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Survey of medicinal plants used for the treatment of diabetes by the Paliyar's Tribe in Sadhuragiri hills, Tamil Nadu, India

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Abstract

An ethnobotanical and literature survey was conducted to collect information about medicinal plants used for the treatment of diabetics and associated complications by Paliyar tribals people of Sadhuragiri hills. Analysis of remedies obtained from different plant parts was performed. The indigenous knowledge of plants used for the treatment of diabetics was collected through questionnaire and personal interviews. A total of 65 plants used to treat diabetes have been documented. The investigation revealed that, Leaves (27%), followed by Fruits (11%), Roots (6%), Seeds (6%), Flower (6%), Bark (4%), Whole plant (4%), Tuber (3%), Rhizomes (2%) and bulb (1%) were mostly used for the treatment of Diabetes. Anti-diabetic medicinal plants used by Tamil People have been listed along with plant parts used and its active chemical constituents.

Keywords: Anti-diabetic, wild medicinal plants, Paliyar's, Sadhuragiri hills, Western Ghats, Tamil Nadu.

1. Introduction

The diabetes mellitus (DM) is one of the world's biggest healthcare challenges and it's increasing day by day, globally it affected about 171 million people in 2003, 173 million people in 2004^[1], 284.6 million in 2009^[2], 371 million 2012^[3], while recently it is expected that up to 552 million people by 2030. Among all DM patients 90% suffer from diabetes^[5]. About 80% DM patients live in under developing countries^[4], About 3.2 million deaths per year are caused due to complications of diabetes. The top most countries (in term of numbers) of DM patients are India, china, USA, Indonesia, Japan, Pakistan, Russia, Brazil, Italy and Bangladesh^[6].

India has 19.4 million diabetes patients and the count is increasing day to day. It is the fourth leading cause of death in the most developed countries and there is substantial evidence that it is epidemic in many developing and newly industrialized nations. Studies have shown that thiazolidinedione sensitizers are affective in terms of glucose lowering occur without additional demands on depleted islet cell insulin reserves. On country, insulin secretion improves with the application of these agents. Furthermore, there is evidence from both preclinical and clinical studies that new herbal agents lower blood pressure, albuminuria, and lipid metabolism and are directly related to insulin resistance itself^[7].

The disease is caused by the inability of pancreas to produce insulin or inability of the body metabolic system to properly use the insulin produced. The causes of this disease are not known; however, it is suspected that occurrences of the disease may result from increased number of elderly people, change in food habits, obesity, and adoption of a sedentary lifestyle. Because the human body cannot properly metabolize sugar when during diabetes, the first symptom of the disease is an increase in blood glucose or hyperglycemia. The impaired metabolism of sugar and other dietary substances like lipids and proteins soon leads to disorders affecting almost all vital organs of the body. In fact, diabetic patients are extremely prone to develop neurological, cardiovascular, retinal and renal complications leading to premature death, which to a lot of extent may be due to diabetes-induced oxidative damage^[8].

Herbal medicines have been used for the treatment of diabetic patients since long and they are currently accepted as an alternative therapy for diabetic treatment. However in the indigenous Indian system of medicine good number of plants was mentioned for the cure of diabetes and some of them have been experimentally evaluated and active principle were isolated. WHO has also recommended the evaluation of the effectiveness of plants in conditions where there are no safe modern drugs. The ethnomedicinal information reports state that about 800 plants may possess anti-diabetic potential. Recently the medicinal values of various plants extracts have been studied by many scientists in the field of diabetic research. (Diabetes information

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hub) Diabetes is associated with long term damage such as malfunction of eyes, kidneys, nerves, heart and blood vessels [9].

Diabetes mellitus is a disease of all ages with a high percentage of prevalence in worldwide about 2.8% in 2000 and expected to be 5.4% in 2025. Allopathic drugs used for the treatment of diabetes were insulin and anti-diabetic drugs which are in almost conditions were expensive and cannot be reached easily specially in developing countries, marked by series side effects [10, 11].

