



Ethanobotanical uses of indigenous plants by tribal people of Garudeshwar and Nandod Talukas of Narmada district

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Abstract

Various idols of gods and goddesses are worshipped in Hindu religion throughout Gujarat. Parts of Various plants are offered to Gods and Goddesses as part of worship. A survey has been conducted to evaluate, to identify and importance of plants with related culture, manage and perceived, across human societies of Narmada District in Gujarat. In the present work, 50 Genus have been enumerated and mentioning the parts which was used medicinally, belonging to the 30 families. The represented families were Malvaceae, Acanthaceae, Rutaceae, Mimosaceae, Simaroubaceae, Liliaceae, Amaranthaceae, Annonaceae, Caesalpiniaceae, Oxalidaceae, Asclepiadaceae, Vitaceae, Menispermaceae, Cleomaceae, Verbenaceae, Cucurbitaceae, Burseraceae, Ebenaceae, Cyperaceae, Euphorbiaceae, Tiliaceae, Apocynaceae, Convolvulaceae, Lythraceae, Leeaceae, Celastraceae, Oleaceae, Fabaceae, Salvadoraceae, Solanaceae. The part of plants treated as medicinally for humanwelfar. The common use of whole plants(4%), leaves(34%), stem(8%), root(16%), bark(10%), Flower(6%), fruit(12%), Seed(8%), Gum(1%), Latex(1%) have been enumerated and mentioning which are used as medicinally.

Keywords: medicinal plants, ethno-medico botany, culture, Narmada district

Introduction

The term 'Ethanobotany' was coined by J.W. Harshberger in 1895 to indicate plants used by the aboriginal; from 'ethano'- study of people and 'botany'- study of plants. Ethnobotany is considered as a branch of ethnobiology. It deals with the study and evaluation of plant-human relations in all phases and the effect of plant environment on human society. Ethnobotany is the study of how people of a particular culture and region make of use of indigenous plants. ^[1] The focus of ethnobotany is on how plants have been or are used, managed and perceived in human societies and includes plants used for food, medicine, divination, cosmetics, dyeing, textiles, for building, tools, currency, Today, ethnobotanical surveys include applied projects clothing, rituals, social life and music. ^[2] The traditional knowledge of different tribes is one of the major source of herbalism and the over exploitation of some well-known plants resulted in rapid decline of lesser known plants. ^[3] The knowledge of wild plants as medicines is found in ancient Vedic literature, particularly in Rigveda, Charak Samhita and Shusruta Samhita. Lots of information about Ethnobotanical data has been collected from the different parts of India. Traditional medicines based on herbal remedies have always play a key role in the health system of our country.

According to WHO, about 80% of the world's population of most developing countries relies on herbal medicines for their primary healthcare needs. These herbal medicines can provide some clues for the development of drugs to treat human diseases. Of the 17500 species of flowering plants found in India, about 17% are considered to be of medicinal value. In India, villages comprise 15% of the total geographical area of Indian landmasses, representing one of the greatest emporia of ethnobotanical wealth. ^[4] India is sitting on a gold mine of well-recorded and traditionally well practiced knowledge of herbal medicine. Recently, considerable attention has been paid to utilizing Eco-friendly and bio-friendly plant- based products for the prevention and cure of different human diseases. ^[5] Natural products such as medicines, although neglected in the recent past, are gaining popularity in the modern era. On a global scale, the current dependence on traditional medical system remain high, with a majority of world's population still dependent on medicinal plants to fulfil most of their healthcare needs. Earlier works on an ethnobotanical and medicinal aspects of plants were carried out by a good number of workers namely Thaker (1910), Saxton and Sedgwick (1918), Nadkarni (1926), Santapau (1954), Patel (1971), Shah (1978), Jain (1991), Shashtri (1996), Punjani (1997), Patel (2001), Bhatt, *et al.* (2003), Jangid (2003), Jangid and Vedia (2004), Jangid (2005), Kabool Chand, (2008), Jain, V. V. (2010), Parimelazhagan, (2010) and Ray (2012). ^[6]

Materials and Method

Study Area

Narmada district (21.7199459°N and 73.60°E) is an administrative district in state of Gujarat in India. The district headquarters are located at Rajpipla. The district is bounded by Vadodara district in the north, by Maharashtra state in the east, by Tapi district in the south and by Bharuch district in the west. The district occupies an area of 2,755 sq.km and has a population of 5, 90,379(as of 2011). It was 10.44% urban as of 2011. Narmada district having five taluka – Nandod, Sagbara, Garudeshwer, Tilakwada, and diyapada. It Due to the Narmada River and heavy rainfall, Narmada district contain good bio-diversity.

