

Documentation of wild edible fruit yielding plants from Sudhnoti, Azad Kashmir for ethno-medicinal uses

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ABSTRACT

Sudhnoti is one of the districts of state of Azad Jammu and Kashmir lies in western Himalayas. It has a rural landscape with biocultural diversity, and it is still characterized by traditional medicinal practices for the treatment of different ailments. There is currently no record of the wild edible fruit plants that the indigenous populations of district Sudhnoti have traditionally used. This study aimed (i) to document the species of wild plants whose fruits people eat in district Sudhnoti, Azad Kashmir and (ii) to contribute to medicine and food supplement research by finding wild edible fruit plants for specific therapeutic applications and identifying the diseases addressed. The data about the ethnomedicinal uses of wild edible fruit plants were collected through semi-structured questionnaires and guided field trips. The data was analyzed using quantitative indices including frequency of citation, use report of each species, use report for each ailment, consensus upon the use of plants, consensus upon the method of applications, and consensus upon the plant parts used. Hundred informants (74 male and 26 female) were interviewed during the study. A total of 27 plants species were recorded whose fruits were edible. The plants of these 27 species were also used as medicines against 13 disease categories. Among the disease categories, the highest use reports were recorded for diseases of the circulatory system (79) and diseases of the digestive system (77). The most frequently used medicinal plants were *Berberis lycium* (FC 55 and URsp 72) and *Rubus elipticus* (FC 44 and URsp 44). The most used part of the plant was the fruit, and the most used method of application was raw material in the form of ripen fruit. In addition, 5 plant species have been discovered to have novel applications, including *Cydonia oblonga* for weakness, *Fragaria vesca* for fever, *Rubus elipticus* for uric acid, *Morus nigra* for goitre, and *Vitis jacquimontii* for allergies. District Sudhnoti is found to have a rich source of wild fruiting plants that can be used not only for food purposes but also for the treatment of different diseases. The people of district Sudhnoti have rich knowledge about the

medicinal uses of wild edible fruit plants. However, due to environmental deterioration and acculturation, this ethnomedicinal knowledge is in grave danger, and the younger generation has shown symptoms of forgetting and abandoning it. As a result, immediate action is required to document and conserve the knowledge of wild plant resource utilization.

Keywords: District Sudhnoti; wild edible fruit plants; ethnomedicinal knowledge

I. INTRODUCTION

To increase the importance of medicinal plants, use as alternative to conventional medicines and poverty contributes, together with inadequate health facilities and poor sanitary infrastructures. Additionally, the dependence on natural remedies derived from medicinal plants is extremely important in emerging countries (Randrianarivony et al., 2017), and medicinal plants represent the principal source for primary health care (Razafindraibe et al., 2013). WHO estimated that nearly 80% of the population in these countries depends mainly on traditional medicine for the treatment of ailments. Malagasy flora provides a wide variety of medicinal plants with a potential represented by more than 12,000 species of vascular plant currently described is not surprising (Rabearivony et al., 2015), and several regions of Madagascar are still not explored. Furthermore, a limited amount of research combined the ethno-botanical characterization together with phytochemical and pharmaceutical properties of the medicinal plant used by a local community (Razafintsalama et al., 2017).

In spite of its rich ecological heritage, the area is characterized by a widespread poverty, and the access to basic social services such as health centers and education is limited (Ratsimbazafy et al., 2008). Different ethnic groups comprise of local population (Merina, Antandroy, Betsimisaraka, Bezanozano, Betsileo, and Sihanaka), living in the nine villages. Their economy is mainly based on traditional agriculture (Randrianarivony et al., 2017), and the forest represents the most important source of resources, as firewood, medicinal plant collection and construction material (Ratsimbazafy et al., 2008).

WEPs (wild edible plants) are those plants that are edible to people and produced in native and introduced species that grow naturally in self-maintaining populations in natural or semi-natural ecosystems and are capable of existing independently without any human interventions, such as without being domesticated or raised in cultivation (Duguma, 2020). WEPs have a remarkable nutritional and therapeutic value and recognized as a good source of vitamins and minerals (micronutrients) such as copper, zinc, iron, manganese, magnesium etc. and some hormones in addition to protein and energy; which all are needed for human body (Berihum and Molla, 2017; Melaku and Ebrahim, 2021). Even in certain circumstances, many of these wild fruits have higher mineral and nutritional benefits than commercial fruits (Seal et al. 2014).

Rural people typically rely on wild edible fruits (WEFs) to meet all of their nutritional needs. They depend on wild edible fruits not only for their daily food security or nutritional requirements, but also for their daily medical treatments (Rehman et al., 2019). The way of life and food security is significantly impacted by these edible wild fruits. At times of food scarcity or shortage, such as during

famine and conflict, and as emergency food in times of drought or other crises, WEFs serve a crucial role in providing an important safety net to the rural poor by way of dietary supplements or an important component of coping techniques (Khattak et al., 2021). The use of WEFs as a source of food, medicine and nutritional supplement is not new but since ancient times and still are widely consumed by many people in rural areas, tribal and indigenous communities (Seal et al. 2014).

Millions of children and women, like those in many other developing nations, have been affected by nutritional issues such as anemia, low birth weight, wasting, stunting, underweight, vitamin A deficiency, and iodine deficiency illnesses (Dejene et al., 2020). The majority of the women and children live in poor rural areas. The worst problems in the world are related to malnutrition. The primary reasons of this malnutrition include shortages in nutrients including iron, folic acid, and vitamins and minerals like energy (UNICEF 2009). As many people are poor and reside in rural areas, they are unable to purchase commercial fruits because of their high cost and scarcity there. In this situation, WEFs can be extremely helpful by supplying these folks with crucial minerals and nutrients. Yet, due to overuse and other pressures from anthropogenic activities like clearing forest and jungle, these wild fruit-producing plants are remarkably declining in number and are even more in danger of going extinct. Therefore, it is crucial to protect and properly care for these plants (Melaku and Ebrahim, 2021).

It has been found that WEFs of District Sudhnoti, Azad Kashmir are used indigenously in local communities for the purposes of ethno-medicine and as well as food. But unfortunately, there is no authentic data regarding documentation of WEFs in these areas. Many investigators were accomplished work on wild edible fruits at different areas in Azad Kashmir and other parts of the world (Mahapatra et al. 2012). But so far there is no such type of work that has been previously reported in District Sudhnoti. In the present study, we conducted an investigation on WEFs and designed to fulfill the following objectives: 1. Phyto-inventory of indigenous wild fruits of District Sudhnoti, Azad Kashmir 2. Exploration of rare wild edible fruits used in local communities of District Sudhnoti 3. Ethno-medicinal knowledge of wild edible fruits in District Sudhnoti, Azad Kashmir.