Moreover, the management of diabetes is a global problem until now and successful treatment is not yet discovered. There are many synthetic medicines has been developed for patients. However, the traditional medicines have demonstrated a bright future in therapy of diabetes and to understand the importance of traditional herbs. Several medicinal plants have been used as dietary adjuncts in the treatment of numerous diseases without proper knowledge of their function and properties [12]. Medicinal plants have also been reported to be useful in diabetic worldwide and used empirically as anti-diabetic and hyperlipidemic remedies [13-14].

Medicinal plants used to treat diabetic conditions are of considerable interest and a number of plants have shown varying degrees of hypoglycemic and anti-hyperglycemic [15]. Therefore, there has been a growing interest in the ethnobotanical approach to examine the anti-diabetic properties of plants traditionally used by the ethnic groups in different parts of the world. A large number of plants and plant-parts have been investigated for their beneficial role and anti-diabetic properties [16-17].

The use of herbs as hypoglycemic is a major avenue in Indian perspectives particularly for treating diabetes, which require to be explored more effectively as there are so many literatures available on these aspects. Traditional plant medicines are used through-out the world for a range of diabetic presentations. Herbal drugs are prescribed widely because of their effectiveness, less side effects and relatively low cost therefore, investigation on such agents from traditional medicine plants has become more important [18]. A number of reviews and elsewhere have been published in the last three decades on plants screened for hypoglycemic activity in India [19-34]. The main purpose of this research work is to document the anti-diabetic plants of Sadhuragiri hills, Paliyar's utilized as the area is comprised of many medicinal floras.

2. Materials and Methods

2.1 Study area

Sadhuragiri hills are situated in Southern Western Ghats comes under Srivilliputhur Grizzled Squirrel Wildlife Sanctuary Srivilliputhur taluk, Virudhunagar district of Tamil Nadu. Sadhuragiri is located at 1200 meters (3,937.0 ft.) mountain in the part of Southern Western Ghats of South India. It lies between 9°. 42' - 9 °.44" West latitude and between 77°.37 - 77°- 41" East longitude and it has an elevation of 881 meters above sea level. Sadhuragiri is in an area with a Tropical evergreen forest, Semi evergreen forest and mixed deciduous forest climate. Only Hindu Paliyar tribes residing in this area (Figure: 1.a).

2.2 Methods

Several field trips were carried out in Sadhuragiri hills from Jan 2015 to March – 2016, Covering different seasons, in order to know the phenology of the plants and Intensive and extensive field survey was made in Sadhuragiri hills and

villages in Virudhunagar district. The data were collected through repeated field visits and the careful interaction with the village people and Paliyar tribes. The collected specimens were identified taxonomically with the help of available Monographs, taxonomic revisions and floras and by using field keys [35-38]. Ethnomedicine information was gathered from all categories of village people such as the local healers' village leaved, elderly persons and Paliyar tribes and the person having a thorough knowledge of Medical practices. Herbal Medicines for the Treatment of Diabetes were cross checked and conformed to the Siddha Doctors. The information gathered from one place was confirmed by different communities of village people, Paliyar tribals in different places of investigation. The collected plants specimen was deposited in the Department of Botany, National College (Autonomous), Tiruchirappalli, Tamil Nadu for future reference.

2.3 Paliyar Tribals

The indigenous people of the study area are called Paliyar/Paliyan. They are found in the hilly regions of Madurai, Dindigul, Theni, Thirunelveli, and Virudhunagar districts. It is believed that paliyars are indigenous people of Palani hills (Situated near to Kodaikanal a famous tourist place). In the Palani hills they are found at an altitude of up to 2200m. Generally Paliyars are illiterate and they speak Tamil (Mother tongue of Tamil Nadu). Paliyars when compared to various tribal communities in Tamil Nadu constitute redelivery a small group.