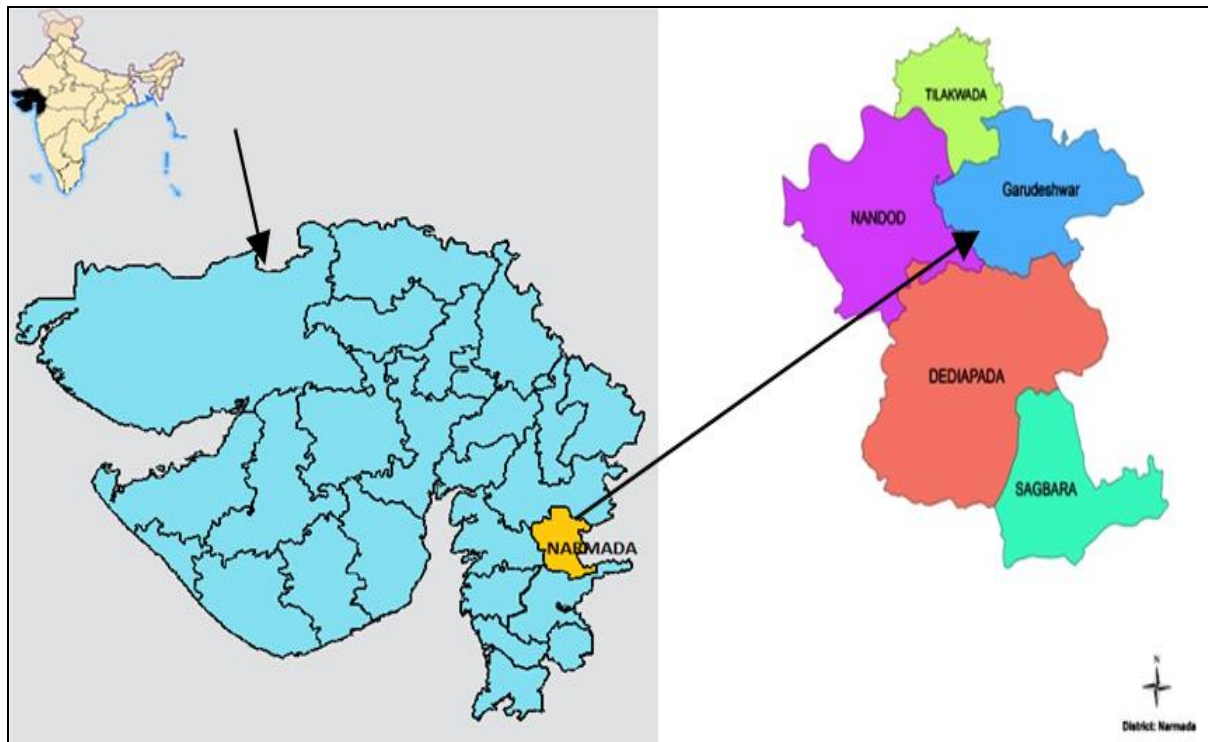


Fig 1: 'Map of Study Area of Narmada District With their Taluka's

Methodology

Several ethnobotanical survey was conducted by in the selected area of Garudeshwar and Nandod Taluka of Narmada district, Gujarat. ^[4-7] Standard methods was adopted for collection of voucher specimen and ethnobotanical data were obtained from interviewing elder tribal, local medicine man, vaidyas, Ojhas, Village Pradhan and many other experienced informants having knowledge of herbal drugs used by different tribal people ^[8].