II. MATERIAL AND METHODS

Study site

The study area is comprised of hills and mountains along with small valleys and plains, spanning a total area of about 569 km². The district is connected to Rawalakot by a 64-km metalled road. Sudhnoti District is divided into three tehsils: Pallandri, Mang, and Trarkhal. Pallandri is a small town, situated in the Sudhnoti District. Pallandri is the district headquarters. It is at an elevation of 1372 meters and is at a distance of 97 kilometers from Rawalpindi via Azad Pattan. Temperature in summer is almost 20 to 35 °C and in winter 5 to 25 °C. Ethnographic composition: The people living in the study area belong to different tribes like Sudhan, Awan, Syed, Gujjar, Qureshi and Kashmiri ethnic groups. The majority of people belong to Sudhan tribe. Almost the entire population is living in rural area that's why to some extent they depend on wildlife for survival. The people living in this area have knowledge about plants and they use plants to treat different types of disease. Those who

are older have more knowledge of plants and these aged people are not so educated. Hospitals here do not have that many facilities and people use different remedies to treat different diseases. During this study pansari and hakeem were also interviewed and they told the names of plants that are used by local people for different disease, and they also told the recipe of plants.

SAMPLE COLLECTION AND IDENTIFICATION

Before the initiation of the task of research, general information about the site was collected. During study, data was collected on random and scheduled visits. All required equipment such as altitude meter, compass, notebook, maps, pencils, markers, crop printer, scale, eraser, tags, polythene request, knife, cutter, sword, rope, digital camera, quiz questions, Measurement tape, leather gloves, water bottle, food were brought to selected locations. Prior to the management of the questionnaire, interviews with local people were held to determine the purpose of the study. Total 100 informants were interviewed, including 26 women and 74 men. The age of the male ranged from 27 to 70 years. Some of the men were farmers, some were teachers, and some were in a driving profession. Others were doing private work. Women's ages ranged from 28 to 90 years. Some of the women were teachers, some were house managers, and a few were LHV at the hospital. The people were randomly selected, and no appointment was made prior to the visit. Full details about the name of the plant parts used fruit seasons, amount of collection, medical use (method of preparation, method of use, treatment of diseases), and other ethno-botanical uses were carefully recorded. In many cases the data collected was also viewed at various locations from local residents by showing a new sample, telling them the names of the places or showing photographs to verify the authenticity of the claims. Voucher specimens were placed in the herbarium of the Department of Botany, University of Poonch Rawalakot for identification.

DATA ANALYSIS

After the completion of field work, all the questionnaires were brought into the lab and process i.e., data was transferred on excel sheets. All the ethno-botanical parameters were analyzed through descriptive statistics using the following indices.

Frequency of Citation (FC): FC is simply the absolute number of participants interviewed that use a certain plant species for a specific event or disease.

Use-Report for Species (URsp). To find which plant species are recognized as therapeutic ones for specific medicinal uses, a use-report (UR) for each species was calculated as individual reports for a single species being useful for certain symptoms or diseases (URsp).

Consensus Upon the Use of Plants (CUuse): The consensus upon the use of plants to the use categories (CUuse) was calculated by dividing the number of informants that mentioned a use of each plant species per use category to the total informants interviewed x 100.

Use-Report for Ailments (URail): The use-report for each ailment (URail) defined as the number of informants that mentioned the ailments (nail) that had been treated with these plants. Use-report for each use-category (URuse) is defined as the total sum of nail into the same usecategory.

Consensus Upon the Method of Application (CUapp): Consensus of uses for the method of application (CUapp) in each usecategory was calculated as use-reports for each method of application (URapp) 16 divided by the total informants interviewed x 100. URapp is defined as the number of informants that mentioned the method of application that had been used for the treatment of each use category.

Consensus Upon the Plant Parts Used (CUparts): Consensus upon the use of plant parts (CUparts) in each use-category was calculated as use-reports for each plant part (URparts) divided by the total informants interviewed x 100. URparts is defined as the number of informants that mentioned the plant parts that had been used for the treatment of each use category.

III. RESULTS AND DISCUSSION

The Total 27 plant species from 16 families were found to have fruits that are used as food. Rosaceae was the dominant family with 8 plant species followed by Moraceae and Ramnaceae with three plant species each. Khalid and Andrea (2016) also reported these plants used as food. Out of 27 plant species, 14 species were trees, 10 were shrubs, 2 were herbs and 1 was climber (Figure 4.1). Out of all life forms, trees were the major medicinal plants used by the community for human treatment followed by shrubs, herbs and climbers.

The most abundant plant species such as *B. lycium*, *R. elipticus*, and *P. garanatum* were found in all studied areas followed by *S. nigrum*, *F. palmate* and *P. pashia* that were found in eight studied areas. *F. carica* and *V. jacqueumontii* were found in seven studied areas. *F. vesca*, *Z. jujuba*, *Baroin*, *P.armaniaca*, *P. persica* and *D. saenab* were found in five studied areas. *E. umbelata*, *P.emblica*, *D. lotus* and *Z. spine christii* were reported in four studied areas. *S. cuminii*, *F. indica*, and *V. grandiflorum* were found in three studied areas followed by *C. oblonga* in two studied areas and *R. niveus* in only one studied area.

The study area was rich in traditional history and knowledge of traditional medicine because of its unique ethnic composition. The local people in the study area used wild edible fruit as another source of food and were well aware of their medicinal uses. The study area was very diverse due to abundance of various medicinal plants which are the traditional source of medicines for various diseases. From district Sudhnoti 10 areas (Lower pallandri, chaichan, baithak, tahliyan, mong, goth, nakkar, gorah, Tangigala, Panthal) were selected for the study (Table 4.1). These areas were selected on the basis of altitude because the research area covers subtropical to alpine climate conditions and altitude variation is one of the factors determining floral richness in the area. Similar data was presented by Admasu and Yohannes (2019).

Table 1 Scientific name, Habit, Family Name, Local Name and Locality of plants collected from the study area.

