

Ethno-medicinal knowledge of a marginal hill community of Central Himalayas: Diversity, usage pattern and conservation concerns

Saraswati Nandan Ojha

Govind Ballabh Pant National Institute of Himalayan Environment and Sustainable Development

Deepti Tiwari

Govind Ballabh Pant National Institute of Himalayan Environment and Sustainable Development

Aryan Anand

Govind Ballabh Pant National Institute of Himalayan Environment and Sustainable Development

R.C. Sundriyal (✉ sundriyalrc@yahoo.com)

G.B. Pant Institute of Himalayan Environment and Development

Research

Keywords: Ethno-medicinal plants, Traditional knowledge, Indigenous people, Ailments, Public health, Bageshwar, Uttarakhand

Posted Date: December 17th, 2019

DOI: <https://doi.org/10.21203/rs.2.19077/v1>

License:  This work is licensed under a Creative Commons Attribution 4.0 International License. [Read Full License](#)

Version of Record: A version of this preprint was published at Journal of Ethnobiology and Ethnomedicine on May 24th, 2020. See the published version at <https://doi.org/10.1186/s13002-020-00381-5>.

Abstract

Background Human beings have been dependent on surrounding resources for their survival since time immemorial. Medicinal plants have been an important resource to cure various diseases and ailments. Unfortunately, the knowledge is depleting fast thus deserves to be documented for its proper use. The present study reports ethnomedicinal know-how of a mountain community from central Himalayas of India.

Methodology Extensive field visits were made to gather information on ethnomedicinal use of plant species in Bageshwar district of Uttarakhand, central Himalayas. Initial survey was done in 73 villages to assess the key persons engaged in herbal healing practices as well as its usage. A total of 100 such persons were identified (70 non-healers/natives and 30 vaidyas) and finally interviewed using semi-structured questionnaires, target interviews and group discussion. Various indices were also used to evaluate the ethno-medicinal data.

Result This study revealed the ethno-medicinal plant diversity, traditional medicinal practices of local herbal practitioners and past and present scenario of ethno-medicinal cure system. A total of 70 medicinal plants used to cure diseases varying from general health care to a few complex ailments with a documented use-report ranging from 03 to 94 and their cultural importance as high as 0.97 within different taxon. A total of 35 families of such medicinal plants were recorded from traditional healers, vaidyas and marginal hill community. This type of knowledge being passed on verbally to generations needs to be preserved for the future bio-prospecting of plants that could be a potential cure to any future disease. Further ethno-botanical indices were employed in the study to analyze the relevance of the study.

Conclusion The present study examines the medicinal plants that are available in the vicinity of the community or sometimes grown as daily edible food, providing an effective and affordable treatment to the marginal class of hill community. Such traditional knowledge of the community has enough relevance to provide with them, a sustainable approach which otherwise may create a disarray in conservation efforts leading to human induced intervention efforts in future.

Introduction

Medicinal plants have been utilized for the treatment of various diseases promisingly from the ancient time; therefore these are an important element of aboriginal curative systems for a creature. The Indian *Rishis* first documented the use of medicinal plants in the form of Samhitas. *Charak Samhita* (1000–800 BC) and *Shushrut Samhita* (800–700 BC) by Maharshi Charak and Maharshi Shashurut respectively are the baselines of Indian Medicinal System. Maharshi Charak mentioned over 500 medicinal plants, out of which 340 plants used in the production of herbal medicine [1–2]. AYUSH (i.e. Ayurveda, Unani, Siddha and Homeopathy) is another traditional Indian healthcare system, considered as a great knowledge based in herbal medicines. Ayurveda alone reported approximately 2000 medicinal plant species. Other medicinal systems also employ large numbers of species viz. Siddha (1121 species), Unani (751 species) and homeopathy (422 species) [3]. Approximately, 70–80% population worldwide still relies on traditional medicinal system for their primary healthcare because of their effectiveness, lack of modern healthcare alternatives and cultural preferences [4–5]. The global demand for herbal medicine continues to increase over the past few decades. The earlier studies stated that out of 2,50,000 flowering plants in the world only less than 10% have been examined successfully for their medicinal potency and still 90% remains unexplored [2]. During the last few decades, increasing interest has been reported regarding the use of medicinal plants and associated traditional knowledge to cure a number of ailments [6–8].

The Uttarakhand Himalaya is one of the hilly states of Northern India. It is well known for its unique geography, rich biological resources, cultural heritage and diverse climatic conditions which supports the highest number of medicinal plant species [9]. The inhabitants of the state learned to live in proximity with their surrounding environment from time immemorial and use the biological resources in various forms such as food, fuel, fodder, medicine etc. but in recent past knowledge on remedial plants is declining regularly due to the development in the present health care system and rapid urbanization. The indigenous people of this region live far-flung areas and use of plants for treating several diseases through local herbal practitioners (*Vaidyas*) to meet their primary health care needs [10–11]. It is observed that due to the changing lifestyle, cultural preferences and socio-economic values, the expensive traditional knowledge about phytotherapy is retreating over the years [12]. Therefore, it is imperative to document medicinal plant diversity and indigenous knowledge of *vaidyas* for future generation. Being the most representative district of Uttarakhand state, Bageshwar district was selected for the present study to explore and document the ethno-medicinal plant

diversity, traditional medicinal practices of local herbal practitioners (*Vaidyas*) and past and present scenario of ethno-medicinal cure system. The qualitative and quantitative information generated from this study can promote the young researchers, non-native and non-healers for detailed knowledge of plant use to conservation and sustainable utilization of ethno-medicinal diversity which contribute to preserve the cultural and genetic diversity of this region.

Materials And Methods

Study area

The present study was carried out at District Bageshwar (Fig.1) which is one of the north most mountainous districts of Uttarakhand State and geographically lies between latitudes 29°42'40" to 30°18'56"N and longitudes 79°23' to 80°10'E. This place is well known for its natural gorgeousness, glaciers, rivers, temples, cultural heritage and land of Lord Shankar is of great religious significance, situated on the confluence of Gomti river and Saryu river which is a tributary of Kali river. The district is bounded by Almora district in the southwest, Chamoli district in the north and northwest and Pithoragarh district in the east. The geographical area of the district is 1687.8 km². For the administrative convenience Bageshwar district, a part of Kumaun division has been divided into four Tehsils viz. Bageshwar, Kapkot, Kanda (Sub-tehsil) & Garur and three blocks viz. Bageshwar, Garur and Kapkot. There are 947 revenue villages, out of which 874 villages are inhabited and 73 villages are uninhabited. The total population of Bageshwar district was 270,332 persons as per the 2011 census.

Brief Profile of Local/Indigenous Communities of Bageshwar District:

The community of the study area divided into 3 categories viz., General, SC, ST which are also divided into their subgroups. General category is divided into *Brahimin* and *Thakur/Kshatriya*. They are mainly involved in primary sectors of agricultural activities and apart from that, secondary sectors and tertiary sectors like private jobs, businesses, govt. jobs etc. with active participation in socio-cultural activities like folk-dances (*Jagar, Jhora-chacheri* etc). Scheduled Class (SC) belongs to the lower verticals of bifurcation such as *Harijan* where most of them are agriculturist; some of them are worked as *lohar* who make agricultural tools. A special type of dance and music is performed by this community during cultivation of rice (*Ropai*) called *Hurki Boll*. These categories also rear livestock such as cow, buffalo, bull, horse, mule, goat, poultry etc. to fulfil their basic needs. The *Bhotiya*, a Mongoloid ethnic, agriculturalist cum pastoralist community; is the third category of Bageshwar district which belongs to scheduled tribe, traditionally living in the high Himalayan region, close to the Tibetan border. Among the three main clans (*Jadhs, Marchas and Tolchas, Shaukas*) of this tribe, *Marchas* resides in Danpur villages of Bageshwar district. Apart from cultural differences, the three *Bhotia* groups resemble in their distinctive Tibetan-like physical appearance. This community is known as the international traders'community carrying out their trades between Tibet (China) and India. They are well known for their indigenous hand-crafts such as carpets, blankets, sweaters from woollen yarns and apart from that, they use the natural resources like oak wood, bamboo (ringal) etc. to make products like *Daliya, Supa, Mosta, Theki, Dokra*. They rear goats and sheep which have multipurpose uses such as they get raw wool, meat and also use them as transport animals. This art is handed over to the daughter by her mother. All *Bhotia* groups are polyglots as they can speak Tibetan, Kumaoni, Garhwali and Hindi.

Data Collection

The study was conducted in 39 villages of Garur block (Garur Ganga Valley with 23 villages) and Kapot block (Saryu valley with 16 villages) of Bageshwar district in Uttarakhand during 2016–2018 across all seasons to document the traditional knowledge system (TKS) with relation to ethno- medicinal uses. Extensive field visits were made to gather information from traditional vaidyas, herbal practitioners and indigenous people using semi-structured questionnaires, target interviews, visual interpretation through snowball methodology. A total of 100 respondents (70 non-healers/natives and 30 *Vaidyas*) were randomly selected for the present study from both valleys. The questionnaire contains information about the ethnomedicinal plants with their local name, parts used, habit, ailment treated by medicinal plants and mode of utilization of herbal formulation. Two general meetings and interviews were also organized at each valley with *vaidyas* and natives. The documented medicinal plant species were collected and rechecked for proper identification using usual literature[13–16] and deposited at Centre of Socio-economic Development (CSED), GBPNIHESD, Kosi-Katarmal, Almora, Uttarakhand.

Ethno-botanical Analysis

The main aim of this study was to investigate the medicinal species used by the villagers in remote and high-altitude areas where medical healthcare facilities are not easily available. These practices are being used since eternity descended from the inherited knowledge of the locals and indigenous population of Uttarakhand. The information on ethno-medicinal important species was recorded including the local names of the species, habit, their uses in different forms, the part used in the medicine practice, mode of administration and the condition of the plant (fresh or dry).