The method adopted for collection of data was about medicinal uses of plants in the treatment of various diseases. The collected plant specimens were identified by using flora and others standard literature (Varma *et al.*, 1993; Singh *et al.*, 2001; Mudgal *et al.*, 1997; Jain and Rao, 1991). Information on plants used for other than medicinal purpose is also given. Information on ailments, plant part used, formulation along with dose and duration etc. Gathered from tribal have been enumerated. ^[9, 10] During the survey information regarding to the use of plant parts as a drug, mode of preparation, route of administration and dosage, vernacular name and status of plant species were collected. ^[11, 12]

Result

In the present work, 50 plants species have been enumerated and mentioning the parts which was used medicinally, belonging to the 30 families. The represented families were Malvaceae, Acanthaceae, Rutaceae, Mimosaceae, Simaroubaceae, Liliaceae, Amaranthaceae, Annonaceae, Caesalpiaceae, Oxalidaceae, Asclepiadaceae, Vitaceae, Menispermaceae, Cleomaceae, Verbenaceae, Cucurbitaceae, Burseraceae, Ebenaceae, Cyperaceae, Euphorbiaceae, Tiliaceae, Apocynaceae, Convolvulaceae, Lythraceae, Leeaceae, Celastraceae, Oleaceae, Fabaceae, Salvadoraceae, Solanaceae. The part of plants treated as medicinally for humanwelfar. The common use of whole plants(4%), leaves(34%), stem(8%), root(16%), bark(10%), Flower(6%), fruit(12%), Seed(8%), Gum(1%), Latex(1%) given in table 2. Plants are used in the various types of diseases like Fever, Ulcer, Skin disease, Diabetes, Fever, Cough, Asthma, Jaundice, Constipation, Tuberculosis, Flatulence, Anaemia Gastric problem, constipation, Asthma, haemorrhoid, Headache, Inflammation, Vitamins and Minerals Deficiency, Toothache, diarrhoea, Cholera, Bronchitis, Colic and dysentery etc. Plants are also used as food, fodder, fuel, furniture etc. The plants have been arranged alphabetically with their Scientific name, Family, common name with their used parts.

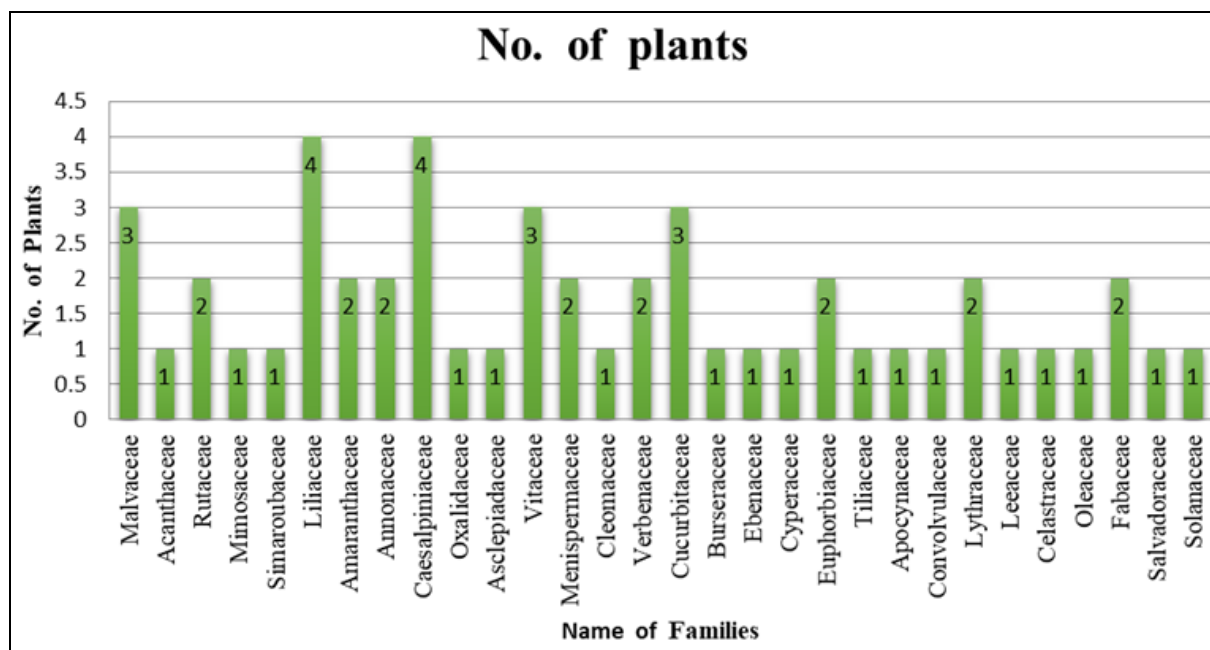


Fig 2: Bar Graph Showing No. of Plant Species used as Ethnomedicine.