Sr. No.	Plant name	Habit	Family name	Local name	Locality
1	<i>Berberis lycium</i> Royle	Shrub	Berberidaceae	Sumbloo	Killan, Baithak, Chaichan, Panthal, Goth, Nakkar, Mong, Tahliyan, Lower pallandri
2	<i>Cydonia oblonga</i> Mill.	Tree	Rosaceae	Bai	Goth, Tangigala
3	<i>Carissa spinorum</i> L.	Shrub	Apocynaceae	Garanda	Baithak, Chaichan, Tahlyan, Panthal, Lower pallandri,
4	<i>Debregeasia saeneb</i> (forssk)Heper and wood(D.Don) Rendle	Shrub	Urticaceae	Sindari	Chaichan, Nakkar, Panthal, Lower Pallandri,Gorah
5	<i>Diospros lotus</i> L.	Tree	Ebenaceae	Amlok	Nakkar, Baithak, Tangigala, Gorah
6	<i>Elaeagnus umbellate</i> Thunb.	Shrub	Elaeagnaceae	Kankoli	Killan, Baithak, nakkar, Gorah
7	<i>Ficus palmate</i> Forssk	Tree	Moraceae	Phawara	Lower Pallandri, Tangigala, Baithak, Mong, Nakkar, Panthal, Chaichan, Gorah
8	<i>Ficus carica</i> Linn.	Tree	Moraceae	Tosi	Killan, Chaichan, Baithak, Panthal, Nakkar, Lower Pallandri ,Gorah
9	<i>Flacourtia indica</i> (Bium.f)	Tree	Flacourtiaceae	Kakoi	Lower Pallandri, Panthal, Baithak,
10	<i>Fragaria vesca</i> L.	Herb	Rosaceae	Banakhra	Lower Pallandri, Nakkar, Baithak, Panthal
11	<i>Morus nigra</i> L.	Tree	Moraceae	Kala kuroon	Lower Pallandri, Tangigala, Baithak, Mong, Goth, Chaichan, Nakkar, Panthal, Gorah.
12	<i>Myrsine Africana</i> L.	Shrub	Primulaceae	Gunglailoo	Lower Pallandri,Tangigala, Baithak, Chaichan
13	<i>Punica granatum</i> L.	Shrub	Punicaceae	Daronni	Goth, Panthal, Chaichan, Nakkar, Mong, Killan, Lower Pallandri, Baithak, Tahlyan. Gorah
14	<i>Pyrus pashia</i> Ham. Ex D.Don	Tree	Rosaceae	Kali tangi	Lower Pallandri, Nakkar, Goth, Panthal, Baithak, chaichan, Tangigala, Gorah.
15	<i>Prunus armeniaca</i> L.	Tree	Rosaceae	Aari	Lower Pallandri, Baithak, Mong, Panthal, Tngigala,
16	<i>Phylanthus emblica</i> L.	Tree	Euphorbiaceae	Aamla	Lower Pallandri, Baithak, Panthal,

					Chaichan
17	<i>Purnus persica</i> L.Bastch	Tree	Rosaceae	Arwari	Lower Pallandri, Tangigala, Baithak, Panthal, Mong
18	<i>Pyrus communis</i> L.	Tree	Rosaceae	Jungli nashpati	Baithak
19	<i>Rubus ellipticus</i> Smith	Shrub	Rosaceae	Akhra	Killan, Baithak, Tahliyan, Panthal, Lower Pallandri, Chaichan, Nakkar, Mong, Goth, Gorah
20	<i>Rubus niveus</i> Thonb.	Shrub	Rosaceae	Pagniyar	Tangigala,
21	<i>Solanum nigrum</i> L./ SAH	Herb	Solanaceae	Kach Mach	Lower Pallandri, Killan, Baithak, Mong, Nakkar, Panthal, Chaichan, Gorah.
22	<i>Syzygium cuminii</i> (L.)	Tree	Myrtaceae	Jammu	Lower Pallandri, Baithak, Panthal,
23	<i>Vibernum grandiflorum</i> De candolle	Shrub	Adoxaceae	Jammar	Nakkar, Tangigala, Gorah
24	<i>Vitis jacquemontii</i> R.Parker	Climber	Vitaceae	Kali dakh	Lower Pallandri, Tangigala, Baithak, Panthal, Chaichan, Nakkar, Gorah.
25	<i>Zyzyphus jujuba</i> Lam.		Rhamanaceae	Bairi	Lower Pallandri, Panthal, Chaichan, Killan, Baithak,
26	<i>Zyzyphus</i>	Tree	Ramnaceae	Baroin	Lower Pallandri, Baithak, Panthal, Mong, Tangigala
27	<i>Ziziphus spina-christi</i> (L.) Desf.	Shrub	Ramnaceae	Amnoii	Lower Pallandri, Mong, Panthal, Chaichan

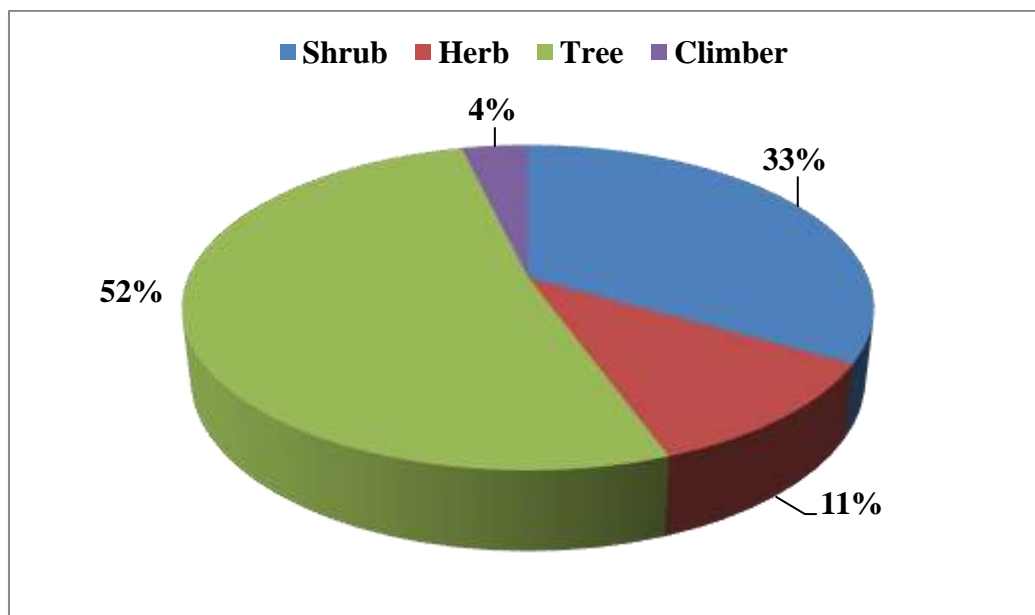


Figure 1 Percentage of life forms

MEDICINAL USES

From study area, a total of 27 fruiting plants were found to have medicinal uses (Table 4.2). The data on medicinally important WEFs indicates that 12 plant sp were used as to treat digestive disorder, 11 species were used to treat circulatory system disorders, 4 species were used as to treat liver disease, 3 species were used to treat disease of urinary system, 5 species were used to treat general and unspecified disease, 5 species were used to treat disease of external causes, 3 species were used to treat abdominal disease, 2 species were used for weakness, 1 specie each was used to treat cardiovascular disease, hormonal disease, ophthalmic disorder, respiratory disorder, and swelling in any part of body.

