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**Ethno-medicinal plants for treatment of diabetes,
cancer and heart diseases: Evidence based
documentation from dependent stakeholders**

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Abstract

Indigenous traditional knowledge of ethno-medicinal plant resources is socially accepted among communities throughout the globe. In the present study, evidence based documentation of ethno-medicinal plant species along with their utilization pattern was done for three major diseases (cancer, diabetics and heart diseases) affecting human health. The study conducted in six villages near Srinagar valley of Garhwal Himalaya and eight villages in Fatehpur district of Uttar Pradesh. The information regarding the evidence based traditional knowledge; uses of plants, local names, parts used, purposes, modes of use, curative properties were documented through interviews and discussions with all informants. The information was collected through a well-structured questionnaire. The information revealed that people from both the places use 53 species of medicinal plants to cure these three diseases. These 53 plants belonging to 33 families with dominant contribution of family Fabaceae. In the life form the dominant contribution was of herbs followed by trees and shrubs. Among the diseases, the highest consensus was reported for cancer (0.75) followed by diabetes (0.50) and heart diseases (0.33). The study concluded that plant species are highly valuable for treating important diseases and therefore, conservation and sustainable utilization of these ethnobotanical resources are essential.

Keywords: Traditional knowledge, diseases, exploration, conservation, sustainable utilization, treatment

Introduction

Indigenous traditional knowledge of herbal medicines combined and supplemented by modern scientific insights can lead the new holistic models for the sustainable development that are economically viable, environmentally benign and socially acceptable (Shinwari *et al.*, 2003)^[10]. Traditional knowledge of herbal medicines when compared with other drug discoveries had contributed many different therapeutic compounds of medicines to cure and prevent various diseases. Most of the plants have secondary metabolites like glycosides, flavonoids, cumerin, polyphenols, terpenes and alkaloids which have been reported to possess the antimutagenic and anticancer properties in many studies (Gupta and Tandon 2004). From several decades, medicinal plants are being utilized to cure various diseases as a natural remedy through the knowledge of Ayurveda. Treatment through herbal medicine provides the source of new knowledge for new drug development which leads towards various healthcare problems and synthesis of new formulations. Medicinal plants when compared with the other preventive and curative medicines, medicinal plants contributed many novel therapeutic compounds for the treatment of several diseases (Lakshmi *et al.*, 2015). Now days, ethnomedicine is becoming much valuable for the developmental activities of health care, conservation and preservation programs in the various parts of the whole world (Antony *et al.*, 2018).

Generally, all plants have their own medicinal values. But scientifically, medicinal plants include all those plants which are rich in secondary metabolites and are the potential source of drugs. Secondary metabolites include glycosides, polyphenols, terpenes, flavonoids, cumerin and alkaloids etc. have been reported for the treatment of several diseases in many studies (Gupta and Tandon, 2004). An age-old relationship is being shared by both human and plants.

Human dependency on plants can be still seen and it is recorded that higher plants contain 25% of prescription drugs which have active components (Tiwari and Joshi, 1990; Das and Choudhuri, 2012).

Cancer is one of the major burden for the public health in developed and developing countries and there are 10.9 million new cases, 6.7 million deaths, and 24.6 million persons living with cancer around the world in the year 2012 (Rashed, 2014). Number of plant species with a huge reservoir of bioactive compounds but only with a small percentage of which have been examined and continued to be as an important source of anticancer agents (Sejal, 2016). The major factors responsible for the heart diseases are stressful life style, improper diet, high serum cholesterol, high blood pressure, heredity etc (Lokhande *et al.* 2006) and is being treated with Ayurveda, treatments using different plant formulations (Lokhande *et al.*, 2006). Diabetes is also one of the challenging health diseases affecting human health. Even though different herbal medicines can be used as an anti-diabetic remedies and used as other synthetic agent such as insulin for cure such disease (Okapala 2015). As these diseases are very serious and can be lethal in the most of cases and hence the information documented needs to be done with care. Therefore in the present study informants were herbal healers, local vaid, and patients, members of the patient's

family and relative of patients. The present study was thus carried out among these knowledgeable and experienced informants who were well versed with these diseases and used plants as well as their applicability to gain the proper evidence.

Material and methods

Study area

The present study was undertaken at two different places in the Uttarakhand and Uttar Pradesh states of India, to document the information on evidence based disease cured methods by plants on cancer, diabetics and heart diseases. In Uttarakhand, the study was focused in the Srinagar valley and its adjacent villages of Garhwal Himalayan sub-tropical region to temperate and in Uttar Pradesh 09 villages in Fatehpur district falls in tropical region. The study villages in Uttarakhand ranges between 900 to 1800m amsl, however in Uttar Pradesh ranged between 100 to 150m amsl. The details of the study area have been given in Table-1 and Figure-1 (Location Map: Figure-1). The annual average temperature in Fatehpur area was 25.9°C and annual rainfall 928 mm. However, the annual average temperature of Srinagar valley was 16.3°C and rainfall 1610 mm (climatedata.org). Both the study area characterized by three main seasons; winter (November to March), dry summer (mid-April to June), and wet period (July to mid-September).

Table 1: Details of study area

Sl	District	Villages	Latitude	Longitude	Altitude (meter)
1.	Pauri	Khola	30°12'46.19"N	78°47'19.54"E	914
2.		Khirsu	30°10'20.72"N	78°52'04.52"E	1766
3.		Gawad	30°10'46.15"N	78°51'59.77"E	1566
4.		Salondhar	30°04'29.90"N	79°04'45.72"E	1800
5.		pauri	30°08'50.71"N	78°46'28.97"E	1686
6.		Jhala	30°11'18.54"N	78°51'23.65"E	1295
7.	Fatehpur	Radhanagar	25°54'13.92"N	80°47'38.31"E	129
8.		Gazipur	25°48'02.96"N	80°45'02.20"E	119
9.		Dadiva	25°47'27.52"N	80°45'46.65"E	120
10.		Banvara	25°47'33.30"N	80°46'26.73"E	119
11.		Lamehta	25°42'47.54"N	80°40'56.89"E	115
12.		Khaga	25°46'20.82"N	81°06'12.69"E	114
13.		Mohammadpur	25°48'27.56"N	80°43'47.09"E	120
14.		Ganganagar	25°54'52.03"N	80°47'58.72"E	118
15.		Samaor	25°47'02.65"N	80°44'06.65"E	121

Data collection

The information regarding the evidence based traditional knowledge; uses of plants, local names, and parts used, purposes, modes of use, curative properties were documented through interviews and discussions with all informants. The informants were mostly elderly people belonging to both the genders. The information were collected from the persons mostly involved with the application of these plant species personally and hence herbal healers, local vaid, patients, experienced people, patient's near and dear ones were mostly targeted in the study. The information was collected through a well-structured questionnaire (Annexure-1). Before collection

of final data oral prior informed consent from the participants was taken. The reported plant species in the present study (Table-2) were also validated with the previous available literature (Table-3).

