taluk of Uttara Kannada district in Karnataka State and is located between 14° 20' to 15°31' N, 74°09' to 74°53' E. It has covering an area of 859 km<sup>2</sup>. The type of vegetation varies with rain fall, temperature and soil pattern and classified into moist deciduous, semi-evergreen and evergreen forests. The thick evergreen forests of Siddapur taluk is home to several tribal and non-tribal communities. Vokkaligas and Kare Vokkaligas are tribal communities and Brahmins, Saraswatas, Nayaks, Harijanas and Nadavas are the other non-tribal communities co-existing.



Karnataka map showing Uttara Kannada District

Siddapur Taluk

**Fig 1. Map of study area****Collection of ethnomedicinal information**

To gather medicinal information, regular field visits were made in different localities of Siddapur taluk from 2015 to 2016. Herbal healers were convinced to disclose the medicinal plants uses for treatment of different ailments and information was gathered through open ended interviews with local traditional healers. The information provided by practitioner was confirmed through frequent field queries in different seasons. The information of traditional practitioners like name, gender, age, literacy and their experience in the field of treatment, the method of diagnosis and mode of treatment were recorded using structured questionnaire.

**Identification of plants and preparation of voucher specimens**

The collected plant specimens were identified with the help of standard floras such as Flora of Presidency of Bombay [11], Flora of British India [19], Flora of Presidency of Madras [15], Flora of Karnataka [31] etc. The present names of the plants have been given according to The Plant List (2015) and IPNI ([www.ipni.org](http://www.ipni.org)). The plants recorded by the healers were photographed in the field; prepared voucher specimens are deposited in the Herbarium, P.G. Department of Botany, Karnatak University, Dharwad with accession numbers.

**Tabulation and data analysis**

The results of the survey are given in Table 1. and recorded plants systematically arranged in alphabetical order. For each plant species botanical name, family, local name, habit, habitat, parts used, relative frequency of citation, family importance value are provided. The formulations for the treatment of diabetes are given separately in Table 2.

**Quantitative ethnobotanical data analysis****Relative frequency Citation (Rfc)**

The locally important plants species and its frequency of citation reported by the traditional practitioners for the treatment of diabetes can be identified through following formula [33]:

$$\text{Relative frequency of citation (\%)} = \frac{\text{Frequency of citation}}{\sum \text{Frequency of citation of all species}} \times 100$$

$$\text{Frequency of citation (\%)} = \frac{\text{Number of informants who cited the medicinal plant}}{\text{Total number of informants interviewed}} \times 100$$

**Family Importance Value (FIV)**

Family importance value shows the percentage of informants mentioning the family and was calculated using following formula [38]:

$$\text{FIV} = \text{FC (family)} / \text{N} \times 100$$

FC is the number of informants mentioning the family; N is the number of informants participating in this study.

**3. RESULTS AND DISCUSSION****Information about practitioners**

The information regarding medicinal plants were collected from 53 traditional herbal healers, out of these information about treatment of diabetic is exclusively obtained from 14 'key informants' (herbalist who have through knowledge of medicinal plants). Among these average age of informants 58 years and it was observed that number of woman practitioners is less than that of man (12 men and 2 women). The traditional healers acquire the medicinal plant knowledge from their parents and have been transferred orally from generation to generation. But now a day this knowledge is vanishing from the modern society as the younger generations are not interested to carry out this tradition.

**Analysis of the data**

Total 18 plant species belonging to 15 families could be documented for the treatment of diabetes. Out of 18 plants used for the treatment of diabetes, herbs (17%), shrubs (22%), climbers (5%) and trees (56%) respectively. In terms of individual plant part used root (33%), leaf and fruit (24% each), bark (10%) and stem (9%) for medicinal purpose. Reports on the value of Relative frequency citation (Rfc) are given in Table 1. Among medicinal plants used *Azadirachta indica* (12.82%) and *Salacia reticulate* (12.82%) species shows maximum frequency citation. Other plants with highest value are *Gymnema sylvestre* (10.25%), *Aegle marmelos*, *Andrographis paniculata*, *Butea monosperma* and *Justicia adathoda* (7.69% each). Subsequently *Aloe barbadensis*, *Annona squamosa*, *Barringtonia acutangula*, *Ficus carica*, *Holarrhena pubescens*, *Lawsonia inermis*, *Psidium guajava*, *Solanum nigrum* and *Terminalia chebula* was reported lowest Rfc with 2.56. Similarly, FIV analysis denotes that Apocynaceae, Celastraceae and Miliaceae are the most important family recorded from the