The reported plants were classified in 12 main categories of ailments which were further divided into different respective sub-categories on the basis of disease and affected body part. The data was then statistically analyzed for different parameters. In order to enhance the indicative value of ethno-medicinal study, suitable quantitative methods and approaches in form of indices namely relative frequency of citation (RFC); use report (on the basis of illness); use report (on the basis of taxa); cultural importance (CI) and consensus factor of informants (F_{ic}); have been used for hypothesis testing, statistical validation and comparative analysis of the ethno-medicines.

Use Report Values (UR)

It is the total number of uses reported for each species. It is similar to the use-value of a species but for use report, the number of events (interviews) the process of asking one informant on one day about the uses they know for one species, is one because the respondents were interviewed only once. And response use values are broken down by the number of uses reported for each plant part.

Use Value Index (UV)

Use Value Index (UV) quantifies the importance of each species for each informant and is calculated by $UV = \sum U/N$ formula where U is the number of uses quoted in each interview by N number of informants. Use values are high when there are many use reports for a plant representing its importance, and come within reach of to zero (0) when the use reports are low [17].

Relative Frequency Citation (RFC)

The RFC index reveals the usage importance of a particular species used by different informants. This index is obtained by dividing the total number of informants referring to a particular taxon with the total number of informants given by $RFC = FC_s/N$. Where FC is the total number of informants that referred to the taxon and N is the total number of informants [18].

Cultural Importance Index (CI)

The Cultural Importance Index is estimated for each locality as the summation of Use-Report (UR) in every use category mentioned for a species in the locality divided by the total number of informants. This index provides an implication of involvement of a particular taxon in the community and a greater value signifies that a particular is widely distributed amongst communities. A null value indicates non-existence of the species in the area. CI is calculated by following formulae: $CI = UR/N$ where, UR is the total number of use reports for each species in every category of illness mentioned and N is the total number of informants [19].

Informant consensus Factor (F_{ic})

Informant consensus index or factor is used to test the consistency of information knowledge in treating a particular illness category. The values obtained, are near one (1) if there lie well-defined selection criteria in the community and/or if information is exchanged between the informants. A value approaching zero (0) represents that the plants are chosen randomly and/or there is no information exchanged between the communities about their use. F_{ic} is calculated as: $F_{ic} = (N_{ur} - N_t) / (N_{ur} - 1)$. Where, N_{ur} refers to

the number of use reports for a particular use category and N_i refers to the number of taxa used for a particular use category by all informants [20].

Result And Discussion

Ethno-medicinal plants diversity and uses by the informants

The data collected from the 39 villages of Bageshwar District viz. Garur-Ganga Valley and Saryu Valley have been statistically analysed with an inventory of 70 medicinal plants used for ethnomedicinal purpose distributed in 35 families and 64 genera. These all taxas are organized in alphabetical order with their botanical names including other information of local name, their habit, part used, treated ailments and ethnobotanical indices to quantities the related data (Table 1.). Various previous workers also documented medicinal plant and their ethnomedicinal use patterns from Bageshwar district [21–25]. Although much of the work has been done on ethnomedicinal practices in the respective study area, around 60% of the total documented species have not been reported till now in any other such works.

Among the 35 families recorded, four families were documented with more than 3 taxas included where Lamiaceae being the highest representative family with 8 species being used in traditional health care practices followed by Asteraceae (6 species), Fabaceae (5 species), Rosaceae (4 species) and Apiaceae, Liliaceae, Ranunculaceae, Rutaceae, Zingiberaceae (3 species each). The remaining families contain only one or two species. The most represented families coincide with those of other ethnomedicinal studies in the trans-Himalayan arid zone of Mustang district, Nepal [26] and Garhwal Himalaya, India [27] with this same methodology. Almost all the species are widely distributed in the community and are used by almost every local person and most of them comprise of daily used plants. As per habit, herb were the dominant (51) life form of documented medicinal plant species followed by tree (10), shrub (7) and 2 species were climbers (Fig. 2).

Although the study area is provisioned with both modern healthcare system as well as traditional health care systems, but till now in remote areas, approximately 70% population preferred to visit *Vaidyas*. Most of the *Vaidyas* were >50 years old and had sound knowledge about the medicinal value of their surrounding flora which have been passed to them by their ancestors. These plants used to cure variety of diseases such as fever, stomach problem, cough, cold, headache etc. from centuries.

Mode of preparation and administration

There have been a total 8 plant parts used from the documented 70 species which are categorized as root/rhizome (29.87%), leaf (22.08%), whole plant (16.88%), seeds (14.29%), fruits (11.69%), flower (2.60%) and both bulb and latex (1.30%). Notably, root-rhizome was the most utilized part in terms of plant-part used in medicinal purpose followed by leaf and whole plant (Fig 3). The used part of the present study is similar to other investigations [28–32]. The roots are the storage part of the plant that contains the deposition of the nutrients and bioactive compounds necessary to scavenge the disease-causing vectors. High concentrations of bioactive compounds were attributed the high importance of the underground part [33] therefore, root was preferred to be used in most of the formulations. Apart from the root part, leaves also contain a high concentration of health-beneficial secondary metabolites, phytochemicals, and essential oils, which contribute significantly to phototherapy or treatment of various health disorders [34–37]. A conservational approach often emphasized the use of leaf part instead of the root part because the root utilization lead to destruction of the whole plant as regeneration is a slow process for many potent species. In the study, 51 plants were in the category of herb and the usage of the whole part is an indication of abundance of this habit in the study area. Lastly, latex and bulb part of the plants were the least utilized part of plant.

Tables 1 & 2 provides the different type of mode of preparation and administration of the plant species to treat different type of healthcare ailments and out of the 10 types of mode of administration of the medicines, decoction and ingestion are widely practiced to be given to the affected ones (Fig 4).The major method of preparation was the decoction has been reported previously [38–42]. Poultice and cooking were also favored for many medicinal plants to be administered in treatment of any ailment. Since the root/rhizome, leaf and whole plant part were used mostly in the medicinal purpose, it can be correlated to the preparation of decoction form, application of poultice and direct of the medicines in treatment. Other mode of administration included cooking and powder form (9.42%), direct application (7.97%), emulsion and infusion (5.80%), ointment (2.17%) and in form of steam (0.72%).

Decoction or syrup is very simple and easy way used for ethno-medicinal preparation, preferred due to complete extraction of the potential bio-active compounds, which is accelerated on heating [43]. Pleasant taste of the herbal drug can be attuned by adding together honey or sugar [44]. Direct ingestion was preferred at second number and poultice was third one as rhizome and leaf part were used in most of the formulations which are needed to be crushed and either mixed in some solvent or applied as paste and band-aid. Other lesser used preparation methods like ointment were ailment specific as it was only used in skeletal and muscle related issues and sometimes used to treat dermatological ailments. Infusion of medicinal plant part is seen common in multiple diseases where anti-oxidants were released in the infused extract to treat various diseases.

Local names of the species

The 100 informants referred to 70 taxas used in the ethnobotanical purpose to treat the various kind of ailment as well as used by the local traditional healers (*Vaidyas*). The common name or the local names have been obtained from the *Vaidyas* themselves as well as from other ethnobotanical researches conducted earlier in the state of Uttarakhand. Many local names of the medicinal plants inhibit their use-type, for example *Berginia ciliate* is called as Pattharchatta (stone destroyer) used in treatment of removal of stone from kidney. *Plantago ovate* is called as Jonkpuri (jonk resembles to worms) is used in treatment of *Ascaris* and other worms in domestic animals. Another species *Viola betonicifolia* (called Garur-jadi where garur means eagle that hunts snake) and the medicine is used as an antidote to treat snake bites. The local names have been organized in Table 1 in front of the scientific names of the species. Most communities have their own nomenclature for flora, fauna and their parts, in which they interested. More over the native names are concern with locally observed phenomenon and thus reflect the broad spectrum of information of local uses, ecology, physiology, anatomy, pharmacological activity etc.[45].

Target treatment categories of ailment

The reported plants were further analyzed for their usage in treatment of different types of healthcare ailments-treatments as provided in Fig 5. A total of 12 general ailment categories were compiled with a multiple sub-category based on the information gathered. The figure also describes the number of taxas used in different ailment categories with 23 taxas being used to treat gastrointestinal disorders followed by general healthcare disorders, dermatological issues, and respiratory issues with 22, 21 and 15 taxas respectively. The different ailment categories have been organized in Table 5 and their sub categories have been documented in Table-1 with popular ailment uses. The subcategories varied from general headache to complex cataract and even fracture and kidney stones.

The maximum numbers of taxa (23) are being included in gastrointestinal ailments comprised of 695 use reports from the total categories with a medicinal importance index value of 30.22. Some most sought species in this category are *Cannabis sativa*, *Citrus aurantifolia*, *Angelica galuca*, *Ajuga reptans*, and *Emblica officinalis*. These species are placed in accordance to their use reports mentioned during data collection. In the category of general health care, 22 species are being used with 524 numbers of use-reports & medical importance of 23.82. The species indicated with the highest number of use-reports are *Ocimum basilicum*, *Citrus aurantifolia*, *Curcuma longa*, *Ajuga repens*, and *Picorhiza kurrooa* on the basis of use reports. Dermatological category ranks third with 21 taxas in use and use report value of 617 and medicinal importance of 29.82. The main species employed for this category on the basis of use reports are *Setaria italica*, *Eupatorium adenophorum*, *Arthemisia martima*. Although the hepatic health cure category comprised of only 8 taxas, it has a medicinal importance index values of 45.50, which is highest of all the categories since the species used under the category are of daily usage and are often included in daily food products with nutritive values. The species include *Glycine max*, *Hordium vulgare*, *Punica granatum*, *Urtica dioica*, *Polygonatum cirrhifolium* etc. In other works carried out in Uttarakhand, they were reported these medicinal plants and use different plant parts in different ratio to cure disease or ailments [16, 21–23, 25, 27, 28, 46–48].