A consensus survey was conducted based on people's perception on the number of plants used for a particular ailment. The consensus factor (F_{ic}) was used to test the homogeneity of the informant's knowledge (Trotter and Logan, 1986; Ragupathy *et al.*, 2008) using following formula. $F_{ic} = \frac{N_{ur} - N_i}{(N_{ur} - 1)}$ where, N_{ur} = number of use report of informants for particular illness

N_i = number of taxa used for particular illness by informants.

Table 2: Plant species used for curing various diseases of cancer, diabetic and heart

S.N.	Species name	Common name	Family	Parts used	Used for diseases	Mode of use
1.	<i>Aegle marmelos</i> (L.) Correa	Bel	Rutaceae	Leaves	Diabetes	Take 15-20 soft and fresh leaves, clean with water, grind them and make juice. Further add a cup of water with juice. Taking half cup of juice daily is beneficial to control diabetes level. Take dry leaves and grind with equal amount of jamun granules and make their powder. Taking 2 teaspoon powder with a glass of water every day in morning is beneficial to control diabetes.
2.	<i>Allium cepa</i> L.	Onion	Amaryllidaceae	Whole plant	Diabetes	Take 3-4 green onions including roots wash and soak them in 1 liter of water at night. Take it empty stomach in morning. Help in control diabetes. Grind green leaves and make juice and take juice with empty stomach, controls diabetes.
3.	<i>Allium sativum</i> L.	Garlic	Amaryllidaceae	Seed	Heart disease	Garlic juice or eating directly provides benefits to cure heart related diseases. Regular use of garlic controls sugar level and helps in blood purification.
4.	<i>Aloe barbadensis</i> Miller	Alovera	Asphodelaceae	Leaves	Diabetes	Alovera juice control and reduce high sugar level. Leaves juice is beneficial for diabetic patients.
5.	<i>Amaranthus viridis</i> L.	Chaurai	Amaranthaceae	Leaves	Diabetes	Collect green leaves, wash them well, boil leaves and make green vegetable is very beneficial to control diabetes.
6.	<i>Anthocephalus cadamba</i> (Roxb.) Miq.	Kadamba	Rubiaceae	Leaves, bark	Cancer	Take leaf, bark and boil it. When water is lukewarm, clean cancer wound with that water helps in healing wound. Drinking leaf juice also benefits to cure cancer wounds.
7.	<i>Azadirachta indica</i> A.H.L. de Juss.	Neem	Meliaceae	Bark, leaves	Cancer, diabetes	For cancer- take bark, grind make paste and impose on cancer wound, it prevents wounds from growing. Taking leaves juice every morning; release all poisonous elements away from body. Juice also cures infection of ulcer in stomach and daily consumption help to survive patient against cancer disease. or diabetes- Take leaf juice with empty stomach every morning controls sugar level. Chewing fresh leaves in morning also controls sugar level.
8.	<i>Berberis aristata</i> DC.	Kingod	Berberidaceae	Root	Diabetes	Overnight dip roots in a glass water and taken with empty stomach in morning controls diabetes.
9.	<i>Boenninghausenia albiflora</i> (Hook.) Reichb. ex Meisn.	Ruta	Rutaceae	Leaves	Diabetes	Leaves soak in a glass of water at night and drink in morning with empty stomach. Soaked leaves grind make juice and juice taken to cure diabetes.
10.	<i>Boerhavia diffusa</i> L.	Punarnava	Nyctaginaceae	Leaves, root	Heart disease	For leaves- wash fresh leaves in clean water, grind and make juice to patient to cure several heart related problems. For root- Dry roots powder mix in equal quantity with turmeric powder. One teaspoon powder mixed in a glass of lukewarm water and given to patient twice in a day to removes Asthma.
11.	<i>Carica papaya</i> L.	Papita	Caricaceae	Leaves, fruits, seeds	Cancer	For leaves- half cup of leaf juice given to patient one time and several times in a day help to cures lesions (wounds) of internal cancer. For seeds- seed powder with water given in regular interval in a day to increases patient resistance power. For fruits- raw fruits eaten by cancer patient. If the patient cannot eat them fruit grind and make juice to the patient.
12.	<i>Carissa carandas</i> L.	Karaunda	Apocynaceae	Leaves & fruits	Cancer	For leaves- Half cup fresh leaf juice given to patient in every morning and evening. For fruits- take fruits, crush and make paste Give paste to patient. Juice can be also given.
13.	<i>Cassia angustifolia</i> L.	Sanay, Indian senna	Caesalpiniaceae	Leaves	Cancer	Give thick leaves paste to patient alone or in food. If patient is not in condition to eat it, half cup of juice of leaves given to patient. Dry leaves powder with one glass of water given to patient 4-6 times in a day.
14.	<i>Cassia fistula</i> L.	Amaltas	Caesalpiniaceae	Fruits, seeds, leaves, bark	Cancer, heart diseases	Bark used for cancer- Take bark, leaf grind, then add some vinegar and make paste which applied on infected cancer (wound) stops spreading infection. Make thick paste of leaf, bark, flowers, seeds and roots in equal proportion and eaten by patient to cure wound of cancer from further spreading. Fruit used for Asthma-Take fruit pulp, add water and heat up to boiling point and make lukewarmness and given to patient.
15.	<i>Cassia tora</i> L.	Chakwad	Fabaceae	Seeds	Cancer	Take seeds, grind and make powder and one tea spoon power in one glass of water given to patient with empty stomach in morning decreases risk of cancer and cure wound.
16.	<i>Catharanthus roseus</i> (L.) G.Don	Sadabahar	Apocynaceae	Leaves, flowers, roots	Cancer, diabetes and blood pressure	For Cancer- Wash young leaves in fresh water grind and make paste to patient. Leaf juice also given. For Diabetes- Juice of leaves, flower and branches given to patient in morning with empty stomach. or Blood pressure- Cleaned roots are given to patient for chewing and eat to cure high blood pressure. Chewing roots of sargandha with it is more beneficial.
17.	<i>Chenopodium album</i> L.	Bathua	Amaranthaceae	Leaves	Diabetes	Well washed leaves boiled and make green vegetable is very beneficial to control sugar level.
18.	<i>Cicer arietinum</i> L.	Chana, chickpea, gram	Fabaceae	Whole plant	Cancer	Whole plant juice extracted without washing and juice given to patient for cancer treatment.
19.	<i>Cichorium intybus</i>	Kasni	Asteraceae	Leaves	Diabetes	Take 4-5 fresh green leaves, wash them well and chew them or drink their juice is beneficial to control the sugar level.
20.	<i>Coriandrum sativum</i> L.	Dhaniya	Apiaceae	Seeds and leaves	Diabetes, blood pressure	For diabetes- Take coriander powder or seeds in soup, pickle or juice, water. Take 2 teaspoon of coriander seeds soaked in water for whole night and drink that water in the morning with empty stomach to cures diabetes. For blood pressure- Take some leaves, grind and make juice is beneficial to control high blood pressure.
21.	<i>Curcuma longa</i> non L.	Haldi	Zingiberaceae	Root	Cancer	Turmeric powder mixed in hot milk and drink regularly helps to get rid of internal lesions like Ulcer and cancer. Regular use of turmeric prevents the risk of any type of cancer and prevents cancerous lesions from growing.
22.	<i>Cynodon dactylon</i> (L.) Persoon	Doob ghas	Poaceae	Whole plant	Diabetes, heart related problem	Morning walk in doob grass reduces blood pressure and drinking its juice with empty stomach control sugar level of body and also helps to cure heart diseases.
23.	<i>Dalbergia sissoo</i> Roxb.	Shisham	Papilionaceae	Leaves	Diabetes	Equal proportion green leaves of shisham, neem and sadabahar and grind them, make paste and use 1 teaspoon paste with water twice in a day reduces and controls high sugar level. Similarly equal proportion of dry leaves of shisham, neem and sadabahar make powder and 2 teaspoon of powder with 1 glass of water daily use with empty stomach control diabetes
24.	<i>Datura</i>	Dhatura	Solanaceae	Seeds,	Heart	For leaves-Asthma can be cured by sniffing burning dry leaves by patient. Smoking of

