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Documentation of antidiabetic medicinal plants in district Mandi of Himachal Pradesh (India)

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Abstract: A survey was carried out in district Mandi of Himachal Pradesh (India) to gather information related to the plants used for the management of diabetes. Documentation of this knowledge is important as it is vanishing gradually. The local people, traditional healers or vaidyas were interviewed by using a semi-structured questionnaire. A total of 25 plant species belonging to 17 families, mostly from Lamiaceae and Cucurbitaceae were used to treat diabetes. Maximum plants (28%) were trees followed by herbs and shrubs (24% each), climber (20%) and liana (4%). Fourteen species were found growing wild and leaves were the most commonly used plant part (40%). The medicinal preparations include juice, decoction, cooked, powder or paste form. All the formulations were prepared from single plant species. *Ajuga parviflora*, *Syzygium cumini*, *Eleusine coracana*, *Tinospora sinensis*, *Berberis aristata*, *Momordica charantia* were some of the most frequently used plant species. Three plant species i. e. *Clematis virginiana*, *Cornus capitata* and *Cucumis sativus* var. *hardwickii* have been reported for the first time as an antidiabetic.

Keywords: Ethnobotany, Medicinal plants, Traditional knowledge, Diabetes.

Introduction

Human being depends upon plants for their various needs such as food, fodder, fuel, timber, fibres, dyes, gums, resins, medicines etc. They have developed this knowledge about plants in due course of time by performing experiments that has subsequently results into traditional knowledge¹. The human healthcare system is highly benefited from traditional or folk knowledge. Medicinal plants have been used from long time all over the world for the treatment of human and animals diseases^{2, 3,4}. In ancient times, most of the medicinal preparations were made from plants or plant parts either in simple or complex form. Even today, large numbers of drugs are developed from plants⁵. The different sections of society in India, still depends upon variety of herbs for the treatment of various health problems. However, the plant parts used, preparation and mode of administration of these medicines may vary for each species at different places⁶. The use of plant based medicines is growing nowadays because of their moderate costs, fewer side effects and easy availability⁷. The important information about the traditional medicinal plants may lost if not taken care. Thus, the maintenance of traditional knowledge is very important⁸.

Diabetes is a health disorder that affects various systems of body such as visual, circulatory, renal and nervous system⁹. In spite of availability of several modern medicines in market it is becoming a major health related problem. Scientists are still searching for a successful treatment to cure it permanently. Presently, several people in different parts of the world have been suffering from diabetes. It has been estimated that number may increase by 5.4% in 2025. However, the disease can be managed by controlling blood glucose level^{10,11}. Many plant species have been known for their antidiabetic potential in different studies^{12,13,14,15}. The present study is

initiated to document the traditional medicinal plants that are used by natives of district Mandi for the treatment of diabetes.

Materials and Methods

The ethnobotanical study has been carried out in district Mandi of Himachal Pradesh that lies between 31°13'50" and 32°04'30"N latitude and between 76°37'20" and 77°23'15"E longitude and covering an area of 3951 km². About 373 km² of area is covered by very dense forest, 735 km² by moderate dense forest and 567 km² of area by open forest. Therefore, 42.41% of geographical area of district is covered by forests¹⁶. The district is situated in the mid hills sub humid zone and high hills temperate wet agro climatic zone of Himachal Pradesh. The average annual rainfall ranges between 1000 to 2376 mm. The variations in climate, geographical locations and topography have blessed the study area with floristic diversity.

The field trips were undertaken for the collection of data during 2012-2015. Field visits were made to different villages of the study area. Local inhabitants, healers and vaidyas were interviewed by using a semi-structured questionnaire. The respondents were selected without considering their educational qualifications, sex and occupation. However, the persons of more than 30 years of age were preferred. The interviews were conducted in local dialect and Hindi for better communication. The local names, habits, sources, plant parts used, modes of preparation and administration of plant species used for the treatment of diabetes were recorded. The useful plants were photographed in their natural habitats. The plants were compared to other floras^{17,18} and also confirmed with the herbarium of Department of Botany, Panjab University, Chandigarh.