present study (FIV=35.71% each). The lowest value of FIV was noted from Annonaceae, Moraceae, Liliaceae and Lythraceae (7.69% each). FIV value denotes the percentage of plant species with respect to family used by traditional healers.

**Table 1: Plants used for the treatment of diabetes**

S. No	Botanical Name	Family	Habit/Habitat	Common Name	Parts used	Rfc	FIV	Literature cited
1	<i>Aegle marmelos</i> (L.) Correa SB/GSM. 7	Rutaceae	T/W	Bilvapatre	Leaf, Root	7.69	21.42	[37,30]
2	<i>Aloe barbadensis</i> Mill. SB/GSM. 12	Liliaceae	H/W	Lolesara	Stem	2.56	7.14	[37,28,30]
3	<i>Andrographis paniculata</i> (Burm.f.) Nees SB/GSM. 14	Acanthaceae	H/W	Kaadu jeerige	Leaf	7.69	28.57	[37,32,23,40]
4	<i>Annona squamosa</i> L. SB/GSM. 18	Annonaceae	T/W	Seetaphala	Root	2.56	7.14	[14,29]
5	<i>Azadirachta indica</i> A.Juss. SB/GSM. 28	Miliaceae	T/W	Beevu	Leaf	12.82	35.71	[37,30]
6	<i>Barringtonia acutangula</i> Gaertn. SB/GSM. 29	Lecythidaceae	T/W	Samudra hagala	Fruit	2.56	7.14	[40]
7	<i>Butea monosperma</i> (Lam.) Taub. SB/GSM. 36	Fabaceae	T/W	Muttugala mara	Stem, Bark	7.69	21.42	[37]
8	<i>Ficus carica</i> L. SB/GSM. 65	Moraceae	T/C	Anjura	Fruit	2.56	7.14	[22]
9	<i>Gymnema sylvestre</i> (Retz.) Schult. SB/GSM. 78	Apocynaceae	Cl/W	Madhunashini	Leaf	10.25	35.71	[21,37,30,40]
10	<i>Holarrhena pubescens</i> Wall. Ex G. Don SB/GSM. 81	Apocynaceae	T /W	Kodasa	Root	2.56	35.71	[3]
11	<i>Justicia adathoda</i> L. SB/GSM. 86	Acanthaceae	S /W	Adumuttada soppu	Root	7.69	28.57	[24]
12	<i>Lawsonia inermis</i> L. SB/GSM. 94	Lythraceae	S /W	Madarangi	Root	2.56	7.14	[40]
13	<i>Mussaenda frondosa</i> L. SB/GSM. 109	Rubiaceae	S/W	Bellatte	Root	5.12	14.28	—
14	<i>Psidium guajava</i> L. SB/GSM. 128	Myrtaceae	T/W	Perale	Fruit	2.56	21.42	[13]
15	<i>Salacia reticulata</i> Wight	Celastraceae	S/W	Ekanayaka	Root	12.82	35.71	[12]

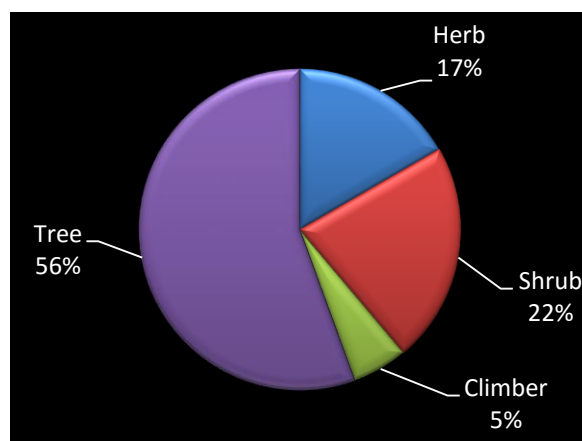
	SB/GSM. 136							
16	<i>Solanum nigrum</i> Linn. SB/GSM. 146	Solanaceae	H/W	Kaaka patale	Leaf, Fruit	2.56	7.14	[27]
17	<i>Syzygium cumini</i> (L.) Skeels SB/GSM. 149	Myrtaceae	T/W	Nerale	Bark	5.12	21.42	[37, 33, 36,40]
18	<i>Terminalia chebula</i> Retz. SB/GSM. 153	Combratacea e	T/W	Anale mara	Fruit	2.56	7.14	[1]