	<i>stramonium L.</i>			leaves	diseases	Datura leaves also helpful in Asthma. For seeds- Regular use of well dried half teaspoon powder of seed with a glass of water cured heart disease.
25.	<i>Digitalis purpurea L.</i>	Hrid Patri	Scrophulariaceae	Leaves	Heart diseases	Well washed plant grind, make juice and filter used regularly by patient help in blood purification and controls blood pressure.
26.	<i>Elaeocarpus ganitrus Roxb</i>	Rudraksh	Tiliaceae	Fruits, seeds	Heart related diseases	Use of fruits juice helps to cure heart related diseases. Seeds are grind make powder which cure heart diseases.
27.	<i>Elettaria cardamomum</i>	Elayachi	Zingiberaceae	Seeds	Heart diseases	Extremely beneficial for cardiovascular disease by using any way. Consuming its seeds in tea or food, improves blood quality and control blood pressure.
28.	<i>Gloriosa superba L.</i>	Vajjanti	Colchicaceae	Seed	Diabetes	Half spoon seed powder with a glass of water given patient with empty stomach daily.
29.	<i>Hibiscus rosa-sinensis L.</i>	Gudahal	Malvaceae	Leaves	Diabetes	Grind fresh leaves, take 3-4 teaspoon of fresh leaf juice mixed in a glass of water and keep for night. Juices are taken with empty stomach in morning control diabetes within 10-15 days. Chewing leaves in morning also helps to control diabetes.
30.	<i>Linum usitatissimum L.</i>	Alasi	Linaceae	Seeds (oil)	Heart disease and diabetes	For heart diseases- Consuming seed oil helps to cure many kinds of diseases. It controls high blood pressure and reduces the risks of heart related problems. For diabetes- Mix 1 teaspoon seed powder in a glass of water at night and drinking with empty stomach in morning controls high diabetes level.
31.	<i>Mangifera indica L.</i>	Mango	Anacardiaceae	Leaves	Diabetes	Soak 10 to 12 mango leaves in a glass of water at night and drink water in morning with empty stomach and grind soaked leaves, make juice and drink juice also beneficial cure diabetes. Half teaspoon dry leaves powder with 1 glass of water helps to cure diabetes.
32.	<i>Mentha arvensis L.</i>	Pudina	Lamiaceae	Leaves	Diabetes and blood pressure	Drinking fresh leaves juice with a glass of water in morning is very beneficial to control diabetes level. Eating leaf paste (chatni) with food daily is beneficial to control low and high blood pressure.
33.	<i>Momordica charantia L.</i>	Karela	Cucurbitaceae	Fruit	Diabetes	Take 3-4 bitter guard, make juice, filter well and given patient with empty stomach in morning regularly keeps sugar level control.
34.	<i>Moringa oleifera Lam.</i>	Sahjan	Moringaceae	Seeds, leaves	Cancer & heart problems	For leaves- Half tea spoon dry leaves powder with 1 glass of water given to patient daily is very beneficial to cure heart related problems (blood pressure), ulcer & cancer. For seeds- Dip seeds in cow urine. Next morning, wash them in clean water, dry them and make powder. Daily use of one tea spoon powder with one glass of water is beneficial to cure cancer.
35.	<i>Murraya koenigii (L.) Sprengel</i>	Curry patta	Rutaceae	Leaves	Diabetes	Take leaf juice or chewing leaves with empty stomach daily in morning cure diabetes.
36.	<i>Ocimum sanctum L.</i>	Tulsi	Lamiaceae	Leaves, seeds	Cancer, diabetes and heart related problems (blood pressure)	For diabetes- Grind leaves and make juice then grind 4-5 black pepper and make powder. Leaf juice mixed with powder given to patient. For cancer- Boil leaf in hot water pot and make extracts. Add ginger and black pepper and given to patient is beneficial to cure ulcer and blood pressure. For Asthama- Consuming equal proportion of tulsi paste with honey cures asthama disease.
37.	<i>Phyllanthus emblica L.</i>	Amla	Phyllanthaceae	Fruit, seeds	Diabetes, heart related problems	For Diabetes- Grind dry fruits with equal proportion of berry's granules to make powder. 2-3 spoon powder with water given to patient with empty stomach in morning daily. Fresh Amla juice is also beneficial to control sugar level. Drinking amla seed powder with milk is cure diabetes. For Heart diseases- For high blood pressure, make murabba and give to patient to eat. Drinking 2 tea spoons Amla powder with milk cure heart problems.
38.	<i>Phyllanthus niruri auct. Pl.</i>	Bhumi Amla	Phyllanthaceae	Whole plant	Diabetes	Half cup juice of cleaned whole plant is given to patient in morning with empty stomach daily is beneficial to control sugar level.
39.	<i>Picrasma quassioides (D. Don) Bennett</i>	Kadavi	Simarubaceae	Root, leaves	Diabetes	For root- Soak root in one glass of water at night and drink water in morning with empty stomach. Soaked root again in another glass of water and drinking it in evening control diabetes level. For leaves- leaf juice given to patient daily in morning cures diabetes also.
40.	<i>Pterocarpus marsupium Roxb.</i>	Vijaysar	Fabaceae	Wood	Diabetes	Cut wood in small pieces. Put about 2 teaspoons of wood in 1 glass of water and keep it for night. In morning, water will turn red, filter water and drink it with empty stomach. Again soak these pieces of wood in another glass of water, boil and filter it in evening and drink controls diabetes.
41.	<i>Ricinus communis L.</i>	Arandi	Euphorbiaceae	Seeds	Cancer	Use seed oil for body massage of patient. Oil can also be use for eating, it cures cancer wound and helpful to slow down body pain.
42.	<i>Rumex hastatus D. Don</i>	Almoda	Polygonaceae	Roots	Diabetes	Roots are soaked in a glass of water and left for overnight and drink water in morning with empty stomach than chew and eat root are beneficial to cure diabetes.
43.	<i>Saraca asoca (Roxb.)</i>	Ashok	Fabaceae	Bark	Heart related problems	Dried bark grind and make powder and take 1 to 2 teaspoon of powder with water every day cure heart related diseases.
44.	<i>Solanum nigrum L.</i>	Makoy	Solanaceae	Whole plant	Diabetes, heart diseases	For leaves- Juice of 10-12 washed fresh leaves are given to patient in the morning with empty stomach to control sugar level and blood pressure. For fruits and seeds- Ripen fruits are beneficial to control sugar level of patient. Eating vegetables of makoy is also useful in several heart diseases.
45.	<i>Spinacia oleracea L.</i>	Palak	Amaranthaceae	Leaves	Cancer, diabetes and heart related problems	For heart problems- Make juice of green leaves and drink, reduces blood pressure and purifies blood. For diabetes- Use of juice, reduces the sugar level and beneficial to control diabetes. For Cancer- Eating spinach in any form reduces risk of cancer.
46.	<i>Syzygium cumini (L.) Skeel</i>	Jamun	Myrtaceae	Leaves, fruit and seeds	Diabetes	For leaves- Fresh leaves juice with 1 glass of water given to patient is beneficial to control to diabetes level. For fruits- Eating fruits directly is also beneficial to cure diabetes. For seeds- Take 2 teaspoon dry grinds seed powder with 1 glass of water twice in a day with empty stomach beneficial in diabetes.
47.	<i>Terminalia arjuna (Roxb. Ex DC.) Wight & Arn</i>	Arjun	Combrataceae	Bark	Heart related problems, diabetes	Grind bark with the equal amount of wild onion and make powder. Take half tea spoon with milk daily to get rid of heart related problems. It also helps to purify blood. Take equal amount of bark of Arjun, Kadamb and Jamun, grind them together and make powder. Heat 1 teaspoon powder with 1 glass of water and make a decoction. Take cool decoction daily is beneficial to, diabetes.
48.	<i>Terminalia bellirica (Gaertner) Roxb.</i>	Baheda	Combrataceae	Fruit, seeds	Diabetes	Dry fruits and seeds grind and make powder. Take 1-2 teaspoons of powder with water daily is beneficial for diabetes.