The study area's local communities were heavily reliant on medicinal plants, and the best therapeutic results for specific illnesses were reported (Ishtiaq *et al.*, 2015). Medicinal plants were utilized in herbal therapies and preparations to treat a variety of ailments, including digestive problems, cardiac disorders, ophthalmic diseases, diabetes, and liver illnesses. The reason for the usage of highest number of plants species to treat the digestive disorder in studied areas of district Sudhnoti might be due to highest prevalence of these infection in the study site. Present finding is similar with the (Riyaz *et al.*, 2020).

FREQUENCY OF CITATION

Most cited plants were the *B. lycium*, *R. elipticus*, *P. granatum*, *P. pashia*, *S. nigrum*, *Ficus palmata*, *Morus nigra*, *Phulanthus emblica*, *C. Spinosa*, *F. carica*, *Frageria*, *P. armaniaca*, *E. umbelata*, *D. lotus*, *Z. spine*, and *V. grandiflorum* with FC value of 55, 44, 36, 35, 30, 24, 21, 21, 18, 16, 16, 13, 12, 11, 10, and 9, respectively (Table 4.2). It has been found that *B. lycium* was the highest cited species.

In this study, *B. lycium* is reported to treat diabetes, constipation, ulcer, toothache, fever, mouth and throat infection and for wound healing. Stem, root bark and fruit were used to treat these diseases. Specifically, for diabetes, small pieces of stem were made and dipped into the water and this water was taken orally. For throat infection and wounds healing, powder of root bark is used and for constipation fruit is eaten. Similar data was presented by Zafar *et al.* (2013) where *B. lycium* was also the highest cited species. *B. lycium* was abundantly found in all studied areas and it was well known to the local people of the study area. It is easily available to the local people. Almost all parts (root, fruit, stem, root and stem and bark) of this plant were used to treat different disease. Previously, it has also been reported as ethnomedicinal plant with wide range of uses (Khan *et al.*, 2021). Previous ethnobotanical record also indicated the same uses of *B. lycium*. For example, *B. lyceum* is used for wounds healing (Abbasi *et al.*, 2019), to treat diabetes, throat infection, ulcer, constipation and toothache and fever (Abbasi *et al.*, 2019).

C. spinorum is reported to treat liver, digestive and hepatic disorders in this study. For liver disease, leaf decoction is used and for digestive and hepatic disorders fruit is eaten. The present data was in accordance with other previous literature (Riyaz *et al.*, 2020) in which it was reported that

Carissa was used as to treat the liver and digestive disorder. Similar findings were also reported by Ishtiaq *et al.* (2021). *C. oblonga* is reported to use against weakness, heart disease and throat infection. Previously, it is also reported to have used in cardiovascular and throat diseases (Ishtiaq *et al.*, 2021). *D. saenab* was used for the treatment of digestive disorders. A similar use of *D. saenab* was also reported by Nisa *et al.* (2011). *E. umbellata* is recorded for the treatment of diabetes and digestive disorder (Constipation) in this study. It has reported to use against diabetes, constipation and hypertension. The fruit of *F. palmata* was used to treat stomach problems especially constipation. *D. lotus* was used to treat high blood pressure, as reported previously (Ahmed *et al.*, 2015).

The laxative properties of its fruit are already reported (Joshi *et al.*, 2014) and effective against digestive disorders other uses of *F. palmata* are the wound healing, liver diseases, digestive disorders and disorders caused by external factors. *F. vesca* was used for the treatment of fever and kidney problems, similar to previous study (Zorica *et al.*, 2014). It is also reported to use in urinary disorder. *M. nigra* was used for cough, throat infection, and goiter and stomach problems. Similar uses were also reported by (Ruhela *et al.*, 2020). *M. nigra* is effective against stomach problems. *M. africana* used as and anthelmintic, as previously reported (Basha *et al.*, 2019). *P. granatum* was used for throat infection (cough), as anthelmintic and relief from burning sensation (Ruhela *et al.*, 2020). Ajaib *et al.* (2021) reported that *P. garanatum* is used to treat cough and it as anthelmintic. *P. armaniaca* was used for lowering the blood pressure and stomach problems. It was reported that this plant was used for hypertension. It is also reported that *Prunus* was used against digestive disorders. *P. emblica* was used for the treatment of hypertension and for stomach disorder. It was also reported for same uses. *P. persica* was used to treat diabetes (Paulina *et al.*, 2018).

P. pashia is found to use for the treatment of cough, hepatitis C, and stomach problems in this study. It was also reported in previous study for the treatment of Hepatitis C (khan *et al.*, 2021). The plant species used for the management of gastrointestinal and respiratory disorders. *R. elipticus* was used for heart disease, blood pressure, uric acid, diabetes and stomach problems. Sharma *et al.* (2019) reported that *R. elipticus* is used to treat heart disease. The present data was also in accordance with the previous literature that reported this plant was used to treat stomach disorder. He also reported that this shrub had anti diabetic effect. *R. niveus* was used for stomach problems. *S. nigrum* was used to treat eye infection, reduce swelling in the body (Dropsy), chest infection, abdominal pain, urinary infection, allergy, and blood purification. Previously it is also reported to use for dropsy, kidney problem, and allergy (Ghani *et al.*, 2021). Campisi *et al.* (2019) reported that *S. nigrum* was used against eye infections. Campisi *et al.* (2019) reported that *S. nigrum* was used against chest infection and blood purification. *S. cumini* was used to treat diabetes in this study. Similar uses were reported in previous study also (Khan *et al.*, 2021). *V. grandiflorum* was used for the weakness and that this plant species was used for the prevention of postpartum bleeding. *V. Jacquemontii* was used against digestive system disorders, circulatory system disorder and the disorders caused by external factors. *Vitis* is a climber it is used to treat stomach problems, blood pressure and allergy. Previously it is reported to use against stomach disorders. *Ziziphus* was used for digestion, blood purification, and dysentery. The similar data was also reported by Hussain *et al.* (2021). He reported that the fruit of this

wild edible plant was used for digestive disorder. Another study reported that this plant was used for digestive problems (Hussain *et al.*, 2021).

Table 2 Medicinal uses, Disease cured, part used, Recipe of use, frequency of citation (FC) and Use report (URsp) of the collected plants.