Table 1

Sr. No.	Botanical Name	Family	Common Name	Used Part	Uses
1	<i>Abutilon indicum</i>	Malvaceae	Kansaki, Khapat	Stem, Root, Leaves	Stem of this plant is used as tooth brush during toothache. Root and stem are boil in oil and this oil is used for inflammation. Leaves juice applies on skin during fever. Dry parts of plants are used in fencing of house in small villages.
2	<i>Adhatoda vasica</i>	Acanthaceae	Ardusi	Leaves	In T.B., give 10 to 20 ml leaves juice with honey three times in the day, which is help to increase Eosinophils in 15 to 20 days and also helps to relief the pain. For children, in cold and cough, give 5 to 10 drops of leaves juice with honey. Apply the juice of leaves on body in Eczema and hyperhydrosis or any skin disease. In Malaria fever and the fever with Cold and cough, give 3 to 6 gm bark powder with leave's juice. Give 5 to 10 gm Gulkand of Adhatoda flower in Acidity and frequently bleeding due to any disorder of liver and vomiting of blood for 2-3 times in the day.
3	<i>Aegle marmelos</i>	Rutaceae	Beal	Leaves, Fruit.	Give a syrup of ripen fruit with sugar in diarrhoea and piles. 5-10 drops of leaves juice apply on eyelid during sty. Give 1- 20 ml beal juice 3 times in day in diabetes. Scape the juice of leaves on body for sweat stinks.
4	<i>Albizia lebeck</i>	Mimosaceae	Sarsado	Leaves, Bark, Flower, Seed.	In erysipelas apply the paste of powder of albizia flower mixed with ghee and water. In any type of poisonous effect in eyes or pain of eyes apply the leaves juice with honey and 4-5 drops in eyes or only leaves juice. In scrofula apply the paste of albizia seed with water or leaves juice. Gorggel boil leaves water to cure any type of mouth and throat ulcer. On sifilis ulcer apply the paste of leaves ash mixture with ghee or oil. Give 10-20 ml leaves juice on bite of Scorpio bees and ant otherwise apply leaves juice on it. In Peoria, rubbed the bark of albizia on tooth.
5	<i>Alianthus exelsa</i>	Simaroubaceae	Arduso	Leaves	Leaves paste is tied on Any type of joints pain and in stomach-ache.
6	<i>Allium sativum</i>	Liliaceae	Garlic	Leaves	Chew the 2-5 piece of garlic with 2 tola sissum oil in the morning when cholesterol increase in blood. In T.B of lung and Bones give 2-5 drops of garlic