49.	<i>Terminalia chebula</i> Retz	Harra, harad	Combrataceae	Fruit	Diabetes	Make powder of equal amount of Harad and Amla seeds. Take 1-2 teaspoons of powder with water in empty stomach during morning. Grind fruits with milk is also beneficial for diabetes.
50.	<i>Tinospora cordifolia</i> (Willd.) Hook. F.	Giloy	Menispermaceae	Whole plant	Diabetes	Collect whole plant and boil in hot water and extract juice given patient for controls increased sugar level and beneficial to cure diabetes.
51.	<i>Trigonella foenum-graecum</i> L.	Methi	Fabaceae	Leaves, seeds	Diabetes	For leaves- Grind leaves and make juice and given to the patient with empty stomach in morning or its vegetable of green leaves control the sugar level of body. For seeds- Soak 1-2 spoons seeds in water at night and take that water in morning with empty stomach or chew or eat those soaked seeds reduces the increased sugar level and beneficial for diabetes.
52.	<i>Vitis vinifera</i> L.	Munakka (wild grapes)	Vitaceae	Fruits	Heart disease	Heat the milk and put 10-15 munakka in that hot milk. When milk gets hotter and looks like reddish then keep it slightly cooler. Taking such milk every day for 2-3 months cure patient completely from disease.
53.	<i>Zingiber officinale</i> Roscae	Adrakh (ginger)	Zingiberaceae	Root	Diabetes, heart related diseases	For Diabetes- Make juice of ginger's root and mix one teaspoon ginger juice in a glass of water and give it to patient. Drinking juice daily reduces diabetes level. For Heart related diseases- Take ginger, cinnamon and soth with equal amounts then grind it and make paste. Take 1 teaspoon paste with milk or water. Drinking it is useful in heart related diseases. It makes strong to heart. It also benefits in Angina or heart pain.

Table 3: Ethnomedicinal uses of documented species and validated with earlier studies