Quantitative analysis of ethnobotanical data

It is importance to draw a scientific interpretation of the qualitative data in terms of quantitative values to validate their importance in the society as well as to other communities in future. Several indices have been analysed from the data obtained on the

medicinal plant usage which are categorized as Relative Frequency Citation (RFC), Use report (Categorical and disease based), Cultural Importance Index (CI) and Informant Consensus Index (F_{ci}). These indices are utilized to verify the homogeneity, importance, cultural similarity of the medicinal plants in communities.

Relative Frequency Citation

RFC values are closely related to the usefulness of the species and its usage by the community in a particular area. The value of RFC ranged from 0.03 to 0.91 and the maximum cited species to be used by the community are *Setaria italic* (0.91), *Zingiber officinale* (0.89), *Ocimum basilicum* (0.88), *Rephanus sativus* (0.87). And those with the least RFC values are *Duchesnea indica* (0.03), *Thalictrum foliosum* (0.04). The low values for these species is due to their usage type as *D. indica* is used in removal of burns and scars and *T. foliosum* is used in treatment of eye infection (white dot cataract) communities tend to use modern medicines for such ailments.

Use Report

Use reports are the number of uses reported by the informants and represents utility of any specific species towards any specific ailment or different ailments. There are two type of use reports analysed; one is UR^c where, use of a particular species to cure specific ailments have been documented from all the informants while other one is UR^d where, sum of all the uses for a particular disease/ailment have been documented. The species with highest use-report values are listed in Table 3. *Ocimum basilicum*, *Cannabis sativa*, *citrus aurantifolia*, *Curcuma longa* and *setaria italica* have been top positioned in terms of use-reports in terms of different ailments cured.

Cultural Importance Index

Cultural importance index specifies the distribution and importance of species in different indigenous people. The CI_s of the species ranged from 0.03 to 0.97. Higher values of the CI indicate the involvements of a particular species in different indigenous population of the study area and to verify, to what level each species is present in the local traditions and in the reminiscence of the local people. The species with highest cultural importance value recorded were *Ocimum basilicum* (0.97), *Cannabis sativa* (0.94), *Citrus aurantifolia* (0.94) and the species with least CI values are *Duchesnea indica* (0.03) with only 3 use-reports obtained, *Micromeria biflora* (0.06) with 6 use-reports and *Drymaria cordata* (0.07) by 7 use-reports. The higher values CI_s also indicate the presence of deep roots of traditional knowledge of the medicines regarding the species and all these species are used in day to day activity from food to culture and traditions. The 21 most significant species have been listed in Table 3 with their respective use-report values. According to Tuttolomondo et al. 2014 [49], the low values of CI indicate that the local populations had little belief in some of the plants relating to the treatment of certain diseases/ailments or as a strong indication of a gap or fading of traditional plant knowledge regarding their medicinal uses. One reason for lower CI_s of some species is that the indigenous people dependent on the natural resources may not consume every wild edible species and thus the knowledge may be sparsely distributed among indigenous people.

Informant Consensus Factor

The ailments documented in the research have been classified in 12 broad categories of whose, informant consensus factor (F_{ic}) ranged from 0.92 to 1.0 (Table 4). The values were almost near 1 which indicates that there lies in homogeneity in selecting the species for particular ailments in the indigenous population. Immuno-regulatory category was assigned the value 1 due to presence of only one taxa in the particular category. Apart from this, hepatic health care and urinogenital categories obtained the value of 0.98 indicating a well-defines criteria of the local population and non-random selection of species for the ailment category.

Hepatic health care were treated mainly by *Asparagus recemosus*, *Glycine max*, *Hordium vulgare*, *Polygonatum cirrhifolium*, *Punica granatum*, *Rephanus sativus* and *Urtica dioica* which are sought to provide nutritive benefits and are of warm potency which is a necessity in higher altitude regions with colder temperatures. All of these species are used in daily food habit of the indigenous

community and is widely used in the state. Also a higher value of F_{ic} verifies the distribution of the different species used for a specific ailment. The urinogenital category, with only 4 taxa included comes second in terms of CI as there is a widely accepted notion of using those species for such disorders within the study area as well as outside too.

Gastrointestinal disorders, dermatological issues, respiratory issues and ailments related to skeletal and muscle parts are having a value of 0.97. These issues may prevail due to local environment and natural systems. Almost all the species covered under these three categories are used by most of the people here and can be found within every household. The higher values of informant consensus factor in almost all the ailment categories also implies that the documented species are the most sought indigenous species that are being used by the local people as well as traditional healers and medicine practitioners. Also, the mode of preparation of these medicines either in form of cooked food or poultice is often similar to the other nearby communities.

Ethno-veterinary uses of medicinal plants

Villages of the study area far-flung to the road side; still depend to a large extent upon plants and household remedies for curing veterinary ailments. The indigenous knowledge of ethnoveterinary medicine and its significance has been identified by the local people through a process of experience over the fifty years. In this investigation, medicinal plant species documented from the study sites are not only used to treat human ailments but also used to cure various animal diseases e.g. *Ajuga reptans* is used to cure throat infection in domestic animals, *Coriandrum sativum* is used against poison, *Taraxacum officinale*, *Verbascum thapsus* and *Viola canescens* to increase lactation in milch animals (Table 2). Thus we can say the indigenous methods of treatment are one of the most important traditional systems in the study area where modern veterinary healthcare facilities are in very poor conditions.

Diminishing traditional ethno-botanical knowledge:

The present scenario of this ethno-botanical knowledge seems to be pale and dull as there has been a steady loss in such practices due to advent of modern healthcare system where people are appalled to the quick recovery, which often comes at a cost of side-effect of the medicine. Data have been collected for one decade from 2008 to 2018 regarding the level of degradation of such precious knowledge. Fig 6 represents the current scenario of the ethnomedicinal practices being followed compared to a decade ago where a few practices have diminished completely and few are on a verge to die. People are moving away from traditional healings and the young generation has no interest in the traditional customs and values. Earlier the people of remote areas preferred to consult with *Vaidyas* for primary healthcare but from last one decade it was noticed that increase in accessibility, availability and affordability towards the modern medicinal system people of the study area are losing faith in traditional health care practices. It has been observed that some of the diseases related especially to children, where modern health care practices are not able to cure such as *Juga* (removal of *Ascaris*), *Chupad* (heavy cough), *Kasar* (constipation), so indigenous people are still depend of traditional cure system. Also more than half of the medicinal plants were highly effective in treatment of the ailments as well as in terms of priority of using ayurvedic medicine against other modern cures available. In view of the effectiveness of the ethno-medicinal plants for usage and treatment among the communities, 57% of the total respondents believe that these plants are highly effective and 30% are to be moderately effective and only 13% respondents say these are lesser effective. Notably the low effectiveness was due to the medicinal plants used in treating very specific and complex ailments. During the study it was observed that the *vaidyas* do not share their knowledge, they believed that the treatment will not be effective if they share the knowledge with anybody. In the changing lifestyle and socioeconomic scenarios, most of the inhabitants are reluctant to live with their traditional heritage leading to vanishing of the knowledge [50].

Conclusion

The relevance of traditional folk medicine is still prominent in remotely located hills of Uttarakhand and with population growth and lack of health care there is a need to adhere to the locally available resources to be utilized for general health care and provisioning of suitable side-effect free treatment to the communities. The impoverishment of such knowledge has led to a huge loss to scientific community in terms of bio-prospecting of modern medicine, knowledge local conservation efforts and sustainable

utilization by communities. A decrease in the trends of following the traditional healthcare system by hill communities can pull apart the complex web of living habit that has evolved from centuries.

The results emphasize on the most sought medicinal plant species used by the marginal people of hills with plethora of the plants being availed locally or from nearby landscapes. But due to declining number of traditional practitioners, concern to conserve the practices and the plant species is also rising. This behooves us to align a path for proper interpolation of such knowledge system in scientific process which will otherwise elapse with due time.

Acknowledgement

We owe our gratitude to the people of Garur-Ganga valley and Saryu valley of district Bageshwar, Uttarakhand who shared the valuable information and knowledge. The authors thankfully acknowledge the facilities received from GBPNIHESD, Kosi-Katarmal, Almora, India for undertaking this work. We are thankful to DST, Govt. of India for the financial assistance provided under a NMSHE, Task Force 5 sponsored project entitled "Network programme on the convergence of traditional knowledge system for sustainable development in the Indian Himalayan Region". We are sincere thanks to Prof. S. C. Garkoti, JNU for his constant support and cooperation.