Results and Discussion

During present investigation, 25 species belonging to 23 genera and 17 families were recorded to be useful in the management of diabetes. These species, their local names, families, habit, source, plant part used, mode of medicinal preparation and administration has been summarized in Table 1. All the species were photographed as a record (Figure 1). Previously, the use of 37 species from 28 families as an antidiabetic by the tribal communities residing in Sikkim and Darjeeling were documented¹⁹. Similarly, 50 herbal preparations were recorded during the survey conducted in selected districts of Lagos State, Nigeria²⁰. In present study, 25 species are distributed in 17 families like Lamiaceae (3 genera) and Cucurbitaceae (2 genera) possess three species each. Two species have been included in the families Berberidaceae (only one genus), Fabaceae, Poaceae and Rutaceae (2 genera in each). Most of the families (64.70%) were monotypic i. e. represented by a single species. Earlier, 12 antidiabetic plant species of family Rubiaceae were enlisted by the people of Eastern Uttar Pradesh, India²¹. Trees were dominating (28%) as compared to herbs and shrubs which were equal in number (24%). Climbers were 20% followed by only 4% lianas (Figure 2). *Ajuga parviflora*, *Syzygium cumini*, *Eleusine coracana*, *Tinospora sinensis*, *Berberis aristata* and *Momordica charantia* were some of the most cited plants. Other species like *Cuscuta reflexa*, *Cynodon dactylon*, *Ocimum tenuiflorum*, *Cordia dichotoma* and *Dalbergia sissoo* have also been utilized as antidiabetic plants. Fourteen of these species are growing wild whereas the remaining are cultivated. It has been observed that all the formulations have been prepared from the single plant species. The use of these species in polyherbal forms likely to be more effective. The dosage of particular medicines may vary as it depends upon the age and general health of the patients.

Various methods of preparation of these herbal remedies have been recorded. Decoction of (24%) species followed by juice of (20%), powder (16%), cooked and paste (4% each) were practised by the inhabitants. In addition to this, 16% species were consumed as such and 20% were chewed to manage the diabetes. Most of the remedies (14) were prepared from fresh fresh materials. Some others (7) were prepared from dry as well as fresh materials. The materials of only from four species have been used in dry form. The additives such as water, salt, fruits of *Piper nigrum* have been used in some preparations. Different plant parts such as fruits, leaves, roots, seeds, whole plant, twigs etc. were used for the preparation of traditional medicines. It has been observed that 40% species were harvested for their leaves, followed by fruits (20%), roots, seeds, whole plant (8% each) and others (such as gel, leaves as well as seeds and so on with 4% each) (Figure 3). Similar study conducted in South Western Nigeria was resulted in documentation of 31 species²². Most of the plant species were from Rutaceae, Leguminosae and Cucurbitaceae families. In another study, 30 antidiabetic plants from 17 families were summarized from Urmia region of Northwest Iran²³. Most of the members were from family Lamiaceae followed by Fabaceae and Rosaceae. Similarly, the members of families Lamiaceae and Cucurbitaceae (3 each) were preferred by the natives of the present study area. Leaves were the commonly used

plant part and given in decoction form. Other plant parts like flowering shoots, fruits, stem and seeds were also used. Ethnobotanical explorations of rural and urban areas of Dhaka had reported 37 antidiabetic plant species²⁴. Out of 37, nine species namely, *Azadirachta indica*, *Catharanthus roseus*, *Centella asiatica*, *Cynodon dactylon*, *Momordica charantia*, *Ocimum tenuiflorum*, *Syzygium cumini*, *Tinospora sinensis* and *Trigonella foenum-graceum* have also been recorded during the present study. This shows the popularity of common traditional medicinal plants across the boundaries. Ethnobotanical studies with special reference to antidiabetic plants were carried out in various parts of the world as well. Previously, various ethnobotanical studies were conducted like in Nanda Devi National Park, Uttarakhand²⁵; Namakkal district, Tamilnadu²⁶; Northeast India²⁷; South Africa²⁸; Morocco²⁹ have registered some of the common plant species to the present study. All these studies have reflected the use of traditional herbal remedies by the people to take care of their health problems including diabetes. *Ajuga parviflora* was one of the most cited plant species for its antidiabetic potential. However, several *in vivo* and *in vitro* studies have also been done on other species of genus *Ajuga*^{30,31}. The detailed study of this species is required to understand its hypoglycaemic activity. Three plant species i. e. *Clematis virginiana*, *Cornus capitata* and *Cucumis sativus* var. *hardwickii* have not been reported previously for the treatment of diabetes. Further studies can be performed on these species to establish their antidiabetic property.