S.N.	Species name	Common Name	Parts used	Used for diseases	¹ Cancer, ² diabetes, ³ heart disease	Other uses
1.	<i>Aegle marmelos</i> (L.) Correa	Bel	Leaves	Diabetes	Pande <i>et al.</i> 2006 ^[3] .	Stomach disorder, appetiser, dysentery (Antony <i>et al.</i> 2018)
2.	<i>Allium cepa</i> L.	Onion	Whole plant	Diabetes	Okpala 2015 ^[2] .	Vomiting, piles, insect bite, itching, blisters (Pande <i>et al.</i> 2006)
3.	<i>Allium sativum</i> L.	Garlic	Seed	Heart disease	Lokhande <i>et al.</i> 2006 ^[3] , Ocvirk <i>et al.</i> 2017 ^[2] , Okpala 2015 ^[2] .	Blood diseases, cholera, joint pain, indigestion, earache (Pande <i>et al.</i> 2006)
4.	<i>Aloe barbadensis</i> Miller	Alovera	Leaves	Diabetes	-	Fire burnt skin, stomach disorder, body pain (Antony <i>et al.</i> 2018), Eye trouble, wound, skin disease, Jaundice (Pande <i>et al.</i> 2006)
5.	<i>Amaranthus viridis</i> L.s	Chaurai	Leaves	Diabetes	-	-
6.	<i>Anthocephalus cadamba</i> (Roxb.) Miq.	Kadamba	Leaves, bark	Cancer	Antony <i>et al.</i> 2018 ^[3] .	Mouth diseases, snakebite, fever, dysentery (Pande <i>et al.</i> 2006). Cholera, diarrhea, tooth pain, pimples, sore, asthma (Antony <i>et al.</i> 2018)
7.	<i>Azadirachta indica</i> A.H.L. de Juss.	Neem	Bark, leaves	Cancer, diabetes	Pande <i>et al.</i> 2006 ^[1,3] , Lokhande <i>et al.</i> 2006 ^[3] , Ocvirk <i>et al.</i> 2017 ^[2] .	Allergy, fever, pneumonia, small pox, appetite problem, brushing teeth, stomach disorder, skin disease, tooth pain (Antony <i>et al.</i> 2018)
8.	<i>Berberis aristata</i> DC.	Kingod	Root	Diabetes		Conjunctivitis, eye diseases, cold, fever (Pande <i>et al.</i> 2006)
9.	<i>Boenninghausenia albiflora</i> (Hook.) Reichb. ex Meisn.	Ruta	Leaves	Diabetes	-	Cuts, wounds, antiseptic, dysentery, vomiting and dandruff (Pande <i>et al.</i> 2006)
10.	<i>Boerhavia diffusa</i> L.	Punarnava	Leaves, root	Heart disease	Pande <i>et al.</i> 2006 ^[3] .	Jaundice, asthma, tonic, anemia, liver diseases (Pande <i>et al.</i> 2006)
11.	<i>Carica papaya</i> L.	Papita	Leaves, fruits, seeds	Cancer	-	Skin diseases, stomach trouble, constipations, gastric trouble (Pande <i>et al.</i> 2006). Gastroenteritis, appetizer, digestive (Antony <i>et al.</i> 2018)
12.	<i>Carissa carandas</i> L.	Karaunda	Leaves & fruits	Cancer	Lokhande <i>et al.</i> 2006 ^[3] .	Congenital heart disease & cardiovascular diseases (Antony <i>et al.</i> 2018)
13.	<i>Cassia angustifolia</i> L.	Sanay, Indian senna	Leaves	Cancer	-	-
14.	<i>Cassia fistula</i> L.	Amaltas	Fruits, seeds, leaves, bark	Cancer, heart diseases	Lokhande <i>et al.</i> 2006 Pande <i>et al.</i> 2006 ^[2] .	Skin diseases, snakebite, antiseptic, toothache (Pande <i>et al.</i> 2006)
15.	<i>Cassia tora</i> L.	Chakwad	Seeds	Cancer		Skin diseases, wounds, tumor, ulcer (Pande <i>et al.</i> 2006)
16.	<i>Catharanthus roseus</i> (L.) G. Don	Sadabahar	Leaves, flowers, roots	Cancer, diabetes and blood pressure	Patel 2016 ^[1] , Lakshmi <i>et al.</i> 2015 ^[1] .	Boils, cough, skin diseases (Pande <i>et al.</i> 2006)
17.	<i>Chenopodium album</i> L.	Bathua	Leaves	Diabetes		Clearing stool, piles, gastroenteritis (Antony <i>et al.</i> 2018)
18.	<i>Cicer arietinum</i> L.	Chana, chickpea, gram	Whole plant	Cancer		Remove dandruff (Pande <i>et al.</i> 2006)
19.	<i>Cichorium intybus</i>	Kasni	Leaves	Diabetes	-	-
20.	<i>Coriandrum sativum</i> L.	Dhaniya	Seeds and leaves	Diabetes, blood pressure		Urinary disorders, digestive trouble, vomiting (Pande <i>et al.</i> 2006)
21.	<i>Curcuma longa</i> non L.	Haldi	Root	Cancer		Wounds, throat sore, skin tonic, internal injury (Pande <i>et al.</i> 2006). Lactation problem of domestic animals, crack on legs, cough and cold, fever, stomach disorder, cuts and wounds (Antony <i>et al.</i> 2018)
22.	<i>Cynodon dactylon</i> (L.) Persoon	Doob ghas	Whole plant	Diabetes, heart related problem	Ocvirk <i>et al.</i> 2017 ^[2] , Antony <i>et al.</i> 2018 ^[3] .	Cuts and wounds, bleeding, vomiting, nose bleeding, increase lactation of domestic animals (Antony <i>et al.</i> 2018), vomiting, cuts, wounds, fever, Internal injuries (Pande <i>et al.</i> 2006)
23.	<i>Dalbergia sissoo</i> Roxb.	Shisham	Leaves	Diabetes	-	Skin diseases, headache, dysentery, vomiting (Pande <i>et al.</i> 2006)
24.	<i>Datura stramonium</i> L.	Dhatura	Seeds, leaves	Heart diseases	Pande <i>et al.</i> 2006 ^[3] , Ocvirk <i>et al.</i> 2017 ^[2] .	Rheumatism, jaundice (Pande <i>et al.</i> 2006) Joint pain (Antony <i>et al.</i> 2018) Joint pain (Kechar <i>et al.</i> 2014)
25.	<i>Digitalis purpurea</i> L.	Hrid Patri	Leaves	Heart diseases	Pande <i>et al.</i> 2006 ^[3] .	-
26.	<i>Elaeocarpus ganitrus</i> Roxb	Rudraksh	Fruits, seeds	Heart related diseases	-	-