H- Herb, S- Shrub, T- Tree, Cl- Climber, W- Wild, C- Cultivated, Rfc- Relative frequency citation, FIV- Family importance value

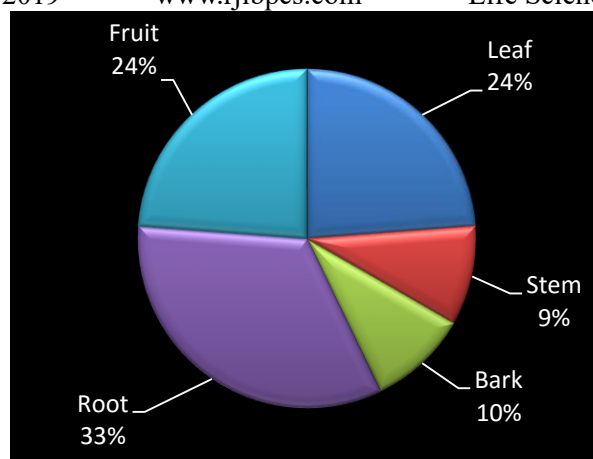
**Table 2: Formulations of plant species used for the treatment of diabetes**

S.No.	Plant name and parts used	Method of preparation and mode of administration	Preparation type / administration route
1	<i>Annona squamosa</i> (Root) + <i>Holarrhena pubescens</i> (Root) + <i>Salacia reticulata</i> (Root)	All drug parts are grounded with lime	Paste/ Oral
2	<i>Gymnema sylvestre</i> (Leaf)	Leaf powder mixed with honey	Paste/ Oral
3	<i>Gymnema sylvestre</i> (Leaf) + <i>Azadirachta indica</i> (Leaf)	Both Leaf powder were mixed with honey	Paste/ Oral
4	<i>Ficus carica</i> (Fruit)	Fruits are crushed with milk and mixed with honey	Infusion/ Oral
5	<i>Aegle marmelos</i> (Root)	Powdered root is mixed with honey	Paste/ Oral
6	<i>Mussaenda frondosa</i> (Root) + <i>Salacia reticulata</i> (Root)	i)Grounded root with milk ii)Small pieces of roots were boiled in water with pepper seed and decoction obtained is mixed with jiggery and lime juice	Paste/ Oral Decoction/ Oral
7	<i>Solanum nigrum</i> (Leaf, Fruit)	Fruit or leaves are crushed with milk or water added with zera powder is orally administered	Infusion/ Oral
8	<i>Syzygium cumini</i> (Stem) + <i>Butea monosperma</i> (Bark)	i)Small pieces of drug parts are boiled in water to get decoction ii)Grounded drug parts with water	Decoction/ Oral Paste/ Oral