Paliyars can be grouped in to three categories based on their life styles, namely, Nomadic, Seminomadic and Settled Nomadic Paliyars don't built houses, they live temporarily in rock caves called "Pudai" semi nomadic Paliyar build temporary house and confine themselves to small territories most of their huts are dark with no window or any other opening to admit air. Settled Paliyars are more less urbanized and live as agricultural laborers. Importance of traditional and folk medicine in the treatment of various human ailments is well recognized amongst these people [39]. (Figure: 1.b).

3. Result and Discussion

The Paliyar tribals knowledge of the indigenous uses of native medicinal plants before their complete assimilation into the urban areas to join the mainstreams of life needs to be studied and documented. During the field survey, the list includes various types of preparations used to cure anti-diabetic. Herbal medicines prescribed by Paliyar tribal healers are either preparation based on single plant part or a combination of several plant parts. Ethnomedicinal information of 65 angiosperms of medicinal plant belonging to 58 genera and 38 families was collected and documented from various habitats of the study region. The collection of medicinal plants is a source of livelihood for the local herbal healers of which some were trees (23 Sps), some herbs (20 Sps), some climbers (17 Sps) and others shrubs (5 Sps). The collected information's are arranged in the alphabetic order of the plant Botanical name with the local (or) common name and mode of use for each plant (see Table-1 & Figure: 2).

In the present study on the ethnomedical treatment of diabetes mellitus, the investigated data revealed that, the dominant plant families were Cucurbitaceae (5 Sps), followed by Caesalpiniaceae (4 Sps), Fabaceae (4 Sps), Liliaceae (4 Sps), Acanthaceae (3 Sps), Aristolochiaceae (2 Sps), Asclepiadaceae (2 Sps), Combretaceae (2 Sps), Euphorbiaceae (2 Sps), Lamiaceae (2 Sps), Meliaceae (2 Sps), Moraceae (2 Sps), Myrtaceae (2 Sps), Nyctaginaceae (2 Sps),

Solanaceae (2 Sps), Zingiberaceae (2 Sps), Rutaceae (2 Sps) and each one is remaining families (Figure:3).

The dominant plant families used for treatment of diabetes were belonging to Asteraceae family [40]. Different mode of usage have been adopted in the application of ethnomedicinal treatment about 34 preparations, infusion (juice) of fresh form or dried of herbal remedies are mainly used by local peoples (about 56% of preparations) the mostly used method for administration of anti-diabetic ethnomedicinal agents in South Africa and India [41-43]. The usage of plant part dominant Leaves (27%), followed by Fruits (11%), Roots (6%), Seeds (6%), Flower (6%), Bark (4%), Whole plant (4%), Tuber (3%), Rhizomes (2%) and bulb (1%) (Figure: 4).

Medicines are prepared in the form of juice/extract followed by infusion, powder, decoction, paste and as such. Among different plants used by Paliyar's, the leaves are more commonly used [40]. The various plant parts used were leaves, barks, roots, stems and fruits. Leaves and fruits formed the major plant parts used. Plant parts were usually used singly. However, in two instances, two plant parts from the same plant were combined in the formulation administered. Juice obtained from a crushed mixture of leaves and stems of *E. fluctuans* was used in one formulation, while juice obtained from a crushed mixture of leaves and roots of *C. grandis* was used in another formulation. In some instances, it was observed that two different plant parts may be used but not used in combination or administered at the same time. For instance, the bark or the root of *L. coromandelica* was used in one formulation. Similarly, diabetic patients were advised to partake of juice obtained from leaves of *M. charantia* or *P. emblica* in the morning and further advised to eat the fruits in the raw form (*Phyllanthus emblica*) or in the cooked form (*M. charantia*) at later times in the day. In all cases except one, a single plant was used for any single formulation. The exception was in the case of *C. roseus* whose leaves were used in combination with leaves of *C. viscosum* for diabetes treatment [8].

The method of preparation falls into 12 categories plant parts used in the form of Juice (20%), Powder (12%), Decoction (11%), Grounded (5%), Extract (4%), Fresh and Orally (3%), infusion (2%) Cooked (2%), Paste (2%) and Soaked (1%). In majority of the cases these medications were prepared by using water as a medium and administered in all the cases mode of application was oral. In regard to the patient conditions, the preparations were use more than two times daily from a week to month till the problem is cured (Figure:5).