References

1. Kala CP. Medicinal plants conservation and enterprise development. *Med Plants*. 2009; 1(2):79-95.
2. Gupta KK, Khandelwal G, Prasad G, Chopra, AK, Mishra A. A review on scientific technologies in practice to innovate plant based molecules and to improve herbal drug quality to overcome health problems. *J Applied and Natur Sci*. 2010; 2(1):165-181.
3. Kala CP, Dhyani PP, Sajwan BS. Developing the medicinal plants sector in northern India: challenges and opportunities. *J EthnobiolEthnomed*. 2006; 2(1):32.
4. Caniogo I, Siebert S. Medicinal plants ecology, knowledge and conservation in Kalimantan, Indonesia. *Econ Bot*. 1998; 52:229-250.
5. Siahsar B, Rahimi M, Tavassoli A, &Raissi A, Application of biotechnology in production of medicinal plants. *Am Eurasian J Agric Environ Sci*. 2011; 11(3):439-444.
6. Rossato SC, Leitao-Filho H, Gegossi A. Ethnobotany of Caicarás of the Atlantic forest coast (Brazil). *Econ Bot*. 1999; 53:387-395.
7. Hanazaki N, Tamashiro JY, Leitao-Filho H, Gegossi A. Diversity of plant uses in two Caicarás communities from the Atlantic forest coast, Brazil. *BiodiversConserv*. 2000; 9:597-615.
8. Gazzaneo LR, Paiva de Lucena RF, Paulino de Albuquerque U. Knowledge and use of medicinal plants by local specialists in a region of Atlantic Forest in the state of Pernambuco (Northeastern Brazil). *J EthnobiolEthnomed*. 2005; 1(1):9.
9. Gaur RD, Sharma J. Indigenous knowledge on the utilization of medicinal plants diversity in Siwalik region of Garhwal Himalaya, Uttarakhand. *J Forest Sci*. 2011; 27(1): 23-31.
10. Kala CP. Status and conservation of rare and endangered medicinal plants in the Indian trans-Himalaya. *Biol Conserv*. 2000; 93:371-379.
11. Dhyani PP, Kala CP. Current research on medicinal plants: Five lesser known but valuable aspects. *Curr Sci*. 2005; 88:335.
12. Kala CP. Current Status of Medicinal plants used by traditional Vaidyas in Uttaranchal State of India. *Ethnobotany Research Applications*. 2005; 3:267-278.
13. Osmaston AE. *A Forest Flora for Kumaun*. International Book Distributors, Dehradun, India. 1926.
14. Naithani BD. *Flora of Chamoli*. Botanical Survey of India, Vol. 1 and 2. Dehradun, India. 1985.
15. Kirtikar KR, Basu BD. (1994). *Indian Medicinal Plants*. Bishan Singh Mahendra Pal Singh, Dehradun. 1994.
16. Gaur RD. *Flora of the District Garhwal: North West Himalaya (with Ethnobotanical Notes)*, (Transmedia, Srinagar, Garhwal), 1999.
17. Phillips O, Gentry AH, Reynel C, Wilkin P, Galvez DBC. Quantitative ethno-medicine and Amazonian conservation. *BiodiversConserv Biol*. 1994; 8:225-248.

18. Tardio J, Pardo-de-Santayana M. Cultural importance indices: a comparative analysis based on the useful wild plants of southern Cantabria (northern Spain). *Econ Bot.* 2008; 62(1):24–39.
19. Pardo-de-Santayana M, Tardio J, Blanco E, Carvalho AM, Lastra JJ, San Miguel E, Morales R. Traditional knowledge of wild edible plants used in the northwest of the Iberian Peninsula (Spain and Portugal): a comparative study. *J EthnobiolEthnomed.* 2007; 3:27.
20. Trotter RT, Logan MH. Informant consensus: a new approach for identifying potentially effective medicinal plants. In: Etkin NL, editor. *Plants in indigenous medicine and diet: biobehavioural approaches.* Bedford hills, New York: Redgrave Publishers. 1986; 91-112.
21. Gangwar KK, Deepali, Gangwar RS. Ethnomedicinal Plant Diversity in Kumaun Himalaya of Uttarakhand, India. *Natur Sci.* 2010; 8(5): 66-78.
22. Rawat B, Sekar KC, Gairola S. Ethnomedicinal plants of Sunder dhungavalley, Western Himalaya, India-traditional use, current status and future scenario. *Indian Forester.* 2013; 139(1): 61-68.
23. Singh P, Attri, BL. Survey on traditional uses of medicinal plants of Bageshwar valley (Kumaun Himalaya) of Uttarakhand, India. *Intern J Conserv Sci.* 2014; 5(2): 223-234.
24. Tewari S, Paliwal AK, Joshi B. Medicinal use of some common plants among people of Garur Block of district Bageshwar, Uttarakhand, India. *Octa J Biosci.* 2014; 2(1): 32-35.
25. Bhatt D, Arya D, Chopra N, Upreti BM, Joshi GC, Tewari, LM. Diversity of ethno-medicinal plant: A case study of Bageshwar district Uttarakhand. *Journal of Medicinal Plants Studies.* 2017; 5(2): 11-24.
26. Shandesh B, Chaudhary RP, Quave CL, Taylor RSL. The use of medicinal plants in the transhimalayan arid zone of Mustang district, Nepal. *J EthnobiolEthnomed.* 2010; 6:14.
27. Kumar M, Mehraj A, Sheikh MA, Bussmann RW. Ethnomedicinal and ecological status of plants in Garhwal Himalaya, India. *J EthnobiolEthnomed.* 2011; 7:32.
28. Malik ZA, Bhat JA, Ballabha A, Bussmann RW. Ethnomedicinal plants traditionally used in health care practices by inhabitants of Western Himalaya. *J Ethnopharmacol.* 2015; 172: 133–144.
29. Bhat JA, Kumar M, Bussmann RW. Ecological status and traditional knowledge of medicinal plants in Kedarnath Wildlife Sanctuary of Garhwal Himalaya, India. *J. Ethnobiol. Ethnomed.* 2013; 9: 1.
30. Kunwar RM, Nepal BK, Kshetri HB, Rai SK, Bussmann RW. Ethnomedicine in Himalaya: a case study from Dolpa, Humla, Jumla and Mustang districts of Nepal. *J. Ethnobiol. Ethnomed.* 2006; 2: 27.
31. Kunwar RM, Shrestha KP, Bussmann RW. Traditional herbal medicine in Far-west Nepal: a pharmacological appraisal. *J. Ethnobiol. Ethnomed.* 2010; 6: 35.
32. Kunwar RM, Mahat L, Acharya RP, Bussmann RW. Medicinal plants, traditional medicine, markets and management in far-west Nepal. *J. Ethnobiol. Ethnomed.* 2013; 9: 24.
33. Moore PD. Trials in bad taste. *Nature.* 1994; 370: 410–411.
34. Keter LK, Mutiso PC. Ethnobotanical studies of medicinal plants used by traditional health practitioners in the management of diabetes in lower eastern province, Kenya. *J. Ethnopharmacol.* 2012; 139: 74–80.
35. Quave CL, Pieroni AA. Reservoir of ethnobotanical knowledge informs resilient foodsecurity and health strategies in the Balkans. *Nature Plants.* 2015; 1(2):14021.
36. Mahmood A, Mahmood A, Malik RN, Shinwari ZK. Indigenous knowledge of medicinal plants from Gujranwala district, Pakistan. *J Ethnopharmacol.* 2013; 148(2):714–23.
37. Bano A, Ahmad M, Hadda TB, Saboor A, Sultana S, Zafar M, Khan MPZ, Arshad M, Ashraf MA. Quantitative ethnomedicinal study of plants used in the skardu valley at high altitude of Karakoram-Himalayan range, Pakistan. *J EthnobiolEthnomed.* 2014; 10(1):43.
38. Gurdal B, Kultur S. An ethnobotanical study of medicinal plants in Marmaris (Mugla, Turkey). *J Ethnopharmacol.* 2013; 146(1):113–26.
39. Ahmad M, Sultana S, Fazl-i-Hadi S, Ben Hadda T, Rashid S, Zafar M, Khan MA, Khan MPZ, Yaseen G. An ethnobotanical study of medicinal plants in high mountainous region of Chail valley (district swat-Pakistan). *J EthnobiolEthnomed.* 2014;10(1):36.

40. Tugume P, Kakudidi EK, Buyinza M, Namaalwa J, Kamatenesi M, Mucunguzi P, Kalema J. Ethnobotanical survey of medicinal plant species used by communities around Mabira central Forest reserve, Uganda. *J EthnobiolEthnomed*. 2016; 12(1):5.
41. Umair M, Altaf M, Abbasi AM. An ethnobotanical survey of indigenous medicinal plants in Hafizabad district, Punjab-Pakistan. *PloS one*. 2017; 12(6):e0177912.
42. Farooq A, Amjad MS, Ahmad K, Altaf M, Umair M, Abbasi AM. Ethnomedicinal knowledge of the rural communities of Dhirkot, Azad Jammu and Kashmir, Pakistan. *J EthnobiolEthnomed*. 2019; 15:45.
43. El Amri J, El Badaoui K, Zair T, Bouharb H, Chakir S, Alaoui T. Ethnobotanical study of medicinal plants in the region El Hajeb (Central Morocco). *J Res Biol*. 2015; 4(8):1568–80.
44. Boudjelal A, Henchiri C, Sari M, Sarri D, Hendel N, Benkhaled A, Ruberto G. Herbalists and wild medicinal plants in M'Sila (North Algeria): an ethnopharmacology survey. *J Ethnopharmacol*. 2013; 148(2):395–402.
45. Singh H. Importance of local names of some useful plants in ethnobotanical study. *Indian J Tradit Knowledge*. 2008; 7(2): 365-370.
46. Jain SK. *Dictionary of Indian Folk Medicine and Ethnobotany*. Deep publications, Paschim Vihar, New Delhi; 1991.
47. Pandey K, Pandey S. Indigenous medicines of Raji tribes of Uttarakhand. *Indian J Tradit Knowledge*. 2010; 9(1):131-133.
48. Joshi M, Kumar M, Bussmann RW. Ethnomedicinal Uses of Plant Resources of the Haigad Watershed in Kumaun Himalaya. *J Medicinal and Aromatic Plant Science and Biotechnology*. 2010, 4(1):43-46.
49. Tuttolomondo T, Licata M, Leto C, Bonsangue G, Gargano ML, Venturella G, La Bella S. Popular uses of wild plant species for medicinal purposes in the Nebrodi Regional Park (north-eastern Sicily, Italy). *J Ethnopharmacol*. 2014; 157:21–37.
50. Maikhuri RK, Nautiyal S, Rao KS, Saxena KG. Medicinal plant cultivation and biosphere reserve management: a case study from the Nanda Devi Biosphere Reserve, Himalaya. *Curr Sci*. 1998; 74(2): 157-163.