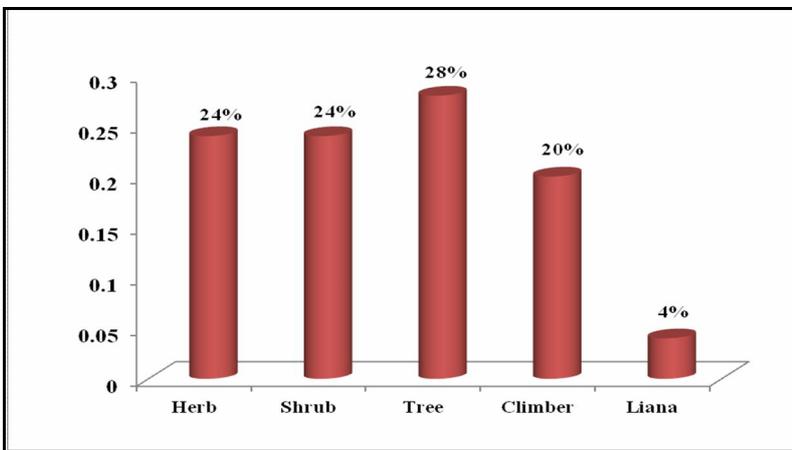


Figure 1: Photographs of plant species used for treatment of diabetes in study area