In this study soursop was the commonly used plants for the

treatment of hypertension and bitter melon for diabetes. Information from the literature revealed that ampalaya or *Momordica charantia* belong to the family Cucurbitaceae are used also in different countries for the treatment of diabetes [44-47]. Ethnobotanical survey is most useful for scientists, research scholars and scientific companies for further studies on isolation and identification of active compounds that can be formulated into anti-diabetic drugs. Isolated drugs can use for diabetic patients [48].

4. Conclusion

Thus many different plants have been used individually or in formulations for treatment of diabetes and its complications. One of the major problems with this herbal formulation is that the active ingredients are not well defined. It is important to know the active component and their molecular interaction, which will help to analyze therapeutic efficiency of the product and also to standardize the product. This study highlighted the abundant knowledge of Paliyar's traditional medicine that is being used for the diabetes treatment by the local people of Sadhuragiri hills region.

5. Acknowledgement

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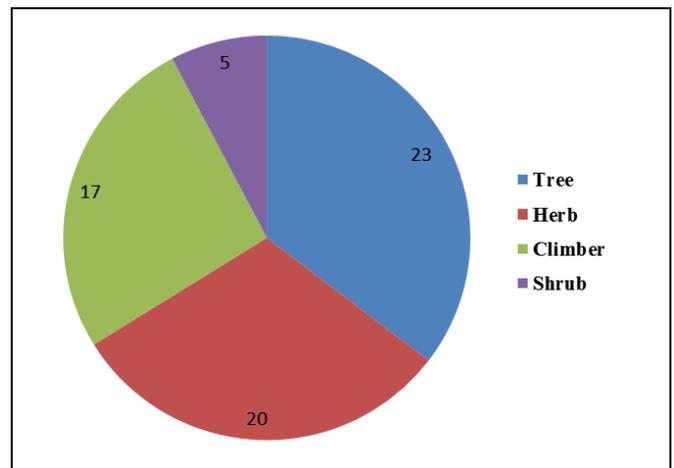