Declarations

Author Information:

1. Dr Saraswati Nandan Ojha; Email: ojhasn16@gmail.com
2. Deepti Tiwari; Email: pandeydeepti1990@gmail.com
3. Aryan Anand; Email: aryananand2010@gmail.com
4. Rakesh Chandra Sundriyal; Email: sundriyalrc@yahoo.com

Institute Name:

G.B. Pant National Institute of Himalayan Environment and Sustainable Development, Kosi – Katarmal, Almora – 263643, Uttarakhand, India.

Authors' contributions

SNO, DT and AA planned and performed the study and field survey, writing the draft manuscript, and analyzed the data and RCY revised the manuscript and data analysis. All authors read and approved the final manuscript.

Competing interests

The authors declare that they have no competing interests.

Funding

Department of Science and Technology, Govt. of India for the financial assistance, provided under a NMSHE, Task Force 5 sponsored project entitled “Network programme on the convergence of traditional knowledge system for sustainable development in the Indian Himalayan Region”.

Availability of data and materials

The authors already included all data in the manuscript collected during the field surveys. The documented medicinal plant species were deposited at Centre of Socio-economic Development (CSED), GBPNIHESD, Kosi-Katarmal, Almora, Uttarakhand.

Ethics approval and consent to participate

During field work prior consent of the informants was taken conducting these studies. This was done to adhere to the ethical standards of community participation in scientific research.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

Tables

Table 1. Quantitative enumeration of ethno-medicinal plants used by indigenous people of district Bageshwar.

Botanical Name & Family	Local Name	Habit	Part Used	Popular Ailment Uses (Group & Categories)	Used in	Preparation	FC ^a	RFC ^b	UR ^c	UR ^d	CI ^e
<i>Aconitum heterophyllum</i> Wall. (Ranunculaceae)	Atis	H	Rt	General health care - Fever Gastrointestinal - vomiting	Hu	Pw In	34	0.34	34	51	0.51
<i>Acorus calamus</i> L. (Araceae)	Bojh/Buch	H	Rh	Skeleton & muscles - Sprain, Inflammation Other - Insect repellent	Hu I	Pw, O Da	55	0.55	21	74	0.74
<i>Ajuga bracteosa</i> Wall. ex Benth. (Lamiaceae)	Ratpatia	H	WP	General health care - Fever Gastrointestinal - Constipation Urinogenital - Diuretic	Hu	De	55	0.55	53	72	0.72
<i>Ajuga reptans</i> L. (Lamiaceae)	Ratpatia	H	Rt	General health care - Fever, Throat infection in animal (<i>Galgotu</i>) Gastrointestinal - Constipation, Stomach ache Urinogenital - Stone	Hu & C Hu	De, Em De, In De	56	0.56	58	87	0.87
<i>Allium sativum</i> L. (Alliaceae)	La san	H	B	Skeleton & muscles - Joint Pain (Arthritis)	Hu	O	59	0.59	59	59	0.59
<i>Angelica glauca</i> Edgew. (Apiaceae)	Gandaraini/ Chippi	H	Rt	Gastrointestinal - Stomach ache, vomiting, Other - Spices & condiment, Herbal tea	Hu	Po Co, Inf	44	0.44	35	89	0.89
<i>Artemisia martima</i> L. (Asteraceae)	Pati/Titpati	H	L	Dermatological - Cuts & wounds, skin ailments	Hu	Po	55	0.55	77	77	0.77
<i>Asparagus racemosus</i> Willd. (Liliaceae)	Keruwa	S	Rt	Immuno-regulatory - Stimulant Hepatic health cure - Tonic Gastrointestinal - Stomach ache	Hu	Pw Pw De	46	0.46	15	65	0.65
<i>Berberis asiatica</i> Roxb. ex DC (Berberidaceae)	Kilmori	S	Rt	General health care - Fever Circulatory - Diabetes	Hu	Pw Pw	42	0.42	13	54	0.54
<i>Bergenia ciliata</i> (Haw) Sternb (Saxifragaceae)	Silphora/ Patharchatta	H	Rt	Urinogenital - Urinary infection, Stone	Hu	Inf, Pw	51	0.51	61	61	0.61
<i>Cannabis sativa</i> L. (Cannabaceae)	Bhaang	H	Sd, L	Gastrointestinal - Purgative & Laxative, Carminative, Constipation, Stomach ache Antidote - Insect	Hu	In Da	63	0.63	46	94	0.94

bite

Other - Warm
effect in winters

In, Co

43

Botanical Name & Family	Local Name	Habit	Part Used	Popular Ailment Uses (Group & Categories)	Used in	Preparation	FC ^a	RFC ^b	UR ^c	UR ^d	CF ^e		
<i>Centella asiatica</i> L. (Apiaceae)	Brahmi	H	L	General health care - Headache	Hu	Po	28	0.28	28	28	0.28		
<i>Citrus aurantifolia</i> (Christm) Sw. (Rutaceae)	Kagji Nimboo	T	Fr	General health care - Headache	Hu	De	38	0.38	20	94	0.94		
				Gastrointestinal-Constipation, weight loss								De	23
				Respiratory - Cold									
Other - Herbal tea, Source of vitamin 'C'	De	32											
<i>Citrus hystrix</i> DC. (Rutaceae)	Jamer/ Jamir	T	Fr	Gastrointestinal - Removal of ascaris (antiparasitic) locally known as <i>juga</i> .	Hu	In	38	0.38	27	50	0.5		
<i>Coriandrum sativum</i> L. (Apiaceae)	Dhaniya	H	Sd	Respiratory - Cold	C	Em	36	0.36	36	36	0.36		
				Antidote - Against poison								7	
				Antidote - Against poison									16
<i>Curcuma longa</i> L. (Zingiberaceae)	Haldi	H	Rh	General health care - Internal injury	Hu	De	78	0.78	39	91	0.91		
<i>Curcuma longa</i> L. (Zingiberaceae)	Haldi	H	Rh	Dermatological - Cuts & wounds, cosmetics	Hu	Da	78	0.78	39	91	0.91		
				Respiratory - Cough								16	
				Dermatological - Boils									36
<i>Cynoglossum zeylanicum</i> Thunb. Ex Lehm. (Boraginaceae)	Chtkura	H	Rt	Dermatological - Boils	Hu	Da	54	0.54	54	54	0.54		
<i>Dactylorhiza hatagirea</i> (D.Don)Soo (Orchidaceae)	Salmpanja/ Hattajari	H	Rt	Circulatory - Bleeding	Hu	De	17	0.17	17	34	0.34		
				Dermatological - Wounds								Po	17
<i>Dioscorea deltoidea</i> Wall (Dioscoreaceae)	Genthi	Cl	Fr (Atu)	Respiratory - Cough & cold	Hu	Co	32	0.32	32	32	0.32		
<i>Drymaria cordata</i> (L.) Willd. ex Schult (Caryophyllaceae)	--	H	WP	Respiratory - Cough	Hu	In	19	0.19	7	7	0.07		
<i>Duchesnea indica</i> (Andrews) Focke (Rosaceae)	Van Kafal	H	L	Dermatological - Burns and removal of burn scars	Hu	Po	3	0.03	3	3	0.03		
<i>Emblica officinalis</i> Gaertn. (Euphorbiaceae)	Aanwla	T	Fr	Circulatory - Diabetes	Hu	In	35	0.35	8	85	0.85		
				Gastrointestinal - Purgative &								In	54

				Laxative, Carminative, Stomach ache Respiratory - Cough Other - Source of vitamin 'C'		In In			6 17			
<i>Eupatorium adenophorum</i> Spreng. (Asteraceae)	Nargadiya/ Pagal-jhad	H	L	Dermatological - Cuts & wounds	Hu	Po	80	0.8	80	80	0.8	
<i>Euphorbia prolifera</i> Ehrenb. Ex. Boiss (Euphorbiaceae)	Dudhiya, Maikuri	H	WP	Other - Insect repellent	I	Da	7	0.07	7	7	0.07	
<i>Ficus palmata</i> Forsk. (Moraceae)	Bedu	T	Lt	Dermatological - Cuts & wounds	Hu	Da	48	0.48	39	39	0.39	
<i>Ficus roxburghii</i> Wall. (Moraceae)	Timul	T	Fr	Gastrointestinal - Acidity, Carminative Circulatory - Blood pressure	Hu	Co Co	26	0.26 0	45 3	48 0	0.48	
<i>Glycine max</i> (L.) Merri (Fabaceae)	Kala Bhatt	H	Sd	Hepatic health cure - Jaundice	Hu	Co	84	0.84	84	84	0.84	
Botanical Name & Family	Local Name	Habit	Part Used	Popular Ailment Uses (Group & Categories)	Used in	Preparation	FC^a	RFC^b	UR^c	UR^d	CI^e	
<i>Hedychium spicatum</i> Buch. Ham. ex Smith. (Zingiberaceae)	Van Haldi	H	Rh	Gastrointestinal - Intestinal problems, Purgative & Laxative, Carminative Respiratory - Cough Dermatological - Cosmetics, anti- lice	Hu	Pw Pw Pw	13	0.13	30 8 14	52	0.52	
<i>Hordium vulgare</i> L. (Poaceae)	Jau	H	Sd	Hepatic health cure -Warm and nutritive effect Dermatological - Burns	Hu	Co O	46	0.46	46 17	63	0.63	
<i>Leucas lanata</i> Benth (Lamiaceae)	Nirasi Jhad	H	L	Respiratory - Cough	Hu	De	80	0.8	80	80	0.8	
<i>Mentha arvensis</i> L. (Lamiaceae)	Pudina	H	L	Gastrointestinal - Stomach ache, vomiting,	Hu	De	43	0.43	50	50	0.5	
<i>Micromeria biflora</i> Benth. (Lamiaceae)	--	H	WP	General health care - Fever	Hu	De	6	0.06	6	6	0.06	
<i>Microtyloma uniflorum</i> (Lam) Verdc.(Fabaceae)	Gahat/Kulthi	H	Sd	Urinogenital disorder - Stone	Hu	Co	69	0.69	69	69	0.69	
<i>Momordica charantia</i> L. (Cucurbitaceae)	Karela	Cl	Fr	Circulatory - Diabetes	Hu	Co, In	39	0.39	39	39	0.39	
<i>Ocimum basilicum</i> L. (Lamiaceae)	Tulsi	S	L, Sd	General health care - Fever Respiratory -	Hu	De De	88	0.88	33 41	97	0.97	