Sr . N o.	Plant name	Habit	Family name	Local name	Disease	Part used	Recipe	FC	URsp
1	<i>B. lycium</i>	Shrub	Berberidaceae	Sumblo	Diabetes/mouth and throat infection / healing wound /constipation/ ulcer /fever/ toothache	stem/ Root bark/ fruit	Cut the stem into small pieces and dip into the water and use for diabetes. Dry the root bark and then grind this and make the powder and use for mouth and throat infection and ulcer and toothache or this can be used for any infection in internal the body and external body. For constipation eat fruit. For	5 5	72 %

							fever cut stem into small pieces and then dip into water and drink water before breakfast.		
2	<i>C. oblonga</i>	Tree	Rosaceae	Bai	Weakness/heart disease/Throat infection	Fruit /fruit /seed	Eat fruit/Boil the fruit in water and add sugar and drink. /Boil the seed in water and drink half cup before breakfast	5	6 %
3	<i>C. spinorum</i>	Shrub	Apocynaceae	Garanda	Hep-C/Relief from burning sensation	Leaf/ Fruit	For Hep-C leaf decoction is used. For relieving burning sensation eat fruit.	18	8 %
4	<i>D. saeneb</i>	Shrub	Urticaceae	Sindari	Digestive disorders (dysentery)	Fruit	Eat fruit	7	7 %
5	<i>D. lotus</i>	Tree	Ebenaceae	Amlok	High blood pressure	Fruit	Juice of fruit is given to lower the blood pressure	11	1 %
6	<i>E. umbellata</i>	Shrub	Elaeagnaceae	Kankoli	Diabetes/ Digestive disorders(constipation)/ high BP	Fruit/ Fruit	For sugar dry and grind the fruit and make	12	2 %

							powder and use. For BP and constipation eat fruit.		
7	<i>F. palmate</i>	Tree	Moraceae	Phawara	Stomach problem (costipation) /Sugar/ healing wounds	Fruit/ leaf /leaf latex	Dry the fruit and eat. Boil the leaves and then remove the water and eat these leaves for one month. For healing wounds put few drops of latex on wounds.	24	27%
8	<i>F. carica</i>	Tree	Moraceae	Tosi	Healing wounds/Soothe bee sting/ Cholestrol/ stomach problems	Leaf latex/ Fruit/ Fruit/ Fruit	Pour few drops of latex on wounds/ Rub fruit on skin it will soothe the bee sting/ For cholesterol eat fruit/For stomach problem eat fruit	16	18%
9	<i>F. indica</i>	Tree	Flacourtiaceae	Kakoi	Stomach problem	Fruit	Eat fruit	1	1%
10	<i>F. vesca</i>	Herb	Rosaceae	Banakhara	Fever /kidney problems	Root	Root decoction is used.	16	17%
11	<i>M. nigra</i>	Tree	Moraceae	Kala kuroon	Goiter/ Throat infection(cough) / stomach problems	fruit/ Fruit/ fruit	Boil the fruit in the water and add sugar drink for	21	22%

							throat infection, For stomach problems eat fruit.		
12	<i>M. Africana</i>	Shrub	Primulaceae	Gunglailoo	Anthelmintic	Fruit	Eat fruit	2	2 %
13	<i>P. granatum</i>	Shrub	Punicaceae	Daronnii	Mouth and throat infection/Relief from burning sensation/Anthelmintic/Jaundis/dysentery/Blood pressure	Fruit epicarp /Fruit/stem/ Root/ seed	For infection and dysentery dry the fruit cover and grind this and make powder and then take this with water. Make the juice of the fruit and drink. For anthelmintic decoction of bark of root and stem is used. For jaundis dry the seed and take this daily. For BP eat fruit.	3 6	38 %
14	<i>P. pashia</i>	Tree	Rosaceae	Kalitangi	Cough /Hep-C/ Stomach problem(constipation)	Fruit	Eat fruit	3 5	36 %
15	<i>P. armanica</i>	Tree	Rosaceae	Aari	High blood pressure/stomach problem	Fruit /fruit	Eat fruit /Boil the fruit in water than dry the water and form tablets	1 3	14 %

							and use for stomach problems.		
16	<i>P. emblica</i>	Tree	Euphorbiaceae	Aamla	High blood pressure/ Digestive disorders/cough	Fruit	Eat fruit.	21	22%
17	<i>P. persica</i>	Tree	Rosaceae	Arwari	Sugar	Fruit	Eat fruit	2	2%
18	<i>P. communis</i>	Tree	Rosaceae	Jungli nashpati	Constipation	Fruit	Eat fruit	1	1%
19	<i>R. ellipticus</i>	Shrub	Rosaceae	Akhra	uric acid /diabetes/ stomach problems(dysentery) / pimple/ Blood pressure/heart disease	Leaf /whole plant/ fruit/ root	For stomach problems boil the leaves in the water then filter this and drink. For diabetes cut the whole plant in small pieces then boil this take this in the morning before breakfast. For uric acid leaf decoction is used. For pimple grind the leaf and make a paste and apply on pimple. For high bp eat fruit. For heart	44	44%

							disease dry roots than boil this in water and drink.		
20	<i>R. niveus</i>	Shrub	Rosaceae	Pagniyar	Stomach problem	Fruit	eat fruit	1	1 %
21	<i>S. nigrum</i>	Herb	Solanaceae	Kach Mach	Eye infection/reduce swelling in the body (Dropsy) /chest infection/ Abdominal pain/ Urinary infection/ allergy/Blood purifier	Leaf Extract /fruit/ Leaf/ fruit	For eye infection leaf extract is used and for swelling fruit powder is used. For urinary infection , chest infection and allergy leaf decoction are used. For abdominal pain and blood purification eat fruit.	30	33 %
22	<i>S. cumini</i>	Tree	Myrtaceae	Jammu	Sugar	Seed	Dry the seeds in the shade then grind this to form powder.	1	1 %
23	<i>V. grandiflorum</i>	Shrub	Adoxaceae	Jammar	Weakness	Fruit	Eat fruit	9	9 %
24	<i>V. jaquontii</i>	Climber	Vitaceae	Kalidakh	Digestive disorder/allergy / High BP	Fruit/fruit extract/ Fruit	Eat fruit for digestive disorder. For allergy apply Fruit water on skin. For	8	8 %

							high BP eat fruit.		
25	<i>Z. spine cristii</i>		Rhamnaceae	Bairi	Fever /pimple	Root/ leaves	Boil the root in the water and then filter this and used. Or dip root in water for two days and drink half cup in the morning . For pimple grind the leaves and apply on pimple.	10	10 %
26	<i>Z. spp</i>	Tree	Ramnaceae	Baroin	Itching/ cough	Leaf/ fruit	Boil the leaf in the water and then filter this and use. For cough eat fruit	6	6 %
27	<i>Z. jujuba</i>	Shrub	Ramnaceae	Amnoii	Blood purification digestion /dysentery/	Fruit /bark	Eat fruit. Bark powder is mixed with milk and honey, and it is used for dysentery.	3	3 %

USE REPORTS (URs)

Higher URs were recorded for *Berberis lycium* (72 URs) followed by *R. ellipticus* (44 URs), *P.garanatum* (38 URs), *P. pashia* (36 URs), *S. nigrum* (33 URs), *F. palmate* (27 URs), *P. emblica* (22 URs), *M. nigra* (22 URs), *C. spinosa* (18 URs), *F. carica* (18 URs), and *F. vesca* (17 URs), shown in Table 4.2. Higher URs revealed the use of these plants against more than one ailment. Moreover, people of local communities are more familiar to these plants.