					oil with 100 ml milk. Put the 2-4 drop of garlic oil in to the ear for the deafness due to cold and vaccination from ear. Massage of garlic oil in Rheumatism, sciatica, lumbago, arthritis.
7	<i>Alternanthera sessilis</i>	Amaranthaceae	Jaljambo	Leaves	Leaf paste is apply on ring worm.
8	<i>Aloe barbadensis</i>	Liliaceae	Kuvarpathu	Leaves	Pith of leaves mixed with haldi and apply on wound and bind over it to relief the pain of wound. In breast tumour apply the paste of the leaves or the root with turmeric on tuber 2-3 times in day its cure the breast tumour and there is no need for operation. The leaves juice applies on burning skin immediately which does not cause the scalp and scare it gives relief in pain. Leaves rub in water and apply for piles. Small pieces of leaves fry in ghee mixed with wheat flour and make a sukhdhi (indian sweet dish) eat 2 to 3 pieces daily for being healthy and strong. Small plant or one leaf hang near the light during monsoon insect refuse to come near light.
9	<i>Annona squamosa</i>	Annonaceae	Custured apple	Leaves, Flower Fruit	Ash of leaves or dry peels of fruits rubbed on scabies and psoriasis. The leaves are used in decoction to treat dysentery and urinary tract infection. In the morning, seven flowers are eat for one week to remove gastric problems. Pith of seed are crushed and mixed with hair-oil to remove nit and louses. Ripen fruits are eat to cure excessive hungriness and gastric problems.
10	<i>Bauhinia racemosa</i>	Caesalpiniaceae	Aasitro	Bark, Leaves, Fruit	The bark juice is applied on the wound. Dry leaves are used as beedi. Fruits are edible.
11	<i>Biophytum sensitivum</i>	Oxalidaceae	Lajamani	Entire Plant	The crushed plant dipped in water and drunk in the morning for fever of child. The burn leaf powder is applied on burnt part due to the hot charcoal.
12	<i>Calotropis procera</i>	Asclepiadaceae	Aak, Akua, Madar	Leaves Flower	Dried and Yellow Leaves Useful in Asthma and cough. Fried leaves are applied externally on stomach-ache. Flowers are useful for worship of god.
13	<i>Cassia fistula</i>	Caesalpiniaceae	Garmalo	Bark, Flower, Fruit	Bark of tree scrub in water or paste of leaves apply in Scabies and in skin diseases. Ringworm cures in 3-4 days when pastes of bark apply on it. Gulkand of flowers take with milk to cure constipation. Beans are put in folding quit or mattress to remove bugs.
14	<i>Cassia tora</i>	Caesalpiniaceae	Kuvadiyu	Root, Leaves, Seed	Seeds are crushed in butter milk and apply on scabies. Juice of leaves apply on tumour. Paste of seed applies in migraine and haemorrhoid. Vegetable (sabji) of leaves are very effective on haemorrhoids. Paste of root, juice of bhrungraj and sissom oil mix with ghee and boil it after cooling sindur is add in it and apply in scrofula.
15	<i>Cayratia trifolia</i>	Vitaceae	Khatkhatumbo	Root	The knot of the root is rubbed and applied on headache.
16	<i>Caesalpinia crista</i>	Caesalpiniaceae	Kanchaka	Leaves, Seed.	In malaria fever to give equal amount of Kernel of fry seed and black papper with water 2-3 times in day. In constipation to prepare powder of seed kernel dry ginger blacksalt and asafoetida in equal amount and give it 2-3 times in day. In worm disease give 1-2gram seed kernel in honey with water. Give 5-10 gm Juice or paste of leaves with sugar in leucorrhoea which give relief in 5-7 days. In elephantiasis giving a leaves juice for drink for their ability. Seed kernel of kanchaka and tamarind seed crushed and applies on body for sweat stink.
17	<i>Celosia argentea</i>	Amaranthaceae	Lempdi	Leaves, Seed	Leaves are used as vegetable (preparing sabji in curd). Seeds are used in kidney stone.
18	<i>Chlorophytum</i>	Liliaceae.	Safed Musali	Root,	To eat Bud of musali in Calculus. Musali crush in