Fig 2: Habits wise distributed in medicinal plants study region

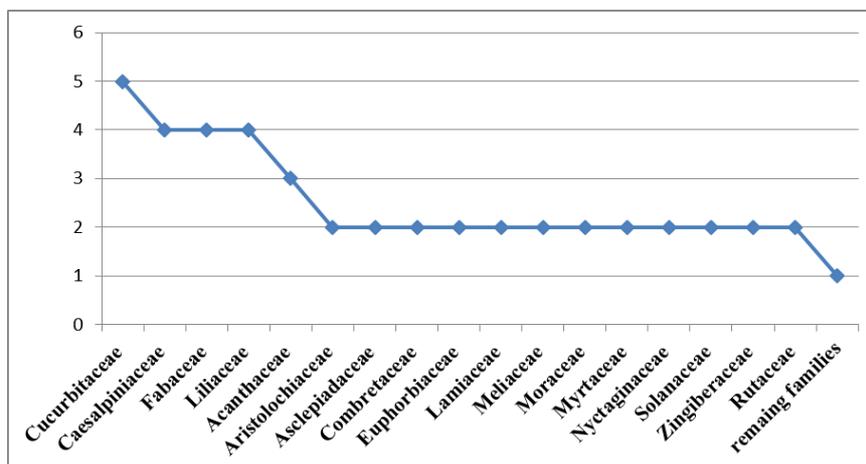


Fig 3: Family wise distributed in medicinal plants study region

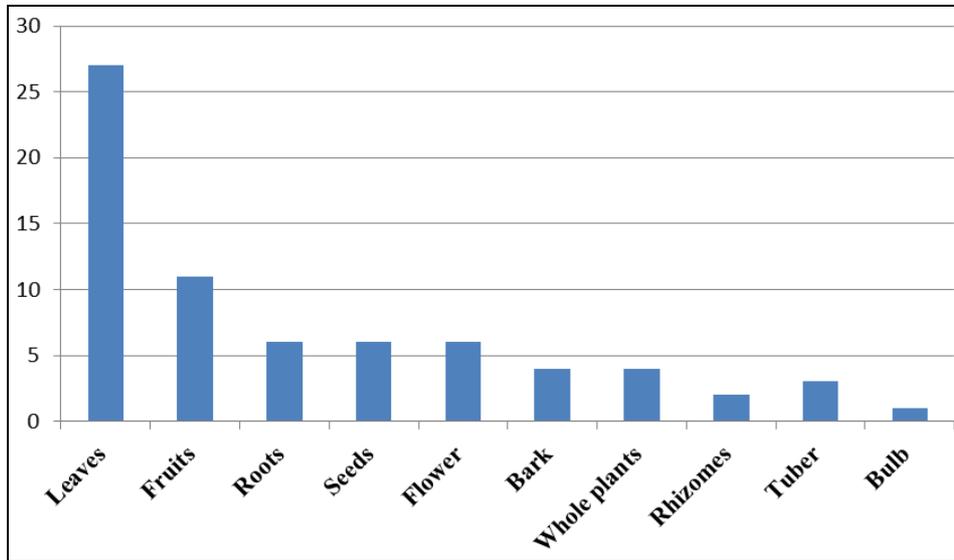


Fig 4: Parts wise used medicinal plants in study region

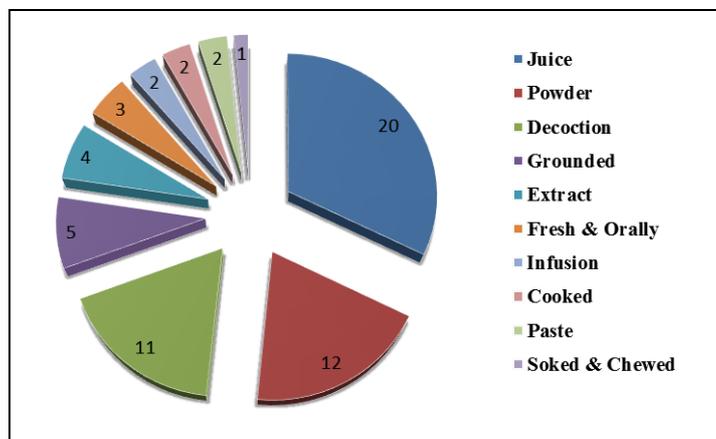


Fig 5: Mode of preparation in medicinal plants

Table 1: Medicinal Plants Used for the Treatment of Diabetes by the Paliyar’s Tribe in Sadhuragiri hills

S.No	Botanical name	Family	Tamil Name	Habit	Part Used	Mode of utilization medicine	References
1	<i>Abrus precatorius</i> L.	Fabaceae	Kudumani	C	L	Juice 2 teaspoon given orally twice a day till cure.	[49,50]
2	<i>Acacia nilotica</i> (L.) Delile.	Mimosaceae	Karuvealam	T	B	Infusion of bark is drunk to treat.	[50, 51, 52]
3	<i>Adhatoda vasica</i> Nees.	Acanthaceae	Adhatoda	S	L	Leaf juice taken orally.	[48, 53]
4	<i>Aegle marmelos</i> L. correa	Rutaceae	Villvam	T	F	Leaves chewed and swallowed every morning help to reduced sugar of diabetes patient.	[48-50, 52-59,]