The higher URs were also reported in previous study (Zafar, 2013), that shows its medicinal importance. (Ruhela *et al.*, 2020; Abbasi *et al.*, 2019). *C. spinosa*, *B. lycium*, *F. palmate*, *M. nigra*, *P.*

pashia, *P. emblica*, *R. niveus*, *F. carica*, *Z. jujuba*, *E. umbelata*, *D. seanab*, *V. jaquemontii*, *R. ellipticus*, *P. armanica*, and *F. indica* were found effective against digestive system disorder (Riyaz *et al.*, 2020). *Berberis lyieum*, *F. palmate*, *P. emblica*, *E. umbelata*, *V. jaquenmontii*, *R. ellipticus*, *D. lotus*, *Z. jujuba*, *S. nigrum*, *P. garanatum*, *P. armanica*, and *P. persica*, were used against disease of circulatory system (Ruhela *et al.*, 2020). *B. lycium*, *Z. S. christii*, *F. palmate*, *V. jaquemontii*, *R. ellipticus*, *S. nigrum*, *Ziziphus*, and *F. carica* were used against disorder caused by injury, poisoning and certain other consequences of external causes (Ghani *et al.*, 2021). 3 species *R. ellipticus*, *S. nigrum*, and *F. vesca* were used against disease of urinary system (Ghani *et al.*, 2021). *R. ellipticus* and *C. oblonga* was used against cardiovascular disease (sharma *et al.*, 2019). *S. nigrum* was used against ophthalmic disease (Campisi *et al.*, 2019). *S. nigrum*, *p. granatum* and *M. africana* was used against abdominal disease (Ajaib *et al.*, 2021). *C. spinosa*, *P. pashia*, *p. granatum* and *F. carica* were used against liver disease (khan *et al.*, 2021). *V. grandiflorum* and *C. oblonga* were used against weakness. *M. nigra* was used against hormonal disease. *S. nigrum* was used against swelling in body (Ghani *et al.*, 2021).

CONSENSUS UPON THE USES OF PLANTS AGAINST EACH DISEASE CATEGORY

A consensus was developed upon the use of plant species against each disease categories and results were shown in (Table 4.3). According to this *R. ellipticus* showed highest CUUse 21 % value against disease of circulatory system. *B. lyceum* showed 33 % CUUse value against the disorder caused by external causes and 24 % CUUse against disease of digestive system. *P. garanatum* showed 24 % CUUse value against general and unspecified disease. *S. nigrum* showed 27 % CUUse value against ophthalmic disease. *P. pashia* showed 31 % CUUse value against hepatic disorders *C. spinosa* showed 21 % CUUse value against circulatory system disorders and 17 % CUUse value against liver disease.

Table 3 Use report for uses (URuse) and consensus upon the uses of plants against each disease category (CUuse) according to informants.

Plant Name	Disease Category	URuse	CUuse
<i>Carissa spinorum</i>	Disease of digestive system	1	1 %
	Liver disease	17	17 %
<i>Rubus ellipticus</i>	Disease of digestive system	15	15 %
	Disease of circulatory system	21	21 %
	Cardiac disease	2	2 %
	Disease of urinary system	5	5 %
	Injury, poisoning and certain other consequences of external causes (Pimple)	2	2 %
<i>Debregeasia seanab</i>	Disease of digestive system	7	7 %
<i>Berberis lycium</i>	General and unspecified	10	10 %
	Disease of digestive system	24	24 %
	Disease of circulatory system	5	5 %
	Injury, poisoning and certain other consequences of external causes	33	33 %
<i>Elaeagnus umbelata</i>	Disease of digestive system	1	1 %

	Disease of circulatory system	11	11 %
<i>Ficus carica</i>	Liver disease	1	1 %
	Disease of digestive system	1	1 %
	Injury, poisoning and certain other consequences of external causes	17	17 %
<i>Punica granatum</i>	General and unspecified	24	24 %
	Liver disease	2	2 %
	Disease of digestive system	12	12 %
	Anthelmintic	2	2 %
	Disease of circulatory system	1	1 %
<i>Ziziphus spina-christi</i>	Disease of digestive system	1	1 %
	Disease of circulatory system	2	2 %
<i>Solanum nigrum</i>	Disease of circulatory system	1	1 %
	Disease of urinary system	1	1 %
	Ophthalmic	27	27 %
	Chest infection	1	1 %
	Abdominal pain	1	1 %
	Swelling in body	1	1 %
<i>Pyrus pashia</i>	General and unspecified	3	3 %
	Disease of digestive system	2	2 %
	Liver disease (Hep-C)	31	31 %
<i>Morus nigra</i>	General and unspecified	2	2 %
	Hormonal disease	18	18 %
	Disease of digestive system	2	2 %
<i>Diospros lotus</i>	Disease of circulatory system	11	11 %
<i>Prunus armaniaca</i>	Disease of circulatory system	12	12 %
	Disease of digestive system	2	2 %
<i>Ficus palmate</i>	Disease of digestive system	8	8 %
	Disease of circulatory system	3	3 %
	Injury, poisoning and certain other consequences of external causes	15	15 %
<i>Phylanthus emblica</i>	General and unspecified	1	1 %
	Disease of digestive system	2	2 %
	Disease of circulatory system	19	19 %
<i>Fragaria vesca</i>	General and unspecified	12	12 %
	Disease of urinary system	5	5 %
<i>Vitis jaquemontii</i>	Disease of digestive system	2	2 %
	Disease of circulatory system	5	5 %
	Injury, poisoning and certain other consequences of external causes (Allergy)	1	1 %
<i>Syzygium cuminii</i>	Disease of circulatory system	1	1 %
<i>Ziziphus spine christii</i>	General and unspecified	8	8 %
	Pimple	2	2 %
<i>Rubus niveus</i>	Disease of digestive system	1	1 %
<i>Ziziphus</i>	General and unspecified	3	3 %
	Injury, poisoning and certain other consequences of external causes (Alergy)	3	3 %
<i>Vibernum grandiflorum</i>	Weakness	9	9 %
<i>Cydonea oblonga</i>	General and unspecified	1	1 %
	Cardiac disease	1	1 %
	For weakness	4	4 %

<i>Myrsine Africana</i>	Anthelmintic	2	2 %
<i>Pyrus communis</i>	Digestive disorder	1	1 %

USE REPORTS FOR EACH AILMENT AND DISEASE CATEGORIES

By compiling the information about the particular use of each species, 13 disease categories had been identified being treated with these plants (Table 4.4). These disease categories are named as: General and unspecified disease, disease of digestive system, disease of circulatory system, disease of urinary system, cardiovascular disease and Injury, poisoning and certain other consequences of external causes. *B. lyceum*, *Z. spine christii*, *M. nigra*, *P. emblica*, *P. pashia*, *Ziziphus*, *P. garanatum*, *Frageria*, and *C. oblonga* was used to treat general and unspecified disease.