				Cough & cold Other - Herbal tea, Warm effect in winters		De			23			
<i>Origanum vulgare</i> L. (Lamiaceae)	Van Tulsi	H	L, Rt	General health care - Fever Respiratory - Cough & cold Dermatological - wounds Other- Herbal tea	Hu	De	31	0.31	15	71	0.71	
						De			18			
						Em			29			
						Inf			9			
<i>Picrorhiza kurrooa</i> Royle. (Scrophulariaceae)	Kutki/Katki	H	Rt	General health care - Fever Gastrointestinal - Abdominal pain	Hu	In	53	0.53	53	80	0.8	
						In			27			
<i>Plantago ovate</i> Forsk. (Plantaginaceae)	Isabgoal	H	Sd	Gastrointestinal - Constipation, digestive problems, Diarrhoea	Hu	In	74	0.74	83	83	0.83	
<i>Plantago lanceolata</i> L. (Plantaginaceae)	Jonkpuri	H	Rt	Gastrointestinal - Removal of stomach worm of domestic animals	C	In	43	0.43	43	43	0.43	
<i>Podophyllum hexandrum</i> Royle (Podophyllaceae)	Van-Kakri	H	Fr, Rt	Dermatological - Wounds	Hu	Po	19	0.19	19	19	0.19	
Botanical Name & Family	Local Name	Habit	Part Used	Popular Ailment Uses (Group & Categories)	Used in	Preparation	FC^a	RFC^b	UR^c	UR^d	CI^e	
<i>Polygonatum cirrhifolium</i> (Wall.) Royle (Liliaceae)	Maha-Meda	H	WP	Hepatic health cure - Tonic Dermatological - Cuts & wounds Circulatory - Blood purifier	Hu	De	21	0.21	13	34	0.34	
						Po			14			
						Co			7			
<i>Polygonatum verticillatum</i> L. (Liliaceae)	Meda	H	Rt	Gastrointestinal - Carminative Dermatological - wounds	Hu	In	15	0.15	8	19	0.19	
						Po			11			
<i>Prunus persica</i> Stokes. (Rosaceae)	Aaru	T	L	General health care - Headache	Hu	Po	6	0.06	6	6	0.06	
<i>Psidium guajava</i> L. (Myricaceae)	Amrood	T	L	General health care - Mouth blisters (astringent)	Hu	In	12	0.12	12	12	0.12	
<i>Punica granatum</i> L. (Punicaceae)	Darim	T	Fr	Respiratory - Cough & cold Hepatic health cure - Anaemia Other- Source of vitamin 'C'	Hu	In	59	0.59	49	71	0.71	
						De			10			
						De, In			12			
<i>Ranunculus repens</i> L. (Ranunculaceae)	Aingadua	H	Rt	Dermatological - Boils Gastrointestinal - Intestinal pains (<i>NasPalatana</i>)	Hu	Po	21	0.21	21	27	0.27	
						In			6			
<i>Rephanus sativus</i> L. (Brassicaceae)	Mooli	H	WP	Hepatic health cure - Jaundice	Hu	Co	87	0.87	87	87	0.87	

<i>Rheum emodi</i> Wall. (Polygonaceae)	Dolu	H	Rt	General health care - Fever Dermatological - Wounds	Hu	De Po	31	0.31	15	42	0.42
<i>Rhododendron arboreum</i> Smth (Ericaceae)	Burans	T	F	Hepatic health cure - Liver complaints, Tonic	Hu	De	47	0.47	64	64	0.64
<i>Rosa moschata</i> Hermm. (Rosaceae)	Kunja	S	L, F	Dermatological - Cuts & wounds, boils, Ophthalmic - Eye diseases	Hu	Po Ste	9	0.09	27	32	0.32
<i>Rubia cordifolia</i> L. (Rubiaceae)	Manjistha	H	Rt	General health care - Fever	Hu	De	27	0.27	23	23	0.23
<i>Rubus ellipticus</i> Smith. (Rosaceae)	Hisalu	S	Rt	General health care - Fever Gastrointestinal - Stomach ache	Hu	De De	9	0.09	9	18	0.18
<i>Saussurea costus</i> (Falc.) Lipsch. (Asteraceae)	Kut/Kuth	H	Rt	General health care - Fever Respiratory - Cough Gastrointestinal - Stomach ache, Dysentery	Hu	Pw Pw De	28	0.28	27	64	0.64
<i>Setaria italic</i> L. (Poaceae)	Kouni	H	Sd	Dermatological - Measles & Chicken pox	Hu	Co	91	0.91	91	91	0.91
<i>Silene vulgaris</i> (Moench)Garcke (Caryophyllaceae)	Pyankura	H	WP	General health care - Fever Gastrointestinal - Removal of ascaris (antiparasitic) locally known as <i>juga</i>	Hu	De De	15	0.15	4	17	0.17
Botanical Name & Family	Local Name	Habit	Part Used	Popular Ailment Uses (Group & Categories)	Used in	Preparation	FC^a	RFC^b	UR^c	UR^d	CI^e
<i>Swertia angustifolia</i> Buch. - Ham. ex D.Don. (Gentianaceae)	Chiraita	H	WP	General health care - Fever Dermatological - Skin ailments	Hu	In In	37	0.37	19	24	0.24
<i>Taraxacum officinale</i> Weber. (Asteraceae)	Dudhil	H	L,Rt	Antidote - Snake bite Other-To increase lactation in mulching animals	Hu	In, Po C Inf	50	0.5	13	39	0.39
<i>Tegetus erecta</i> L. (Asteraceae)	Hazari	H	L	General health care - Fever, ear infection Dermatological - wounds	Hu	Po Po	51	0.51	46	61	0.61
<i>Terminalia chebula</i> (Gaertner) Retz. (Combretaceae)	Harar	T	Fr	Gastrointestinal - Purgative & laxative, Carminative, Constipation,	Hu	Pw, Po	12	0.12	64	64	0.64

digestive
problems,
Diarrhoea

<i>Thalictrum foliosum</i> DC. (Ranunculaceae)	Uppankathi/ Mamira	H	WP	Ophthalmic - Eye infection (White dot-cataract) Other - Insect repellent	Hu	Inf	4	0.04	9	21	0.21
<i>Thymus serpyllum</i> L. (Lamiaceae)	Van-ajwayan	H	WP	Skeleton & muscles - Joint pain Respiratory - Asthma Gastrointestinal - Digestive & stomach problems Other - Spices & condiments	Hu	Em	18	0.18	3	14	0.14
<i>Trifolium repens</i> L. (Fabaceae)	Chalmoda	H	L	General health care - Headache Dermatological - Skin disease of dogs (Luta)	Hu	Po	44	0.44	18	22	0.22
<i>Trigonella foemun-graecum</i> L. (Fabaceae)	Maithi	H	L,Sd	Circulatory - Diabetes Gastrointestinal - Carminative, Obesity, Indigestion, Constipation Skeleton & muscles - Joint pain	Hu	Inf	31	0.31	11	61	0.61
<i>Urtica dioica</i> L. (Urticaceae)	Shishun/Kandali/Bichhu ghas	S	L	Skeleton & muscles - Joint pain Hepatic health cure -Warm and nutritive effect	Hu	Da	37	0.37	31	52	0.52
<i>Verbascum thapsus</i> L. (Scrophulariaceae)	Akalveer	H	WP	Dermatological - Boils Other - To increase lactation in milching animals	Hu	Po	63	0.63	17	42	0.42
<i>Viola betonicifolia</i> J.E. Smith (Violaceae)	Garurjadi/ garurabuti	H	WP	Antidote - Snake bite	Hu	Po	12	0.12	13	13	0.13
<i>Viola canescens</i> Wall. Ex Roxb (Violaceae)	Gulovansh	H	WP	Other - To increase lactation in milching animals	C	Da	29	0.29	29	29	0.29
Botanical Name & Family	Local Name	Habit	Part Used	Popular Ailment Uses (Group & Categories)	Used in	Preparation	FC^a	RFC^b	UR^c	UR^d	CI^e
<i>Vigna mungo</i> L. (Fabaceae)	Mass, Urad	H	Sd	Skeleton & muscles -	Hu	In	61	0.61	61	61	0.61

				Fracture									
<i>Zanthoxylum armatum</i> DC	Timoor/	S	Sd	General health care	-	Hu	In	61	0.61	21	77	0.77	
(Rutaceae)	Timuru			Toothache									
				Respiratory Cough & cold	-		In			19			
				Gastrointestinal			In			6			
				- Carminative, Other - Spices & condiments			In			31			
<i>Zingiber officinale</i> Rosc.	Adrak	H	Rh	Respiratory Cough & cold	-	Hu	Em	89	0.89	89	89	0.89	
(Zingiberaceae)													

^aUse Citation of Taxa (The no. of informants that referred the taxon); ^bRFC= FC/N, Where N is the total no. of informants; ^cUse-reports taxon by ailment category; ^dUse-reports of the taxon; ^eCI= UR/N_i, where N_i is the total no. of reported taxa;

Aerial tuber(Atu); Bulb (B); Cattle (C); Climber (Cl); Cooking (Co); Decoction (De); Direct application (Da); Emulsion (Em); Flower (F); Fruit Herb (H); Insect (I); Infusion (Inf); Ingestion (In); Hour (hr); Human (Hu); Leaves (L); Latex (Lt); Ointment (O); Poultice (Po); Powder (Pw); Rhizome (Rh); Root (Rt); Shrub (S); Seed (Sd); Steam (Ste); Tree (T); Whole Plant (WP).