27.	<i>Elettaria cardamomum</i>	Elayachi	Seeds	Heart diseases	-	Fever (Pande <i>et al.</i> 2006)
28.	<i>Gloriosa superba</i> L.	Vaijanti	Seed	Diabetes	-	Tumor, infection, skin diseases (Pande <i>et al.</i> 2006)
29.	<i>Hibiscus rosa-sinensis</i> L.	Gudahal	Leaves	Diabetes	-	Jaundice, cough, oral contraceptive (Pande <i>et al.</i> 2006) Tonsillitis, dandruff, hair loss (Antony <i>et al.</i> 2018)
30.	<i>Linum usitatissimum</i> L.	Alasi	Seeds (oil)	Heart disease and diabetes	-	-
31.	<i>Mangifera indica</i> L.	Mango	Leaves	Diabetes	³ Lokhande <i>et al.</i> , 2006 ² Ocvirk <i>et al.</i> 2017	Impotency, intestinal diseases, bleeding, scorpion sting (Pande <i>et al.</i> 2006). Congenital heart disease & cardiovascular diseases Jaundice, blood dysentery, diarrhea (Antony <i>et al.</i> 2018)
32.	<i>Mentha arvensis</i> L.	Pudina	Leaves	Diabetes and blood pressure		Vomiting, indigestion (Pande <i>et al.</i> 2006)
33.	<i>Momordica charantia</i> L.	Karela	Fruit	Diabetes	Okpala 2015 ^[2] . Pande <i>et al.</i> 2006 ^[2] .	Eczema, rheumatism, stomachache (Pande <i>et al.</i> 2006)
34.	<i>Moringa oleifera</i> Lam.	Sahjan	Seeds, leaves	Cancer & heart problems	Antony <i>et al.</i> 2018 ^[3] . Pande <i>et al.</i> 2006 ^[3] .	Blood pressure, gastroenteritis, cold and cough, body pain, clearing stool, cuts and wounds of domestic animals, snake repellent (Antony <i>et al.</i> 2018)
35.	<i>Murraya koenigii</i> (L.) Sprengel	Curry patta	Leaves	Diabetes	Antony <i>et al.</i> 2018 ^[3] .	Skin disease, snake bite, vomiting, cutaneous diseases (Pande <i>et al.</i> 2006) Gastroenteritis, diabetes (Antony <i>et al.</i> 2018)
36.	<i>Ocimum sanctum</i> L.	Tulsi	Leaves, seeds	Cancer, diabetes and heart related problems (blood pressure)	Lokhande <i>et al.</i> 2006 ^[3] . Ocvirk <i>et al.</i> 2017 ^[2] . Antony <i>et al.</i> 2018 ^[1] .	Malaria, vomiting, coryza, throat sore (Pande <i>Et al.</i> 2006). Asthma, cold and cough, fever, bronchitis, genito-urinary disorders, diaphoretic, antiperiodic, stimulating (Antony <i>et al.</i> 2018)
37.	<i>Phyllanthus emblica</i> L.	Amla	Fruit, seeds	Diabetes, heart related problems	Lokhande <i>et al.</i> 2006 ^[3] . Ocvirk <i>et al.</i> 2017 ^[2] . Pande <i>et al.</i> 2006 ^[2, 3] .	Hair loss, liver problem, stomach pain (Antony <i>et al.</i> 2018)
38.	<i>Phyllanthus niruri</i> auct. Pl.	Bhumi Amla	Whole plant	Diabetes	-	-
39.	<i>Picrasma quassioides</i> (D. Don) Bennett	Kadavi	Root, leaves	Diabetes		Vomiting, stomachache, tonic, cough, fever (Pande <i>et al.</i> 2006)
40.	<i>Pterocarpus marsipium</i> Roxb.	Vijaysar	Wood	Diabetes	Okpala 2015 ^[2] . Pande <i>et al.</i> 2006 ^[2] .	Burn, pain, chest pain, tonic, tongue, toothache (Pande <i>et al.</i> 2006)
41.	<i>Ricinus communis</i> L.	Arandi	Seeds	Cancer	Pande <i>et al.</i> 2006 ^[2] .	joint pain, jaundice, headache, fever, boils, dysentery, stomach problems, indigestion, skin disease, hair loss, sores, boils, burns, rheumatic swelling, stomach worms (Antony <i>et al.</i> 2018)
42.	<i>Rumex hastatus</i> D. Don	Almoda	Roots	Diabetes	-	Cut, wounds, insect bite, boils, check bleeding, sunstroke (Pande <i>et al.</i> 2006)
43.	<i>Saraca asoca</i> (Roxb.)	Ashok	Bark	Heart related problems		Mental problems, tonic, urinogential problems (Pande <i>et al.</i> 2006)
44.	<i>Solanum nigrum</i> L.	Makoy	Whole plant	Diabetes, heart diseases	Pande <i>et al.</i> 2006 ^[3] .	Pills, stomachache, swelling, eye trouble (Pande <i>et al.</i> 2006). Dysentery, vomiting, asthma, bronchitis, fever, urinary discharge, cuts and wound (Antony <i>et al.</i> 2018)
45.	<i>Spinacia oleracea</i> L.	Palak	Leaves	Cancer, diabetes and heart related problems	-	
46.	<i>Syzygium cumini</i> (L.) Skeel	Jamun	Leaves, fruit and seeds	Diabetes	² Ocvirk <i>et al.</i> 2017 ² Pande <i>et al.</i> 2006	Cough and cold, blood dysentery, gastroenteritis (Antony <i>et al.</i> 2018)
47.	<i>Terminalia arjuna</i> (Roxb. Ex DC.) Wight & Arn	Arjun	Bark	Heart related problems, diabetes	Lokhande <i>et al.</i> 2006 ^[3] . Ocvirk <i>et al.</i> 2017 ^[2] . Antony <i>et al.</i> 2018 ^[2, 3] . Pande <i>et al.</i> 2006 ^[2, 3] .	Jaundice, dysentery, pneumonia, wounds (Pande <i>et al.</i> 2006). Asthma, heart problem, diabetes, stomach disorder, gastroenteritis, appetizer (Antony <i>et al.</i> 2018)
48.	<i>Terminalia bellirica</i> (Gaertner) Roxb.	Baheda	Fruit, seeds	Diabetes	Ocvirk <i>et al.</i> 2017 ^[2] . Pande <i>et al.</i> 2006 ^[2, 3] .	Cough and cold, stomach disorder, indigestion, gastroenteritis (Antony <i>et al.</i> 2018)
49.	<i>Terminalia chebula</i> Retz	Harra, harad	Fruit	Diabetes	Ocvirk <i>et al.</i> 2017 ^[2] . Lokhande <i>et al.</i> 2006 ^[3] .	Hypertension, Almost for all sickness, appetiser, cough and cold, gastroenteritis, jaundice, liver, pneumonia (Antony <i>et al.</i> 2018) Skin infection, diarrhea (Pande <i>et al.</i> 2006)
50.	<i>Tinospora cordifolia</i> (Willd.) Hook. F.	Giloy	Whole plant	Diabetes	Pande <i>et al.</i> 2006 ^[2] . Lokhande <i>et al.</i> 2006 ^[3] . Ocvirk <i>et al.</i> 2017 ^[2] . Patel, 2016 ^[1] . Antony <i>et al.</i> 2018 ^[2] .	kapha, vata and pitta, Stomach pain, diabetes (Antony <i>et al.</i> 2018)
51.	<i>Trigonella foenum-graecum</i> L.	Methi	Leaves, seeds	Diabetes	Antony <i>et al.</i> 2018 ^[2] .	Diabetes, joint pain (Antony <i>et al.</i> 2018)
52.	<i>Vitis vinifera</i> L.	Munakka (wild grapes)	Fruits	Heart disease		Urinary trouble, tonic ((Pande <i>et al.</i> 2006))
53.	<i>Zingiber officinale</i> Roscae	Adrakh (ginger)	Root	Diabetes, heart related diseases	Patel, 2016 ^[1] .	Cold, cough, fever, snakebite, dysentery (Pande <i>et al.</i> 2006)

(where, 1- cancer, 2- diabetes, 3- hear diseases)

Table 4: Family wise status and habit of plant species used for different diseases (LC=Least Concern; Vu= Vulnerable; NT= Near threaten)