Table 4 Use reports for each ailment and disease categories

Disease category	No of species	Use report per ailment
General and unspecified	9	Fever (19), Cough (23), Toothache (1), Mouth, and throat infection (16)
Diseases of the Digestive System	16	Dysentery (18), Constipation (30), Stomach problems (20), Ulcer (2), and Relief from burning sensation (7)
Diseases of the circulatory system	12	Blood purifier (2), Blood pressure (43), and Diabetes (34)
Diseases of the urinary system	3	Kidney problem (5), Uric acid (5), and Urinary infection (1)
Cardiovascular disease	2	Heart disorder (3)
Injury, poisoning and certain other consequences of external causes	8	Wounds healing (63), Allergy (5), Bee sting (2), and Pimple (3)
Ophthalmic	1	Eye infection (28)
Respiratory disease	1	Chest infection (1)
Abdominal disease	3	Abdominal pain (1), and Anthelmintic (5)
Swelling in body	1	1
Liver disease	4	Jaundice (4), Hep-c (38), and Cholesterol (1)
Weakness	2	13
Hormonal disorder	1	Goiter (18)

PLANT PARTS USED

The parts of wild edible trees, shrubs, herbs and climbers that were consumed include fruits, seeds, leaves, root, latex, bark, and stem. Among them, fruits were the most widely used WEPs parts followed by leaves (Figure 4.2).

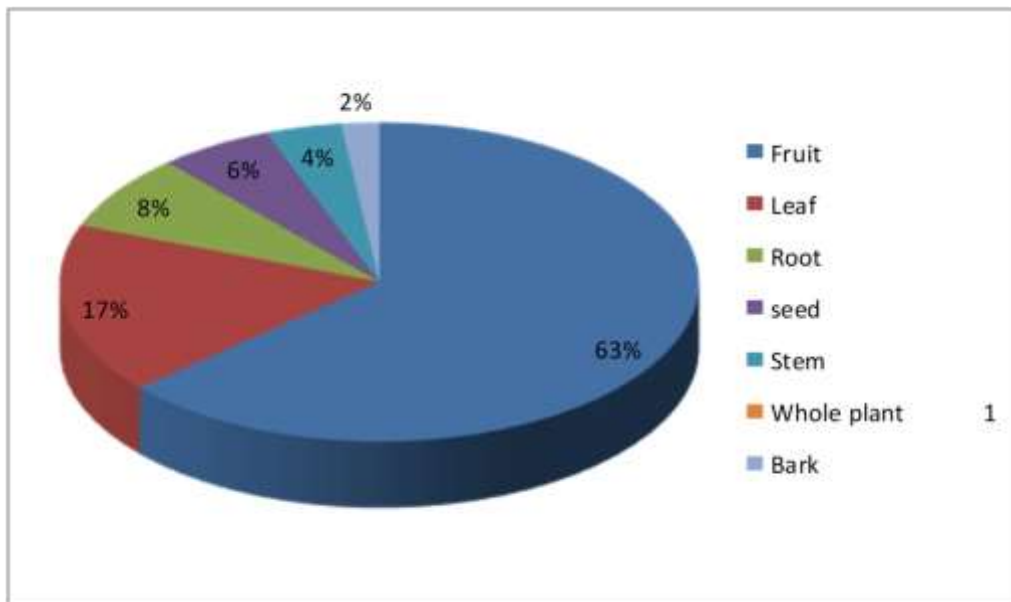


Figure 2 Percentage of plant parts used

A consensus was developed upon the use of plant parts for the treatment of particular disease categories and results were shown in Table 4.5. The fruits were used against disease of digestive system, disease of circulatory system, liver disease, hormonal disease, weakness, general and unspecified disease, and abdominal disease, disease of external causes, cardiovascular disease and swelling in body with CUparts values of 64 %, 56 %, 33 %, 14 %, 12 %, 10 %, 2 %, 2 %, 1 %, and 1%, respectively. The roots were mainly used in the treatment of the liver disease, disease of urinary system, Circulatory system, disease of cardiovascular system, disease of respiratory system, and disease cause by external causes with CUparts values of 8 %, 6 %, 3 %, 2 %, 1 %, and 1 %, respectively. The leaves were used against disease caused by external caused, ophthalmic disease, disease of circulatory system, liver disease, disease of urinary system, and disease of digestive system with CUparts values of 36 %, 28 %, 17 %, 9 %, 6%, and 4 %, respectively. Bark was used against disease of external causes, general and unspecified, circulatory system, and digestive system with CUparts values of 31 %, 8 %, 5 %, and 4 %, respectively. The fruit epicarp was used against the general and unspecified disease, disease of digestive system, disease of circulatory system, and abdominal disease with CUparts values of 18 %, 3 %, 3 %, and 3 %, respectively. Stem was used against disease of circulatory system and general and unspecified disease with CUparts values of 4 % and 2 %, respectively. Seed was used against disease of digestive system, general and unspecified disease and disease of circulatory system with CUparts values of 4%, 2 %, and 1 %, respectively.

Table 5 Consensus upon the use of plant parts for each disease category

Disease category	Plant Parts Used													
	Root		Leaf		Root/Stem Bark		Fruit epicarp		Fruit		Stem		Seed	
	URuse	CUuse	URuse	CUuse	URuse	CUuse	URuse	CUuse	URuse	CUuse	URuse	CUuse	URuse	CUuse
General and unspecified (cough, Fever and toothache)	23	23			8	8	18	18	10	10	2	2	2	2%
Disease of digestive system	5	5	4	4	4	4	3	3	64	64			4	4
Diseases of the circulatory system	3	3	17	17	5	5	3	3	56	56	4	4	1	1%
Diseases of the urinary system	6	6	6	6										
Cardiovasc	2	2							1	1				

ular disease														
Injury, poisoning and certain other consequences of external causes	1	1	36	36	31	31			2	2				
Ophthalmic			28	28										
Hormonal disease									18	18				
Respiratory disease	1	1												
Abdominal disease							3	3	2	2				
Swelling in body									1	1				
Liver disease	8	8	9	9					33	33				
Weakness									12	12				

MODE OF APPLICATION

Raw material in the form of ripen fruit was the most used mode of application (46 %) followed by decoction (29 %), Powder (13 %), Mucilage (4 %), extract (4 %), Juice (2 %), and paste (2 %) as shown in Figure 4.3.