	<i>tuberosum</i>			Leaves	butter milk and given in dysentery. Leucorrhoea is cure to drink milk after eating bud of musali with shoe flower.
19	<i>Cissampelos pareira</i>	Menispermaceae	Laghu patha	Root, Leaves	Roots used in ulcer, lowering blood pressure, headache, diarrhoea. Juice of leaves used in eye trouble. Paste of crushed leaves applied in skin diseases and wounds. Leaves are chewed in fever, Cholera, Bronchitis, Colic and dysentery.
20	<i>Cleome viscosa</i>	Cleomaceae	Shambharshingi	Leaves, Fruits	In jaundice, rub the leaves with fruits together and put the juice of it in to the ear.
21	<i>Clerodendrum multiflorum</i>	Verbenaceae	Arani	Root, Leaves, Bark	Paste of root mix with ghee and apply on scabies and also in smallpox. Leaves juice of agethu and bamboos effective on scrofula. Juice of root and bark mixed with honey which is used to reduce fat in the body.
22	<i>Coccinia grandis</i>	Cucurbitaceae	Ivy-gourd.	Leaves, Stem	Due to bitter species in taste it is very useful in Diabetes, Fever, Cough, Asthma, Jaundice, Constipation, Tuberculosis, Flatulence; Ulcer very carefully. It is very effective in Anaemia. Pulp of leaves cure Carbuncle.
23	<i>Cocculus pendulous</i>	Menispermaceae	Vevadi	Stem	When the children have green diarrhoea, its vine is tied in the hand.
24	<i>Commiphora wighatti</i>	Burseraceae	Gugal	Fruit, Gum	Apply paste of gugal and dry ginger on body during cold. Give fume of gugal on centripeds bites. In diabetes give one spoon powder of gugal fruit with cup of water for 21 days. Preapare ointment with bash gugal in ghee applies on narration and racism. Boiled one or two fruits of gugal in water and gorggle with this water in morning and evening to cure tooth disease and give strong gumes.
25	<i>Diospyrous melanoxyton</i>	Ebenaceae	Timaru	Bark, Leaves, Fruit	Leaves are used in bidi and fruits are edible. The bark juice is drunk for vomiting. Fruits are edible.
26	<i>Eriophorum comosus</i>	Cyperaceae	Vavadi	Leaves	The bandage of the leaves is tied on the chest of the children in the asthma.
27	<i>Euphorbia neriifolia</i>	Euphorbiaceae	Sehund, Thor	Milk, Stem	Milk apply around navel to relief swelling of intestine. Milk and Boil leaves are applied on piles for ripening and fork removing. Stem of this plants are boil in sissom oil and this oil is applied on crack of heel and also putrefy of leg during monsoon. Milk absorbs in cotton and put in the hole of teeth during toothache.
28	<i>Gloriosa superba</i>	Liliaceae	Kankasani	Root, Leaves	Paste of Tuber is antidotal in snake & scorpion bite. Juice of Neem plant and this plant apply in scrofula inflammation and swelling. Glory lily, dry ginger and root of boerhavia crush in cow urine used in any type of swelling. Root powder is used in Fever.
29	<i>Grewia hirsuta</i>	Tiliaceae	Kharmandari	Root	For leucorrhoea, crushed root soaked in 2 litre water for two days and give with sugar. The soak root water is given for diarrhoea.
30	<i>Hibiscus caeiusus</i>	Malvaceae	Bhendu	Entire plant	The plant is cut from the roots and tied together with a few plants soaked in water on the river bank for a few days to make a rope from the fibers coming out of it.
31	<i>Hibiscus rosa-sinensis</i>	Malvaceae	Shoe-flower	Bark, Flower	Bark of root or stem is chew slowly-slowly to cure mouth ulcer. 5 flowers are soak in water then it mixed with sugar and this syrup is drink to cure urinary disease. To make oil of Shoe flowers, juice of Neem and Henna's leaves to applied on hair fall, hair loss. Paste of flower petals applies in root of hair to remove hair fall. Flowers are soaked in sugar solution for 3-4 hours and it is used in deficiency of vitamin-c, ayarn and phosphorus.
32	<i>Holarrhena - antidysenterica</i>	Apocynaceae	Indrajav	Leaves, Bark, Fruit,	Give Sabji of unripen fruit or leaves in worm disease of children. Tertian fever or in malarial fever give 2-3 gm seed powder with neem juice.