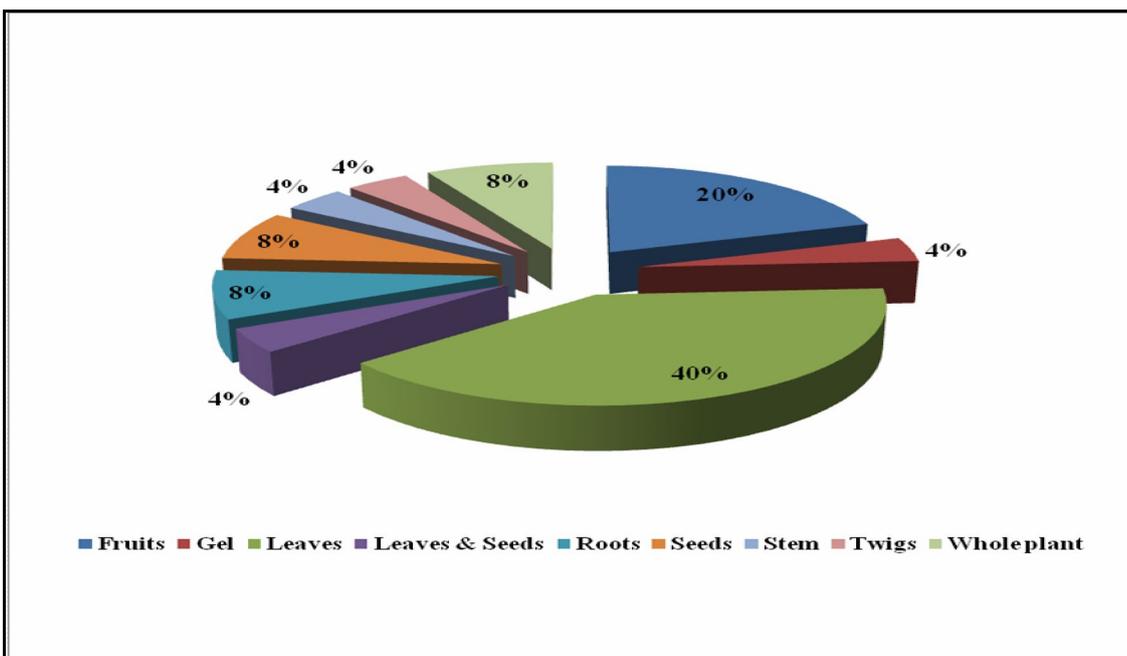


Figure 3: Percentage(s) of part used in preparation of medicines

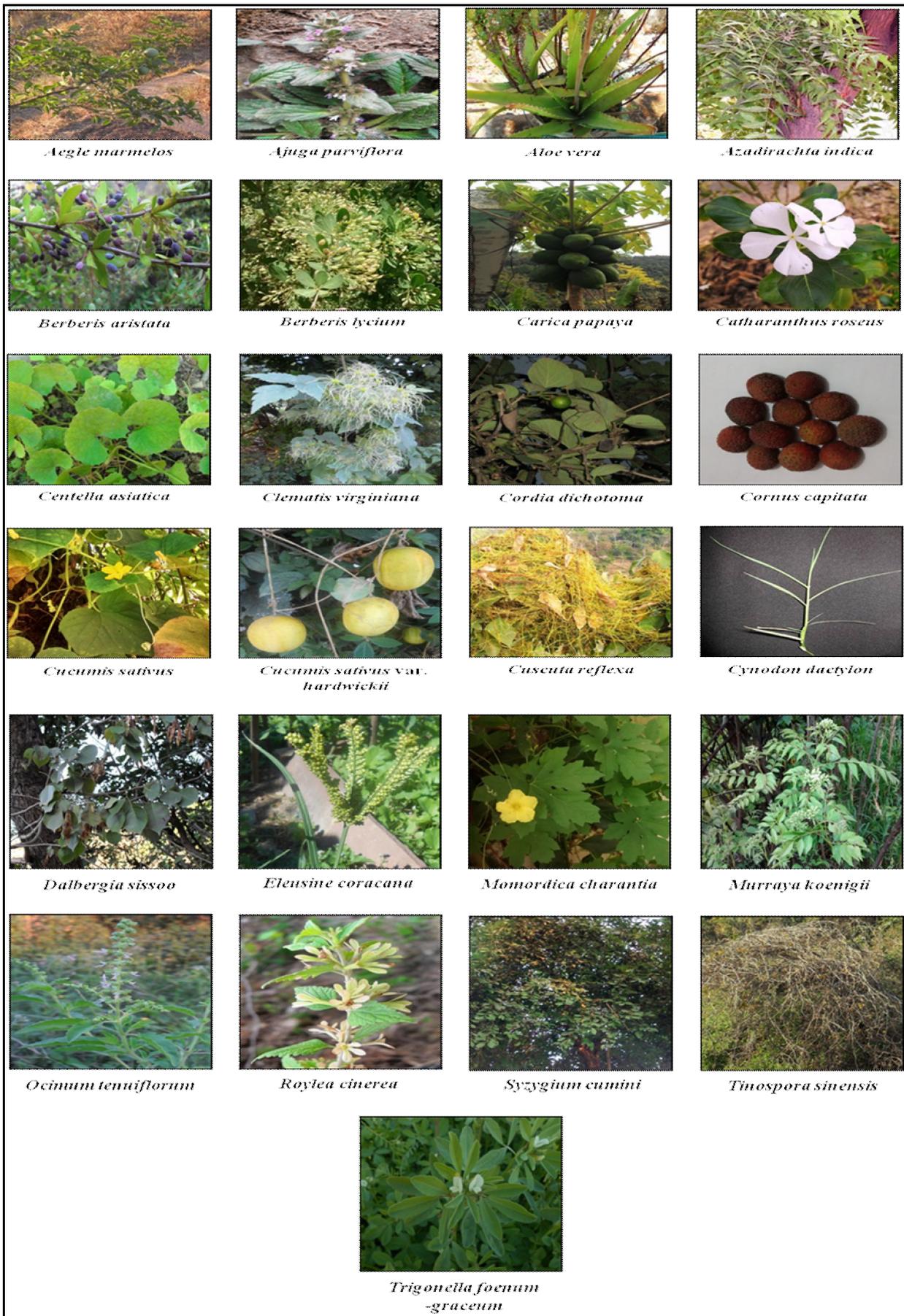


Figure 2: Life form(s) of different medicinal plants

Conclusion

The ethnobotanical study conducted in district Mandi has revealed the significance of wild and cultivated plant species in diabetes. Many recorded species have also been used traditionally for the same purpose by inhabitants of other regions or countries including India. Many of these species have been proved scientifically for their antidiabetic potential. However, as per the available literature, *Clematis virginiana*, *Cornus capitata*, *Cucumis sativus* var. *hardwickii* have been reported for the first time. These species are likely to have an antidiabetic potential. Further studies are required to prove their antihyperglycaemic activity. This can provide some new, alternate or modified materials to the pharmaceutical sectors.