9	<i>Psidium guajava</i> (Fruit)	Grinded fruit is mixed with milk and zera powder and boiled to get thick paste is used	Paste / Oral
10	<i>Aloe barbadensis</i> (Stem)	Small pieces of pulp mixed with milk and zera powder is added and directly used	Juice / Oral
11	<i>Barringtonia acutangula</i> (Fruit) + <i>Psidium guajava</i> ( Fruit)	Grounded fruit with milk or water	Paste / Oral
12	<i>Butea monosperma</i> (Stem) + <i>Aegle marmelos</i> (Leaf)+ <i>Gymnema sylvestre</i> (Leaf)	Drug parts are powdered and mixed with boiled water	Juice / Oral
13	<i>Justicia adathoda</i> (Root) + <i>Lawsonia inermis</i> (Root)	Powdered root parts are mixed with honey is used	Paste / Oral
14	<i>Justicia adathoda</i> (Root)+ <i>Mussaenda frondosa</i> (Root) + <i>Salacia reticulate</i> (Root )	Drug parts are boiled in water and mixed with honey	Decoction / Oral
15	<i>Andrographis paniculata</i> (Leaf) + <i>Azadirachta indica</i> (Leaf)	Powdered leaf mixed with honey	Paste / Oral
16	<i>Terminalia chebula</i> (Fruit)	Powdered fruit mixed with milk or water	Juice / Oral



**Fig 2. Habit wise analysis of plants used for diabetes**



**Fig 3. Parts of plants used for preparation of drugs for diabetes**

### **Method of drug preparation and mode of treatment**

The survey resulted in 16 different formulations for the treatment of diabetes practiced by the indigenous herbalists of the area. Out of 16 formulations, 7 involved single plant parts and 9 formulations involves combination of different plant parts. The most common method employed for preparation of drug includes juice, decoction, paste and infusion. Most of the drugs prepared were administered through oral route. Majority of the practitioners prefer fresh plant parts for preparation of drug but in some cases dried parts of plants are used. As per practitioner, paste is used as most common method of preparation for treatment of diabetes. Very common media used for preparation of medicines are water, milk, lime. Of this water is used for preparation of decoction and for preparation of paste the water or milk is used. In some cases honey is also used for paste preparation where dry powders of plant parts are used for formulation. But in majority of cases honey, milk, lime juice and jiggery are used mask the odor and also improve the adequacy of herbal preparations [34]. In this case honey and jiggery are act like an adjuvant to mask the undesirable odor of drug.

### **Related literature reports on diabetes**

Gathered information are validated with available Ayurvedic literatures [23,40] and other reported work of this area given in Table 1. Altogether 18 species reported, 16 species are mentioned for treatment of Diabetes in available literature. In Ayurveda, *Andrographis paniculata*, *Barringtonia acutangula*, *Gymnema sylvestre*, *Lawsonia inermis* and *Syzygium cumini* are plants cited for the management of Diabetes. Some other plants e.g *Andrographis paniculata* [20], *Gymnema sylvestre* [35] have already reported as anti-diabetic. 'Salacinol' is the compound having anti-diabetic activity isolated from root part of *Salacia reticulata* reported from Shri lanka [39]. Similarly, fruit and bark of *Syzygium cumini* are used to control the carbohydrate metabolism in diabetes patients [24]. In Ayurvedic and Unani system of medicine *Holarrhena pubescens* is used in dysentery, diarrhea and skin diseases. The bark powder used as an effective drug in several formulations against diabetes is recorded from earlier work reported from Nepal [3]. The aqueous extract of the seeds of this plant

has been found to be effective in diabetes management [2]. In Eastern part of Asia leaf of *Psidium guajava* is used in the treatment of Diabetes. Hydro alcoholic extract of leaf of *Psidium guajava* have shown anti diabetic property [13]. Leaf of *Aegle marmelos* is used as potent agent for diabetes and also juice obtained from fresh fruit is used to lower the blood sugar level [33]. Only one species *Mussaenda frondosa* could not mentioned so far in any literature available, for the treatment of diabetes. However, from the present study it is noted that mode of administration and method of preparation drug mentioned are quite different from earlier reports of the present area of research. The present investigation not only describes the uses of traditional medicinal plants, but also provides evidence for pharmacognostic evaluation of plants mentioned to synthesize potent modern drugs against diabetes.

#### 4. CONCLUSION

The main objective of present study is to document the indigenous knowledge of native medicinal plants practiced among the local healers for treatment of diabetes. Among reported plants, *Azadirachta indica* and *Salacia reticulate* shows high frequency citation used in the management of diabetes. Based on the present study it is concluded that recorded plants are further investigated pharmacologically and phytochemically for the discovery of natural drug.

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#### CONFLICT OF INTEREST

Authors do not have any conflict of interest.

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