S.N	Family	Species name	Status		Habit				
			IUCN Red Data Book Status	Gaur, 1999	Tree	Shrub	Herb	Total	
1	Apocynaceae	<i>Catharanthus roseus</i> (L.) G.Don	-	Cultivated	-	-	H	2	
		<i>Carissa carandas</i> L.	-	Cultivated	-	S	-		
2	Moringaceae	<i>Moringa oleifera</i> Lam.	-	Common	T	-	-	1	
3	Euphorbiaceae	<i>Ricinus communis</i> L.	-	Common	-	S	-	1	
4	Asphodelaceae	<i>Aloe barbadensis</i> (L.) Burm. F.	-	Common	-	-	H	1	
5	Fabaceae	<i>Cicer arietinum</i> L.	-	Cultivated	-	-	H	8	
		<i>Cassia tora</i> L.	-	Abundant	-	-	H		
		<i>Cassia angustifolia</i> L.	-	Common	-	-	H		
		<i>Cassia fistula</i> L.	-	Common	T	-	-		
		<i>Dalbergia sissoo</i> Roxb.	-	Common	T	-	-		
		<i>Pterocarpus marsupium</i> Roxb.	NT	Uncommon	T	-	-		
		<i>Trigonella foenum-graecum</i> L.	-	Often cultivated	-	-	H		
		<i>Saraca asoca</i> (Roxb.)	Vu	Occasionally planted	T	-	-		
6	Rubiaceae	<i>Anthocephalus cadamba</i> (Roxb.) Miq.	-	Rare	T	-	-	1	
7	Lamiaceae	<i>Ocimum sanctum</i> L.	-	Common	-	-	H	2	
		<i>Mentha arvensis</i> L.	LC	Uncommon	-	-	H		
8	Caricaceae	<i>Carica papaya</i> L.	-	Widely cultivated	T	-	-	1	
9	Solanaceae	<i>Solanum nigrum</i> L.	-	Common	-	-	H	2	
		<i>Datura stramonium</i> L.	-	Common	-	-	H		
10	Phyllanthaceae	<i>Phyllanthus niruri</i> auct. Pl.	LC	Common	-	-	H	2	
		<i>Phyllanthus emblica</i> L.	-	Common	T	-	-		
11	Colchicaceae	<i>Gloriosa superba</i> L.	LC	Common	-	-	H	1	
12	Combrataceae	<i>Terminalia chebula</i> Retz	-	Common	T	-	-	3	
		<i>Terminalia bellirica</i> (Gaertner) Roxb.	-	Common	T	-	-		
		<i>Terminalia arjuna</i> (Roxb. Ex DC.) Wight & Arn	-	Common	T	-	-		
13	Amaranthaceae	<i>Chenopodium album</i> L.	-	Common	-	-	H	3	
		<i>Amaranthus viridis</i> L.	-	Common	-	-	H		
		<i>Spinacia oleracea</i> L.	-	Commonly cultivated	-	-	H		
14	Zingiberaceae	<i>Zingiber officinale</i> Roscae	-	Widely cultivated	-	-	H	3	
		<i>Curcuma longa</i> non L.	-	Cultivated	-	-	H		
		<i>Elettaria cardamomum</i>	-	-	-	-	H		
15	Tiliaceae	<i>Elaeocarpus ganitrus</i> Roxb	-	-	T	-	-	1	
16	Poaceae	<i>Cynodon dactylon</i> (L.) Persoon	-	Common	-	-	H	1	
17	Vitaceae	<i>Vitis vinifera</i> L.	LC	Commonly cultivated	-	S	-	1	
18	Scrophulariaceae	<i>Digitalis purpurea</i> L.	-	Cultivated	-	-	H	1	
19	Linaceae	<i>Linum usitatissimum</i> L.	-	Cultivated	-	-	H	1	
20	Nyctaginaceae	<i>Boerhavia diffusa</i> L.	LC	Common	-	-	H	1	
21	Cucurbitaceae	<i>Momordica charantia</i> L.	-	Commonly cultivated	-	-	H	1	
22	Menispermaceae	<i>Tinospora cordifolia</i> (Willd.) Hook. F.	-	Not uncommon	-	-	H	1	
23	Meliaceae	<i>Azadirachta indica</i> A.H.L. de Juss.	-	Not uncommon	T	-	-	1	
24	Myrtaceae	<i>Syzygiumcumini</i> (L.) Skeel	-	Common	T	-	-	1	
25	Anacardiaceae	<i>Mangifera indica</i> L.	-	Abundant	T	-	-	1	
26	Amaryllidaceae	<i>Alliumcepa</i> L.	-	Common	-	-	H	2	
		<i>Allium sativum</i> L.	-	Common	-	-	H		
27	Malvaceae	<i>Hibiscus rosa-sinensis</i> L.	-	Cultivated	-	S	-	1	
28	Rutaceae	<i>Boenninghausenia albiflora</i> (Hook.) Reichb. ex Meisn.	-	-	-	S	-	3	
		<i>Murraya koenigii</i> (L.) Sprengel	-	Common	-	S	-		
		<i>Aegle marmelos</i> (L.) Correa	-	Common	T	-	-		
29	Apiaceae	<i>Coriandrum sativum</i> L.	-	Commonly cultivated	-	-	H	1	
30	Simarubaceae	<i>Picrasma quassioides</i> (D.Don) Bennett	-	Rare	-	-	H	1	
31	Polygonaceae	<i>Rumex hastatus</i> D.Don	-	Fairly common	-	S	-	1	
32	Berberidaceae	<i>Berberis aristata</i> DC.	-	Common	-	S	-	1	
33	Asteraceae	<i>Cichorium intybus</i>	-	-	-	-	H	1	
TOTAL						16	8	29	53

Results and Discussion

Ethnomedicinal use

In the present study a total of 53 plant species were used to cure three diseases i.e., cancer, diabetes and heartproblems (Table 2). These 53 species were belonging to 33 families. The

highest (8) species were reported in family Fabaceae followed by 3 species each in Combretaceae, Amaranthaceae, Rutaceae and Zingiberaceae (Table-4.) The contribution of different life forms was dominated by herbs followed by trees and shrubs (Table-4). Among these reported species, the highest number

(23) exclusively used for diabetic purposes, followed by 08 (eight) species each for cancer and heart diseases. Further eight species (*Cynodon dactylon*, *Linum usitatissimum*, *Zingiber officinale*, *Solanum nigrum*, *Coriandrum sativum*, *Mentha arvensis*, *Terminalia arjuna* and *Phyllanthus emblica*) were used for both diabetics and heart diseases. Three species (*Catharanthus roseus*, *Ocimum sanctum* and *Spinacia leracea*) had properties to cure all these three diseases together. Two species (*Cassia fistula* and *Moringa oleifera*) were used for cancer and heart diseases and only one species (*Azadirachata indica*) was used for cancer and diabetics (Table-2, Figure-2). The other workers also reported similar finding of the plants species from other parts of the country have been shown in Table-3. The other uses of plants also have been reported by researchers from the other parts of country is shown in Table-3.