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Table 1: Plant species used for the management of diabetes

Botanical name	Local name	LF	SOU	PPU	Method of use
Apiaceae					
<i>Centella asiatica</i> (L.) Urb.	Brahmi, Haandu-maalu Katorni, Minki	H	W	Lv	Decoction of dry leaves given to drink
Apocynaceae					
<i>Catharanthus roseus</i> (L.) G. Don	Sadabahar	S	C	Lv	Three fresh leaves are chewed and eaten empty stomach early in the morning
Berberidaceae					
<i>Berberis aristata</i> DC.	Kashmal	S	W	Rt	Decoction or infusion of roots are given to drink
<i>Berberis lycium</i> Royle	Kashmal	S	W	Rt	Decoction or infusion of roots are given
Boraginaceae					
<i>Cordia dichotoma</i> G. Forst.	Lasora	T	C	Lv	Juice of leaves is given to drink
Caricaceae					
<i>Carica papaya</i> L.	Papita	T	C	Fr	Fruits are eaten as such
Convolvulaceae					
<i>Cuscuta reflexa</i> Roxb.	Akash bail	Cl	W	Wp	Juice of whole plant is taken
Cornaceae					
<i>Cornus capitata</i> Wall.	Thrimbal	T	W	Fr	Fruits are eaten as such
Cucurbitaceae					
<i>Cucumis sativus</i> L.	Kakdi	Cl	C	Fr	Juice of fruit is given to drink
<i>Cucumis sativus</i> var. <i>hardwickii</i> (Royle.) Alef.	Fafanu	Cl	W	Fr	Fruits are eaten as such
<i>Momordica charantia</i> L.	Karela	Cl	C	Fr	Juice of the fruits is given to drink
Fabaceae					
<i>Dalbergia sissoo</i> DC.	Tahli, Syunti	T	W	Lv	Infusion of leaves are taken in morning
<i>Trigonella foenum-graceum</i> L.	Methi	H	C	Sd	One small spoon of seed powder is given with water
Lamiaceae					
<i>Ajuga parviflora</i> Benth.	Neelkanthi	H	W	Lv	Leaves are chewed and eaten
<i>Ocimum tenuiflorum</i> L.	Tulsi	S	C	Lv	Leaves are chewed
<i>Royalea cinerea</i> (D. Don) Baill.	Kadkoi, Kdkhre, Kadwo, Itsri	S	W	Lv	Leaves are chewed
Meliaceae					
<i>Azadirachta indica</i> A. Juss	Neem	T	C	Lv	Leaves are chewed and eaten
Menispermaceae					
<i>Tinospora sinensis</i> (Lour.) Merr.	Giloe	L	W	St	Stem is eaten as fresh or dry powder

Myrtaceae					
<i>Syzygium cumini</i> (L.) Skeels	Jaman	T	W	Lv, Sd	Dry leaves, seeds are powdered and taken with water or water kept in a bowl made of its wood is taken
Poaceae					
<i>Cynodon dactylon</i> (L.) Pers.	Doob	H	W	Wp	Juice of whole plant is taken with salt in morning time
<i>Eleusine coracana</i> (L.) Gaertn.	Kodra, Mandal	H	C	Sd	The seed is made into flour to make 'chapati' and eaten
Ranunculaceae					
<i>Clematis virginiana</i> L.	Bakarbail, Gurmar	Cl	W	Lv	Leaves are pounded with 2-3 fruits of <i>Piper nigrum</i> and paste is given
Rutaceae					
<i>Aegle marmelos</i> (L.) Correa.	Bil	T	W/C	Tw	Cold infusion of twigs is given to drink
<i>Murraya koenigii</i> (L.) Spreng.	Gandhelu	S	W	Lv	Dry powder of leaves is taken
Xanthorrhoeaceae					
<i>Aloe vera</i> (L.) Burm. f.	Kware	H	C	Gl	Leaf gel is eaten as such

Abbreviations: LF= Life form(s); SOU= Source(s); PPU= Plant part used; Cl= Climber, H=Herb, S=Shrub, T=Tree; W=Wild, C=Cultivated, W/C=Wild/Cultivated; Fr=Fruits, Gl=Gel, Lv=Leaves, Rt=Roots, Sd=Seeds, St=Stem, Tw=Twigs, Wp=Whole plant