				Seed.	Bark powder rub on teeth in pyorrhoea and fill the powder at where from the pus come out.
33	<i>Ipomoea turpethum</i>	Convolvulaceae	Nasotar	Leaves, Root.	The root is known as medicine which is known as Nasotar. For kidney stone give the Nasotar and <i>Holarrhena</i> powder with milk. Leaves sabji give for stomach disease. Give the Nasotar powder with honey to cure fever. Mixture of powder ghee and milk or warm water or grapes juice drains the heat. In leprosy give mixture of Nasotar powder and honey with sugar.
34	<i>Lawsonia alba</i>	Lythraceae	Heena	Leaves, Seed.	Apply the crushed leaves paste on shapeless and thin growth of nail. In leucorrhoea give 3-6gm seed powder with one glass of milk three times in day. In diarrhoea Keep giving mixture of 2 gm Heena seed powder and 2gm suger with ghee for a while. Give 10-20 ml of leaves juice with one spoon sugar in 2-3 hours in day during the inflammation of urine. In inflammation of hand and feet, apply the crush the leaves paste or powder with water or also on the forehead. It is very effective when it's mix with lemon juice.
35	<i>Leea asiatica</i>	Leeaceae	Donu	Root	The root paste is applied on headache.
36	<i>Limonia acidissima</i>	Rutaceae	Kothu	Leaves, Fruit	To remove scars on face juice of kothu (<i>Limonia acidissima</i>) and Rayan (<i>Manilkara hexandra</i>) leaves apply three times in day. Chutney (paste) of this fruit takes in mouth to cure anorexia. Juice of flower applies to eyes during skin disease. Deficiency of calcium during smallpox the syrup of ripe fruit take with sugar and juice of leaves apply on smallpox and also to take bath with boil leaves water.
37	<i>Maytenus emarginata</i>	Celastraceae	Vikro	Stem, Bark	Being a thorny plant, it is used in fencing. Leaf and bark is chewed for cold and cough.
38	<i>Miliusa tomentosa</i>	Annonaceae	Umbh	Leaves	Leaves paste is tied on the waistache, headache, and chest pain.
39	<i>Momordica dioca</i>	Cucurbitaceae	Kankoda	Root, Fruit	The knot of root is rubbed and applied on the tumour. Fruits are edible. (as vegetable)
40	<i>Nyctanthes arbortristis</i>	Oleaceae	Parijat	Leaves	To drink 20ml juice of leaves in sciatica. 1-2 tea spoon leaves juice with sugar give for warm diseases of children. Juice or paste of leaves apply on ring worm.
41	<i>Phyllanthus niruri</i>	Euphorbiaceae	Bhuiaonla	Whole Plant	Paste of this plant mix with sugar cure jaundice, and diabetes. Leaves paste mixed with salt and applied on skin disease and ulcer. Boil Juice of Leaves and root are applied in alternative fever (Malaria).
42	<i>Pterocarpus marsupium</i>	Fabaceae	Biyo	Bark	In the fever, the bark is soaked in water and given in the morning. The soaked bark juice is given in jaundice.
43	<i>Salvadora persica</i>	Salvadoraceae	Salvadora	Leaves Root.	Juice or paste of leaves apply on Scabies, Ringworm and Psoriasis and also drink 10-20ml leaves juice. Leaves juice mixed with ghee and apply on erysipelas. Vegetabl (sabji) cure stomach disease. Root crushed in water and applies below navel for relief pain and easy delivery in pregnancy.
44	<i>Solanum xanthocarpum</i>	Solanaceae	Kantakari	Whole Plant	<ul style="list-style-type: none"> ▪ Juice or paste of leaves is applied on skin during scabies, psoriasis and skin disease. Root leaves and fruits are boil in water and gorggel with this water during ulcer of mouth. Ash of this plant use with honey in the breath problem. Ripen fruit apply on scabies and fume of burn ripen fruit take in mouth to relief pain of putrefy tooth of toothache. ▪
45	<i>Solena heterophylla</i>	Cucurbitaceae	Gumalu	Root, Fruit	Fruits are edible. And root knot is used in chest pain.

46	<i>Tephrosia purpurea</i>	Fabaceae	Surpankha	Stem, Seed.	Seed used in worms festation in children. Stem of dry plants used to make broom and fencing
47	<i>Vitex negundo</i>	Verbenaceae	Nagod	Leaves	Paste of leaves is applied on headache and foot of leg. To drink juice of leaves or boil leaves are apply in swelling of body part and inflammation. Juice of leaves is boil with oil and apply in dullness of hearing and swelling of ear.
48	<i>Vitis quadrangularis</i>	Vitaceae	Hadsankal	Stem	Paste of stem mix with honey and take it one spoon every day in Asthma. Juice of plant given internally and applied externally on fractured bone. Deficiency of vitamin-c and calcium, in scurvy to eat fritters of pith with adad dal every day. Vegetable (sabji) of leaves and stem used in Constipation.
49	<i>Vitis rependa</i>	Vitaceae	Ganda velo	Root	Crushed root is applied on tumour.
50	<i>Woodfordia fruticosa</i>	Lythraceae	Pesaru	Leaves	Its leaves are used to feed cattle for joints and blains.