5	<i>Aerva lanata</i> (L.) Juss. Ex schult.	Amaranthaceae	Poolai	H	L	Pepper and leaf Prepare the decoction is consumed regularly.	[59, 60, 61]
6	<i>Allium cepa</i> L.	Liliaceae	Vengayam	H	L	Juice is taken orally with honey or milk till cure.	[48-50, 54, 57, 62, 63]
7	<i>Allium sativum</i> L.	Liliaceae	Poondu	H	L&B	Leaf and bulb taken orally to treat diabetes.	[48-50, 57, 61, 64]
8	<i>Aloe vera</i> L.	Liliaceae	Kathalai	H	L	Raw leaf bulb is consumed twice daily.	[48]
9	<i>Andrographis paniculata</i> (Burm. F.) Wall. Ex Nees.	Acanthaceae	Siriyangai	C	L	Crush or Powder with honey mixture eaten.	[48- 50, 52, 53 , 60, 65, 66]
10	<i>Annona squamosa</i> L.	Annonaceae	Kaattuseetha	T	L	Past taken orally with milk daily in the morning.	[49, 50, 62, 65, 66]
11	<i>Aristolochia bracteolate</i> Lam.	Aristolochiaceae	Aduthinakodi	C	L	Decoction is used for drinking	[53]
12	<i>Aristolochia indica</i> L.	Aristolochiaceae	Isuramuli	C	S	Ground seeds are mixed with black pepper and made into a paste and given three times a day for about 15 days to treat.	[49]