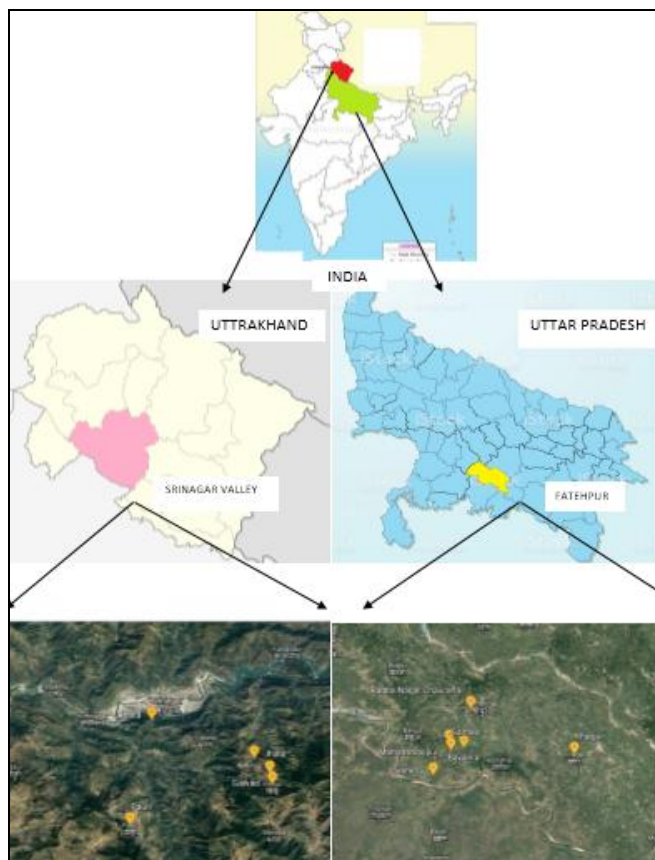


Fig 1: Location map of study area

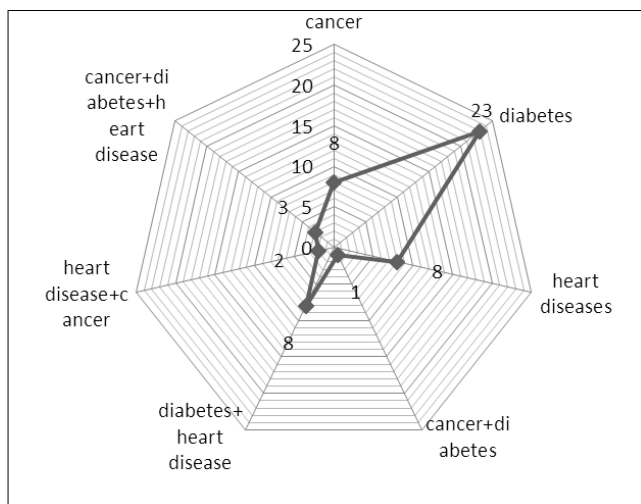


Fig 2: Number of plants used for different disease cure

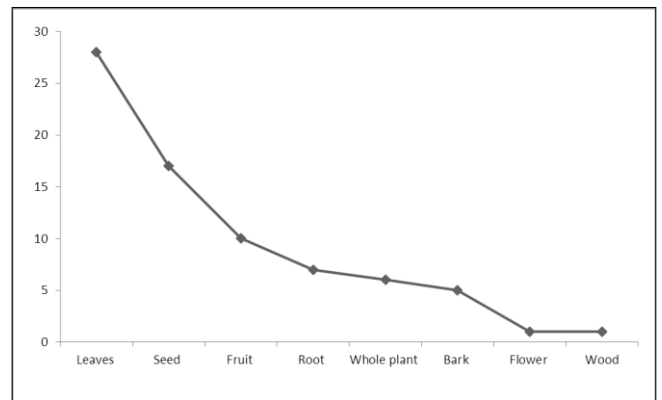


Fig 3: Plant part used for various disease cures

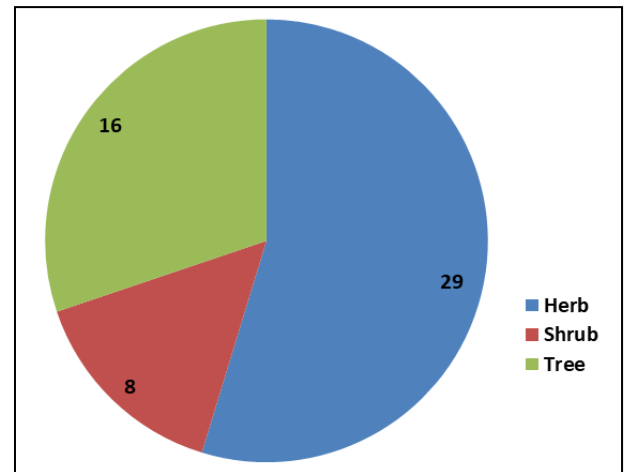


Fig 4: Number of trees, shrubs and herbs used for cure different diseases

Plant part used and their habit

Among the plant parts used for curing different diseases, leaves contribute of maximum species (28) followed by seed (17 species), fruit (10 species), root (7 species), whole plant (6 species), bark (5 species) and flower and wood contributed only one of each plant (Figure-3). The details of trees, shrubs and herbs used for curing different diseases have been shown in Figure-4, where maximum (29 species) contribution was of herb followed by trees (16) and shrubs (08). Pala *et al.* (2012) reported that leaves as the dominant plant part used in traditional medicine in Garhwal Himalaya. A study of Debbarma *et al.* (2017) in Tripura has also suggested that among the plant parts leaves are used most for curing different diseases. Keter and Mutiso (2012) in their study of Kenya (2012) reported that leaves are the most frequently used plant parts.

Consensus index

The consensus survey on plants used for cancer, diabetes and heart diseases was done. The high values of informant's consensus indicated that high consensus of information regarding use of plant taxa for the concern purposes. Among the diseases, the highest consensus was reported for cancer (0.75) where 14 informants use report suggested that 9 taxa used for cancer diseases. The second informant's consensus (0.50) was given for diabetes and third for heart diseases (0.33). Ragupathy *et al.* (2008) published first consensus analysis research for aboriginal group in India. The consensus report of northeast India is also carried out by Sajem and Gosai (2006). Kumar *et al.* (2013) published information of consensus index for Garhwal Himalayan people of the region.

Ecological Status

In this study we checked the status of collected plants on IUCN RED DATA BOOK used by local people for diabetes, heart diseases and cancer. Among the species, there are some plants e. g., *Phyllanthus niruri*, *Gloriosa superba*, *Vitis vinifera*, *Boerhavia diffusa*, *Mentha arvensis* of Least Concern (LC) category and *Saraca asoca* in Vulnerable and *Pterocarpus marsupium* Nearly Threatened (NT) category. However, according Gaur (1999), the flora of Garhwal Himalaya reported the status of species in Himalaya (Table 4), mostly species were common, few cultivated (commonly cultivated, widely cultivated) and only two species (*Anthocephalus cadamba* and *Picrasam quassioides*) reported in rare category (Table-4). The valuable plants species are under certain category of threatened and therefore their conservation are essential. These plants due to their availability are helping to cure the health of patient like cancer, diabetic and heart, but as the plants are under high consumption they are shirking and reducing their population. Thus ecological status is a symbol to save the species as soon as possible for further requirement.

Conclusions

The present study is focused on plant species used for cure diseases like cancer, diabetes and heart problems. The study suggests that these plants are playing important role for curing diseases and saving life of human being. The consensus index for the plants for curing diseases is also high which reflect that peoples have higher opinion on the plants for the use of these plants. Ecological status also suggest that the plants are certain level of threat, which may leads the loss of plants for future if proper care not to be taken from the current situation. Thus the importance of plants for curing purposes, the conservation status need to be developed as soon as possible and to enhance population of the valuable plants through conservation, cultivation for mass multiplication for future need.

Acknowledgement

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Annexure-1

Questionnaire used to collect the oral information from local people-

Information related to informant

Name of informant	Age
Place of informant	Village & District
Date of information collection	Occupation
Gender of informant	

Ethnobotanical uses of plants

1. Local/vernacular name of plant:
2. Scientific name of plant:
3. Part used of plant:
4. Disease name for the plant part is being used:
5. Mode of preparation:
6. Availability in natural habitat:

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