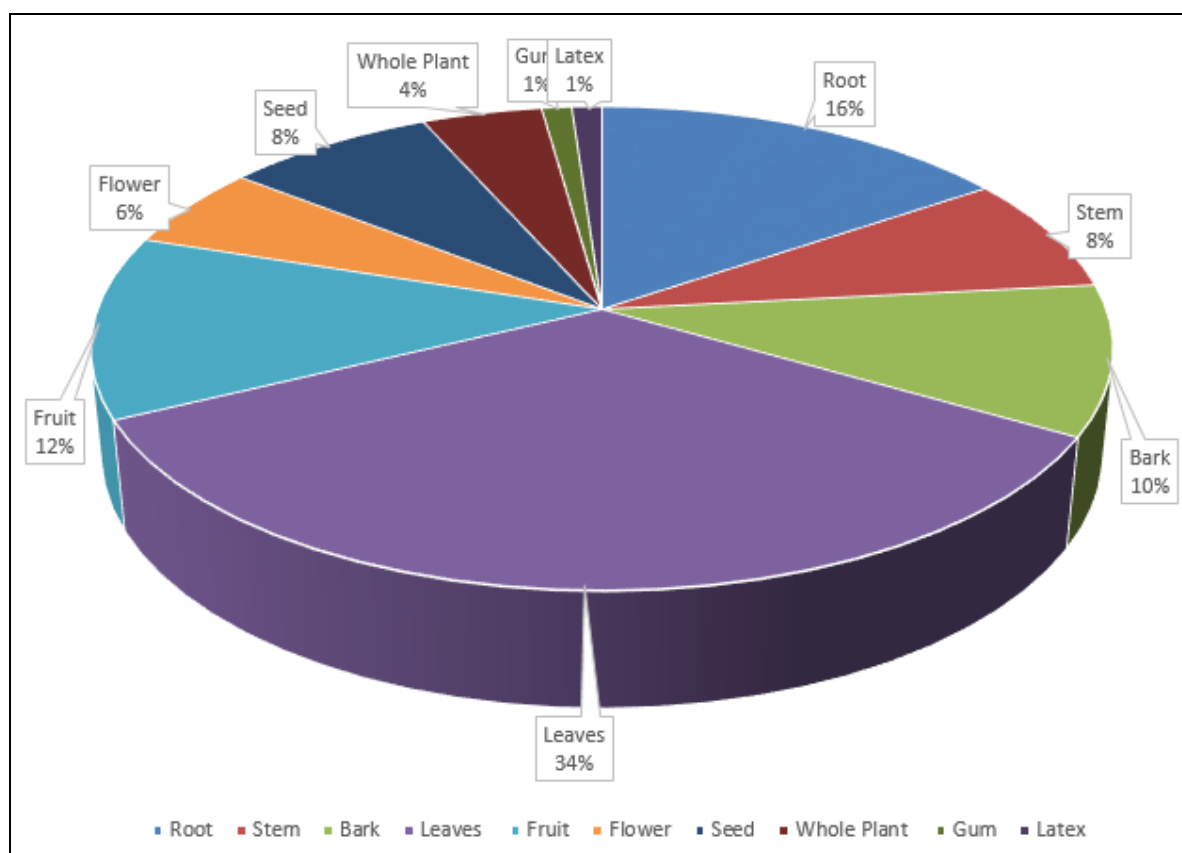


Fig 3: Pie Chart Showing Percentage of Plants Parts Used As an Ethanomedicine

Discussion

India has century's old heritage of medicinal plants and herbal medicines for curing human illness. Medicinal plants form the only easily accessible health care alternative for the most of our population in rural and tribal areas. The life, tradition and culture of tribal's remained almost static since last several hundreds of years. The knowledge accrued by the tribal's through generation's shows the in-depth understanding of the forest resources [13]. Plant species used as medicine by tribal people in Narmada District is reported in Ethnobotanical uses of plant by tribal Dwellers in Narmada Forest Division, Gujarat [14]. Traditional Healers used some plant species is observed in An Ethnobotanical Survey of Medicinal Plants Used by Traditional Healers of Kaprada Forest Gujarat, India by C. Patel *et al.* [15] Observed Traditional uses of plants species in Ethnobotanical Study of Traditional Medicinal Plants Used By Tribe of Guna District, Madhya Pradesh, India. By Rakesh Samar *et al.* [9] Tribal of Tamil nadu Used Ethanomedicine is reported in Ethnobotanical survey of medicinal plants from Vellore district, Tamil nadu, India by P. Saranraj [16] Tribal People of Alirajpur (M.P) used 52 species of plants belonging to 36 families to cure various diseases. According to research, 14 new ethno medicinal uses of plants that are not available in the earlier literature by Jitendra Singh Pachaya *et al.* [17] Observed Some Homegarden plants species used as medicine Ethnobotanical Study on Wealth of Homegardens in Gosiling Gewog of Tsirang District by Bimal Kumar Chetri *et.al.* [18] Observed Some chemical compound obtained from plants in

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Conclusion

Climate changes taking place due to increase of development in this Morden age which is causing deforestation. Some species of plants are also being disappeared and the information about the plants by tribal people as medicine as well as domestic use is also being vanished. Through this study, we can know the use of plants found in the field area by tribal people and the value of plants as medicine. The element, which is present in the plants useful for the future medicine and this study is also helpful for the bio-diversity.

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