Table 2. Bio-processing of Medicinal Plants of District Bageshwar.

Scientific Name	Mode of administration
<i>Aconitum heterophyllum</i> Wall.	Dry root powder (1TS) taken orally with boiled water twice a day for 2-3 days against fever; 1-2 roots chewed to control vomiting.
<i>Acorus calamus</i> L.	Root powder mixed with grains used as insect repellent, 3-4 dry roots heated with mustard oil applied on the sprain and inflammatory region.
<i>Ajuga bracteosa</i> Wall. ex Benth.	Juice of whole plant (10-20 ml) taken twice a day for 2-3 days.
<i>Ajuga reptans</i> L.	Decoction prepared from 100g fresh or dried roots with water given 3-5TS orally in fever, stomach ache and constipation for 5 days; this decoction taken orally in empty stomach regularly for stone; 1-2 leaves chewed on empty stomach for gastric problem; decoction of whole plant (5-8) crushed with red chilli (3) and 100g Jiggery (<i>Gur</i>) given twice a day for 2-3 days to treat throat infection in domestic animals.
<i>Allium sativum</i> L.	Paste prepared from 5-7 Spilled bulb heated with 20 ml mustered oil, massage on joints
<i>Angelica glauca</i> Edgew.	Root powder (50g) mixed with 100ml water used to control vomiting & stomach ache; rhizomes are used as spices & condiments and tea (as flavour).
<i>Artemisia martima</i> L.	Juice (5-10ml) of fresh leaf applied on the affected area.
<i>Asparagus racemosus</i> Willd.	Root decoction (100 gm) prepared in water given to cure stomach ache (5 ml for adult, 1TS for children) for 3-5 days, one palm full root powder taken with water as stimulant and tonic.
<i>Berberis asiatica</i> Roxb. ex DC	Root powder (100-150g) taken with warm water given twice a day for 3 days against fever; fresh or dried roots soaked in water overnight, filtered and taken orally to cure diabetes in empty stomach.
<i>Bergenia ciliata</i> (Haw) Sternb.	Fresh or dried roots (50-100g) soaked overnight and filtered, taken orally in morning for kidney stone. Root powder (50g) taken with water twice a day for urinary infection.
<i>Cannabis sativa</i> L.	Grinded seeds cooked with some local vegetables (e.g. <i>Colacasia esculanta</i> , <i>Brassica oleracea</i>) for warm effect; broiled seeds are grinded with salt and green chilli to prepare salt (<i>Pahadi namak</i>), Broiled seeds grinded with <i>Punica garnatum</i> mixed with green leaves of coriandum, green chilli, salt and sugar to prepare <i>Chatni</i> ; Fresh leaves crushed with 3-5 seeds of black pepper and applied on insect bite.
<i>Centella asiatica</i> L.	Fresh leaf paste is applied on forehead.
<i>Citrus aurantifolia</i> (Christm) Sw.	Juice extracted from fruit mixed with 1TS honey and 50 ml water taken orally in empty stomach for constipation and weight loss; lemon tea used in Fever & Cold.
<i>Citrus hystrix</i> DC.	Fruit juice given orally (1TS) to children for removal of ascaris; cough & cold 10 ml thrice a day; fruit juice with mentha leaves (100g) and coriander seeds made into paste given to domestic animals against poison.
<i>Coriandrum sativum</i> L.	Seed (80-100g) paste mixed with 1-2 ltr. processed curd (<i>Mattha</i>) is given to domestic animals against poison for 2-3 days.
<i>Curcuma longa</i> L.	Haldi powder (5g) mixed with a full glass of warm milk for internal injury; paste of rhizome applied on cuts and wounds.
<i>Cynoglossum zeylanicum</i> Thunb. Ex Lehm.	Fresh or dried root paste applied on the affected parts
<i>Dactylorhiza hatagirea</i> (D.Don)Soo.	Decoction of 100 gm root with water taken orally (10-15ml) twice a day for excessive bleeding; root paste applied on wounds
<i>Dioscorea bulbifera</i> L.	Broiled fruit and cooked vegetable.
<i>Drymaria cordata</i> (L.).	Juice of aerial parts (2-4 drops) taken orally for 2-3 days.
<i>Duchesnea indica</i> (Andrews) Focke	Leaf paste is regularly applied on affected part.
Scientific Name	Mode of administration
<i>Emblica officinalis</i> Gaertn.	Fresh fruits are chewed regularly to control diabetes; dried fruits (3-5) boiled with water, filtered and taken orally against cough, stomach ache; fresh and processed fruits are source of Vitamin 'C'.
<i>Eupatorium</i>	Leaf paste prepared from 100g fresh leaf twigs applied on affected parts for early healing..

<i>adenophorum</i> Spreng.	
<i>Euphorbia</i> sp.	Whole plant (50-100) mixed with FYM.
<i>Ficus palmata</i> Forsk.	Milky latex applied on cuts & wounds.
<i>Ficus roxburghii</i> Wall.	Fresh fruits are cooked as vegetable.
<i>Glycine max</i> (L.) Merri	<i>Bhatt ka Jaula</i> (an indigenous dish) is prepared from paste of seeds (soaked overnight) & cooked with rice in an iron vessel " <i>Kadahi</i> ".
<i>Hedychium spicatum</i> Buch. Ham. ex Smith.	Dried rhizome powder (2-3g) taken with hot water once a day; paste of fresh rhizome used as anti-lice
<i>Hordium vulgare</i> L.	<i>Sattu</i> prepared from 200g broiled seeds mixed with 100g jaggery (<i>Gur</i>) and 100g <i>Ghee</i> for warm and nutritive effect; 50g broiled seeds heated with 40ml mustard oil applied on burns.
<i>Leucas lanata</i> Benth	Leaf juice with 3-5 drops of breast milk taken orally twice a day for one week.
<i>Mentha arvensis</i> L.	Leaves (100g) boiled with water and filter, the filtrate (50ml) given orally twice a day.
<i>Micromeria biflora</i> Benth.	Juice of whole plant with water (1-2 times in a day).
<i>Macrotyloma uniflorum</i> (Lam) Verdc.	<i>Gahat ka Ras</i> (an indigenous dish) prepared by 150g seeds cooked with water (1 ltr.) until the volume reduced (100ml) and taken regularly.
<i>Momordica charanti</i> L.	Vegetable and juice (50ml) of fresh fruit taken regularly.
<i>Ocimum basilicum</i> L.	Decoction of 100g leaves and seeds, zinger (50g), 5 seeds black paper with 150 ml water taken orally 2-3 times a day for fever, cough & cold; aerial part used to make herbal tea.
<i>Origanum vulgare</i> L.	Decoction of 1 00g fresh & dried leaves with water taken orally (10ml) for a week in cough, cold & fever; root paste applied on wounds.
<i>Picrorhiza kurrooa</i> Royle.	Decoction of 50g root with water taken orally against fever and abdominal pain for 5-7 days.
<i>Plantago ovate</i> Forsk.	Seeds (10g) soaked overnight or consumed directly with water twice a day for 30 days against constipation and digestive problems; Isabgoal (15g) mixed with 10TS fresh curd taken after meal for diarrhoea.
<i>Plantago lanceolata</i> L.	Paste of roots (100g) given to domestic animals.
<i>Podophyllum hexandrum</i> Royle	Root paste applied on wound.
<i>Polygonatum cirrhifolium</i> (Wall.) Royle	Small pieces of tuber (8-10) soaked in water for overnight, taken in empty stomach for weakness and develop immunity; cooked green leaves eaten as blood purifier; root paste applied on cuts and wounds.
<i>Polygonatum verticillatum</i> L. All	Root powder (50g) is taken with warm water in gastric complaints; fresh root paste applied for wound healing.
<i>Prunus persica</i> Stokes.	Fresh leaf paste applied on head for 2-3 hr.
<i>Psidium guajava</i> L.	Fresh leaves are chewed.
<i>Punica granatum</i> L.	Powder (50g) of dried fruit peel taken orally with warm water for old cough; Fruit juice (50ml) given twice a day to anaemic patient.
<i>Ranunculus repens</i> L.	Root paste (50g) applied for boils and 30-50ml filtered root extract (juice) is given twice a day against intestinal pain.
<i>Rephanus sativus</i> L.	Vegetable prepared from fresh leaves and root as salad.
<i>Rheum emodi</i> Wall.	Decoction of 100g root with warm water taken orally (10ml) for fever twice a day; root paste applied on wounds.
<i>Rhododendron arboreum</i> Smth	Juice extracted from fresh flowers
Scientific Name	Mode of administration
<i>Rosa moschata</i> Hermm.	Fresh leaf paste is applied on cuts, wounds and boils; water extracted from fresh flowers used in eye diseases.