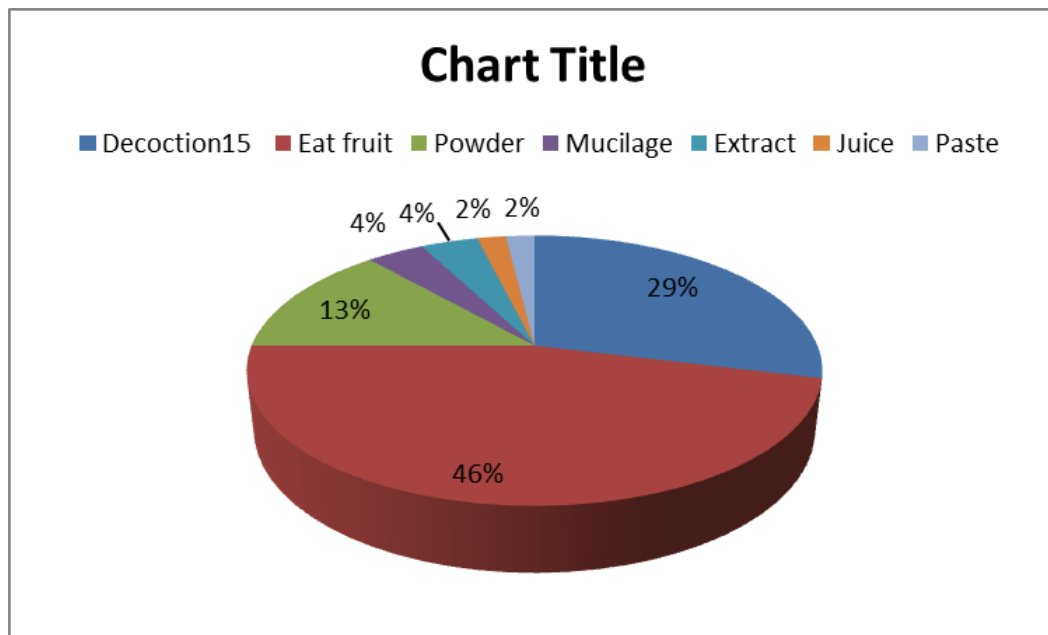


Figure 3 Percentage of methods used for the application.

Based upon the consensus of the informants, eat fruit, decoction, powder and leaf latex were the most popular methods of application followed by leaf extract, seed roasting, fruit juice and mucilage (Table 4.6). The reason for consumption of ripen fruit can be a no need to cook or to boil or to roast the fruits. Fruit could be consumed directly and no need for further processing. Similar data was presented by (Amente, 2017). Specifically, the consensus showed that fruit is used for different disease categories such as for general and unspecified (CUapp 10 %), digestive system (CUapp 61 %), circulatory system (CUapp 53 %), liver disease (CUapp 34 %), hormonal disease (CUapp 14 %), and weakness (CUapp 12 %). Making tea/decoction was used against disease of circulatory system (CUapp 22 %), general and unspecified disease (CUapp 18 %), liver disease (CUapp 17 %), disease of urinary system (CUapp 12 %), disease of digestive system (CUapp 6 %), against cardiovascular disease (CUapp 3 %), disease caused by external causes (CUapp 3 %), abdominal disease (CUapp 3 %), disease of the respiratory system (CUapp 1 %). The treatment mucilage is commonly used against Diseases of General and unspecified (cold fever and toothache) and disease of circulatory system about CUapp value of 1 %. Powder was mainly used against disease caused by external causes with CUapp value of 30 %, against general and unspecified disease with CUapp value of 26 %, against the disease of circulatory system with CUapp value of 10 %, against diseases of the digestive system about the CUapp value of 9 %, against liver disease with CUapp value of 2 %, against swelling in body

with CUapp value of 1 %. Leaf extract was used against ophthalmic disease about CUapp value of 28 % and against disease caused by external causes about CUapp value of 1 %. Fruit juice was used against digestive system disease about CUapp value of 5 % and against circulatory system with CUapp value of 1 %. Seed roasting was used against general and unspecified disease about CUapp value of 1 %.

Table 5 Consensus upon the mode of application used for each disease category.

Disease category	Method of application															
	Leaf Extract		Powder		Decoction		Eat Fruit		Fruit/seed Juice		Seed Roasting		Mucilage		Leaf latex	
	URuse	CUuse	URuse	CUuse	URuse	CUuse	URuse	CUuse	URuse	CUuse	URuse	CUuse	URuse	CUuse	URuse	CUuse
General and unspecified (cough, Fever and toothache)			26	26	18	18	6	6			1	1	1	1%		
Disease of digestive system			9	9	6	6	61	61	5	5						
Diseases of the circulatory system			10	10	22	22	53	53	1	1			1	1%		
Diseases of the urinary system					12	12										
Cardiovascular disease					3	3										
Injury, poisoning and certain other consequences of external causes	1	1	30	30	6	6	2	2							28	28
Ophthalmic	28	28														
Hormonal disease							18	18								
Respirator disease					1	1										
Abdominal disease					3	3										
Swelling in body			1	1												
Liver disease			2	2	17	17	34	34								
Weakness							12	12								

NOVELTY ASSESSMENT

Some novel uses of plants were also found during the current study. Novel uses are the uses that did not found in previous literature. For novelty assessment, a comparison was made by between the medicinal uses of these wild edible plants with previous literature. In this study, 5 plants species were identified that had novel uses. For example, *C. oblonga* was reported for weakness, *F. vesca* was reported for fever, *R. elipticus* was reported for uric acid, *M. nigra* was reported for goiter, and *V. jacquimontii* was used for allergy.

Previous studies also support this argument that fruits are being used as medicinal purposes. For example, Amente (2017) reported that fruits were the most widely used edible plant part and different parts of medicinal and wild edible plants; fruits were the parts that were used for medicinal purposes as well as for edible food. The reason for consumption of more fruit is, it contains different types of vitamins, nutrients, proteins, carbohydrates and that's why consuming fruit was very effective for the treatment of different diseases. It is also clinically proven that fruits reduce the risk of different diseases like digestives system diseases and circulatory system diseases (Zhao *et al.*, 2017). Similar data was reported in different studies (Hanan *et al.*, 2020). The present data was in accordance with the data presented in previous literature (Yaseen *et al.*, 2018).

Conclusion

In conclusion, the District Sudhnoti is found to have rich sources of wild fruiting plants that can be used not only for food purpose but also for the treatment of different diseases. The local people of the study area depend on surrounding plant resources. The plants with novel uses were the *Cydonea*, *Morus nigra*, *Ziziphus*, *Vitis* and *Rubus elipticus*. Protecting indigenous knowledge is vital to ensuring continuity and preserving the record of traditional culture heritage, which is also being lost as a result of local biodiversity.

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