13	<i>Asparagus racemosus</i> Willd.	Liliaceae	Thnervitan kezhanku	C	T	Decoction of tuber of s and bark of <i>Azadirachta indica</i> is given twice a day	[67]
14	<i>Azadirachta indica</i> Andr. Juss.	Meliaceae	Veambu	T	L	Green leaf mixed <i>Curcuma aromatic</i> Juice given daily in the morning.	[53, 57, 49, 50, 60, 58, 59, 48, 65, 66,52]
15	<i>Boerhavia diffusa</i> L.	Nyctaginaceae	Mukuruttai	C	WP	Two teaspoonful whole plant juice is given orally twice a day for 40 days	[68]
16	<i>Bombax ceiba</i> L.	Bombacaceae	Illavam	T	R	50 g fresh roots are crushed then mixed with 500 ml water and boiled. One cup decoction is administered internally once a day to control.	[58, 69]
17	<i>Caesalpinia pulcherrima</i> (L.) Sw.	Caesalpinaceae	Mayilkondrai	S	F	The powder is given with milk or honey.	[60]
18	<i>Cajanus cajan</i> (Linn.) Millsp.	Fabaceae	Kollul	C	S	Cooked and taken along with food.	[48,49,57]
19	<i>Cassia auriculata</i> L.	Caesalpinaceae	Aavaaramboo	S	F	One tea spoon powder of flower is given once in the morning for about 15 days or more.	[48,53, 56, 68]
20	<i>Cassia fistula</i> L.	Caesalpinaceae	Konrai	T	S	Powder of seeds is given once in the morning for about 15 days or more.	[50, 56, 70]
21	<i>Cassia tora</i> L.	Caesalpinaceae	Nellatharai	H	R	Juice 10g mixed 400ml of cured water, is boiled and taken orally once a day for about 15 days.	[49]
22	<i>Catharanthus roseus</i> (L.) G. Don.	Apocynaceae	Nithyakalyani	H	F	10 gm flower is mixed with 100 ml hot water and given orally.	[50, 52, 54, 58,59, 64,66, 68,70]
23	<i>Centella asiatica</i> (L.)Urban.	Apiaceae	Vallarai	H	WP	Juice is taken in empty stomach	[50, 54, 59, 65, 66]
24	<i>Citrullus colocynthis</i> (L.) Schrad.	Cucurbitaceae	Kumapatti	C	S	One seed taken raw eaten early in the morning for three weeks is good to cure.	[65]
25	<i>Coccinia grandis</i> (L.) J.Voigt.	Cucurbitaceae	Kovai	C	F	20 ml whole plant extract is given orally to treat.	[48, 49, 50, 53, 60, 68]
26	<i>Coccinia indica</i> Wt & Arn	Cucurbitaceae	Malaikovai	C	F	Juice of green fruit is given daily in the morning.	[71]
27	<i>Curcuma longa</i> Auct. Non L.	Zingiberaceae	Manjal	H	Rh	The powder and mixed <i>Tinospora cordifolia</i> soaked in water for few hours and then filtered. The filtrate is given to drink with milk	[48, 50, 57, 59, 60, 65, 66]
28	<i>Cynodon dactylon</i> Pers.	Poaceae	Aruku	H	L	Plant juice is mixed with <i>Leucas aspera</i> given in the morning.	[50,58,70]
29	<i>Ficus benghalensis</i> L.	Moraceae	Aalam	T	B	The powder is given to drink with milk	[48, 49, 50, 53, 56, 57, 60, 62, 64]
30	<i>Ficus racemosa</i> L.	Moraceae	Arasam	T	F	Dried fruits taken with warm water are helpful.	[49, 50, 53, 54, 66, 68, 72,]
31	<i>Gymnema sylvestri</i> (Retz.) R. Br. Ex Roemer & Schultes.	Asclepiadaceae	Sarkkaraikolli	C	L	Leaves are raw eaten directly or 5 g dried leaf powder is mixed with water and given orally once in a day.	[44, 50, 51, 55, 57, 59, 60, 73-76]
32	<i>Helicteres isora</i> L.	Sterculiaceae	Valamburi	T	R	Decoction is given twice a day	[59, 74]
33	<i>Hemidesmus indicus</i> (L.) Schult.	Asclepiadaceae	Nannari	C	R	Juice of bark is mixed with water	[54, 72, 77]
34	<i>Hibiscus rosa-sinensis</i> L.	Malvaceae	Semparuthi	S	F	One tea spoon powder of flower mixed pepper is given once in the morning for about 10 days or more.	[49, 62, 64, 70]
35	<i>Justicia adhatoda</i> L.	Acanthaceae	Aduthinapala	H	WP	Plant juice mixed with pepper given in the morning and evening.	[49, 50]
36	<i>Lawsonia inermis</i> L.	Lythraceae	Maruthani	T	L	Leaf juice mixed with cow's milk taken once in a week.	[54]
37	<i>Leucas aspera</i> Spreng.	Lamiaceae	Thumbai	H	WP	Whole plant whole plant extract is taken in empty stomach	[65, 66]
38	<i>Mangifera indica</i> L.	Anacardiaceae	Maa	T	L	The infusion is made from boiled leaves and taken orally	[44, 48, 52-54, 57, 64]
39	<i>Melia azedarach</i> L.	Meliaceae	Mlaiveambu	T	L	Juice taken orally	[44, 53]
40	<i>Mirabilis jalapa</i> L.	Nyctaginaceae	Anthimantharai	H	T	Crushed tuber mixed with hot water after meals taken.	[54]
41	<i>Momordica</i>	Cucurbitaceae	Paagarkkaai	C	F	Leaf and fruit juice in early morning is	[50, 52, 56-60, 64-

	<i>charantia</i> L.					used to treat.	66, 68, 75]
42	<i>Momordica dioica</i> Roxb. ex Willd.	Cucurbitaceae	Naripagal	C	T	Tuberous root is ground in hot water and 50ml of the juice is taken orally once a day on an empty stomach for 10 days to treat.	[76]
43	<i>Moringa oleifera</i> Lam.	Moringaceae	Kattumurungai	T	L	Boiled in water prepare the decoction taken as hot drink.	[52, 57, 61, 66]
44	<i>Murraya koenigii</i> (L.) Spr.	Rutaceae	Kariveppilai	T	L	Leaf extract, 2-3 tea spoon early in the morning.	[77]
45	<i>Nelumbo nucifera</i> Gaertn.	Nelumbonaceae	Thamarai	H	F	Made to juice and taken orally for about 15 days.	[49, 50, 57]
46	<i>Ocimum sanctum</i> L.	Lamiaceae	Thullasi	H	L	Leaf powder is taken orally with honey.	[49, 50, 54,]
47	<i>Oxalis corniculata</i> L.	Oxalidaceae	Pulichan	H	L	100 gm leaves are wrapped with banana leaf and after roasted in firewood is given with salt once daily at an interval of 3 days	[54, 58]
48	<i>Phyllanthus emblica</i> L.	Euphorbiaceae	Nelli	T	L&F	One teaspoonful of juice obtained from squeezed leaves is taken in the morning on an empty stomach. Fruits are chewed and taken as much as possible, dried fruits are soaked in water and the water is taken orally with the fruit.	[50, 65, 66]
49	<i>Piper betle</i> L.	Piperaceae	Vettrilai	C	L	Crushed and mixed with pepper powder boiled decoction empty stomach.	[60]
50	<i>Psidium guajava</i> L.	Myrtaceae	Koya	T	L&R	Decoction is consumed regularly	[48,50, 56, 57, 62, 78]
51	<i>Pterocarpus marsupium</i> Roxb.	Fabaceae	Seavankai	T	B	Bark decoction mixed with <i>curcuma longa</i> drinking daily.	[56, 59]
52	<i>Punica granatum</i> L.	Punicaceae	Madhulai	T	F	Powder about 1 teaspoonful is taken with water in the morning in empty stomach and also in the evening before meals.	[48, 49, 56, 70]
53	<i>Ricinus communis</i> L.	Euphorbiaceae	Amanaku	T	L&S	Water extract of the plant is given twice daily, seeds powder is taken with milk.	[79, 80]
54	<i>Rubia cordifolia</i> L.	Rubiaceae	Sevalaikodi	C	R	Powder is given with honey to treat diabetes.	[55, 59, 81, 82]
55	<i>Solanum nigrum</i> L.	Solanaceae	Manattakkali	H	L	Juice is taken orally in early morning.	[48, 50, 70]
56	<i>Syzygium cumini</i> (L.) Skeels.	Myrtaceae	Naval	T	S	Powder about 1 teaspoonful is taken with water in the morning in empty stomach and also in the evening before meals.	[44, 49-51, 58, 62, 64, 65, 83]
57	<i>Tamarindus indicus</i> L.	Caesalpiniaceae	Puli	T	F	Boiled water, flower mixed filter the decoction drink empty stomach.	[57, 70]
58	<i>Tephrosia purpurea</i> Pers.	Fabaceae	Kozhunchi	H	R	Half cup of juice obtained from crushed stems is taken in the morning on an empty stomach.	[84]
59	<i>Terminalia arjuna</i> (Roxb.) Wight & Arn.	Combretaceae	Marutham	T	B	Water extract of bark mixed with Milk is given before sleep for 3 weeks.	[70, 64]
60	<i>Terminalia chebula</i> Retz.	Combretaceae	Kadukai	T	F	Fresh fruits are also dried when available and when not available, dried fruits are soaked in water overnight followed by drinking the water in the morning.	[44, 64]
61	<i>Tinospora cordifolia</i> (Willd.) Hook. f. & Thoms.	Menispermaceae	Kattukodi	C	L	Leaf decoction is given internally.	[50, 58, 59, 64, 68, 72, 77]
62	<i>Tribulus terrestris</i> L.	Zygophyllaceae	Nerungil	H	F	Dried fruit decoction is used for drinking	[59]
63	<i>Withania somnifera</i> Dunal	Solanaceae	Amukkuran	H	L	The juice of the leaves used for diabetes.	[48, 57]
64	<i>Zingiber officinalis</i> Roxb.	Zingiberaceae	Iengi	H	Rh	Decoction is consumed regularly.	[57]
65	<i>Zizyphus jujube</i> (L.) Gaertn.	Rhamnaceae	Illanthai	S	F	Powder is taken twice or thrice daily in empty stomach.	[79]

Parts used Key: L-Leaves, F-Fruits, R-Roots, S-Seeds, F-Flowers, B-Bark, WP-Whole plant, Rh- Rhizomes, T-Tuber and b-Bulb. Habits Key: T-Tree, S-Shrubs, H-Herbs and C-Climbers.

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