<i>Rubia cordifolia</i> L.	Root decoction with water given orally (1-2TS) against fever twice a day to children (5 months-10years)
<i>Rubus ellipticus</i> Smith.	Decoction (10ml) of 100g roots with water taken orally against fever and stomach ache for 5 days.
<i>Saussurea costus</i> (Falc.) Lipsch	Decoction of root (50g) with water given against dysentery for 3-5 days twice a day; root powder (50g) taken orally with boiled water in fever, cough and stomach ache.
<i>Setaria italic</i> L.	<i>Koni ka Jaula</i> (an indigenous dish) prepared from seeds cooked with water.
<i>Silene vulgaris</i> (Moench)Garcke	Root decoction (10ml) with warm water given against fever for 3 days; 1TS is used for removal of ascaris (<i>Juga</i>);leaves are used as a vegetable.
<i>Swertia spp</i>	Juice of fresh leaves (100g) given with boiled water 3TS for 3-5 days for fever; <i>Panchang</i> (whole plant) is used after soaking overnight and taken (50-100ml) orally in empty stomach for 15 days.
<i>Taraxacum officinale</i> Weber.	For snake bite: juice of whole plant with water taken orally (1-2TS) thrice a day & applied on injured part for one week; mixture of 100g roots with 9 seeds of black pepper, 1-2 ltr. processed curd (<i>Mattha</i>) and 250g paste of black soybean given to increase lactation in milching animals
<i>Tegetus erecta</i> L.	Fresh leaf juice with water taken against fever(3-5 TS twice a day); leaf extract (2-3 drops) in ear infection; fresh leaf paste is applied for healing cuts & wounds.
<i>Terminalia chebula</i> (Gaertner) Retz.	Dried fruit powder (100g) given orally with boiled water twice a day for 3-5 days in stomach ache; dried fruit crushed with water and given (1-2 ml) orally to children (3 months to 5 years) and small amount applied around the navel.
<i>Thalictrum foliosum</i> DC.	Fresh roots (50g) soaked in rose water (100ml) for overnight, filtered and used as eye drop.
<i>Thymus serpyllum</i> L.	Paste of whole plant mixed with mustered oil gently applied on joints; whole plants juice (10ml) mixed with honey (20g) is taken orally for cough and asthma; broiled seeds (10-15g) with warm water taken for digestive and stomach problems; leaves and seeds are used as spices & condiment.
<i>Trifolium repens</i> L.	Leaf paste (5g) with water.
<i>Trigonella foemun-graecum</i> L.	Leaf juice is taken orally for curing obesity, indigestion, joints pain and constipation; 25g seeds are soaked overnight filter, the filtrate taken orally in empty stomach for gastric problems and diabetes.
<i>Urtica dioica</i> L.	Branches with leaves are gently rubbed on joints and muscles; Fresh leaf twigs taken as vegetable; fine powder of dry leaf (5-10 g) dissolve in 50 ml water is taken orally in joints & muscular pain
<i>Verbascum thapsus</i> L.	Fresh leaf paste applied on affected part for boils; 8-10 whole plants mixed with grass given mulching animals
<i>Viola betonicifolia</i> J.E. Smith (Violaceae)	Paste of whole plant (fresh or semidry) applied on affected part for 1-2 weeks.
<i>Viola canescens</i> Wall. Ex Roxb	Fresh plants (30-50) given with grass for one to two weeks.
<i>Vigna mungo</i> L.	Paste prepared by grinding of 150g seeds with water applied on the fractured part.
<i>Zanthoxylum armatum</i> DC	Seeds (100g) boiled with water taken orally twice a day; seed bark used as a spices.
<i>Zingiber officinale</i> Rosc.	A piece (5-10g) of broiled rhizome mixed with small amount of honey and chewed.

Farm Yard Manure (FYM); Tablespoon (TS);

Table 3. Ethnomedicinal taxa with more use-reports.

Taxa	UR ^a	FC ^b	CI ^c	NDAS	Ailments Categories (Decreasing order)
<i>Ocimum basilicum</i> L.	97	88	0.97	5	Respiratory, general health care and others
<i>Cannabis sativa</i> L.	94	63	0.94	6	Gastrointestinal, others and antidote
<i>Citrus aurantifolia</i> (Christm) Sw.	94	38	0.94	6	Others, gastrointestinal, general health care and respiratory
<i>Curcuma longa</i> L.	91	78	0.91	5	General health care, dermatological and respiratory
<i>Setaria italica</i> L.	91	91	0.91	2	Dermatological
<i>Angelica glauca</i> Edgew.	89	44	0.89	4	Others and gastrointestinal
<i>Zingiber officinale</i> Rosc.	89	89	0.89	2	Respiratory
<i>Ajuga reptans</i> L.	87	56	0.87	5	General health care, gastrointestinal and urinogenital disorder
<i>Rephanus sativus</i> L.	87	87	0.87	1	Hepatic health cure
<i>Embllica officinalis</i> Gaertn.	85	35	0.85	6	Gastrointestinal, others, circulatory and respiratory
<i>Glycine max</i> (L.) Merri	84	84	0.84	1	Hepatic health cure
<i>Plantago ovate</i> Forsk.	83	74	0.83	3	Gastrointestinal
<i>Eupatorium adenophorum</i> Spreng.	80	80	0.80	2	Dermatological
<i>Leucas lanata</i> Benth	80	80	0.80	1	Respiratory
<i>Picrorhiza kurrooa</i> Royle.	80	53	0.80	2	General health care and gastrointestinal
<i>Artemisia martima</i> L.	77	55	0.77	3	Dermatological
<i>Zanthoxylum armatum</i> DC	77	61	0.77	5	Others, general health care, respiratory and gastrointestinal
<i>Acorus calamus</i> L.	74	55	0.74	3	Others and skeleton & muscles
<i>Ajuga bracteosa</i> Wall. ex Bent.	72	55	0.72	3	General health care, gastrointestinal and urinogenital disorder
<i>Origanum vulgare</i> L.	71	31	0.71	5	Dermatological, respiratory, General health care and others
<i>Punica granatum</i> L.	71	59	0.71	4	Respiratory, others and hepatic health cure

^aTotal no. of Use-reports of the taxon; ^bUse Citation of Taxa (The no. of informants that referred the taxon; ^cCI= UR/N_t, where N_t is the total no. of reported taxa; No. of different ailment subcategories (NDAS).

Table 4. Informant consensus factor (F_{ic}) and medicinal importance (MI) of Ethno-medicinal plants.

Ailments Category	No. of Taxa (N _t) ^a	Frequency (%) ^b	No. of Use -reports (N _{ur})	Informant consensus factor (F_{ic}) ^c	Medicinal Importance (MI) ^d
Gastrointestinal	23	32.86	695	0.97	30.22
General health cure	22	31.43	524	0.96	23.82
Dermatological	21	30.00	617	0.97	29.38
Respiratory	15	21.43	402	0.97	26.80
Hepatic health cure	8	11.43	364	0.98	45.50
Circulatory	7	10.00	126	0.95	18.00
Skeleton & muscles	6	8.57	178	0.97	29.67
Antidote	5	7.14	83	0.95	16.60
Urinogenital	4	5.71	137	0.98	34.25
Ophthalmic	2	2.86	14	0.92	7.00
Immuno-regulatory	1	1.43	15	1.00	15.00
Other	15	21.43	377	0.96	25.13

^aNo. of species listed in several of the categories of medicinal usage; ^bPercentage of records on the total of 70 records; ^c $F_{ic} = (N_{ur} - N_t) / (N_{ur} - 1)$; ^dMI = N_{ur} / N_t

Figures

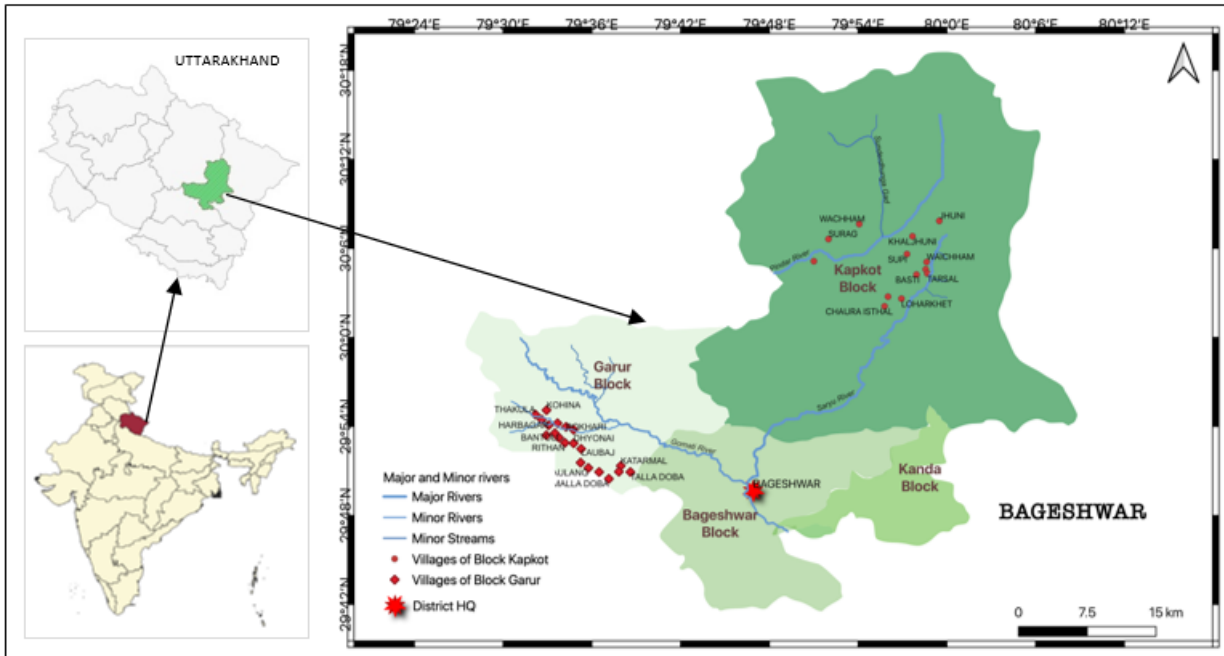


Figure 1

Study villages of the Garur and Kapkot Bolck of District Bageshwar

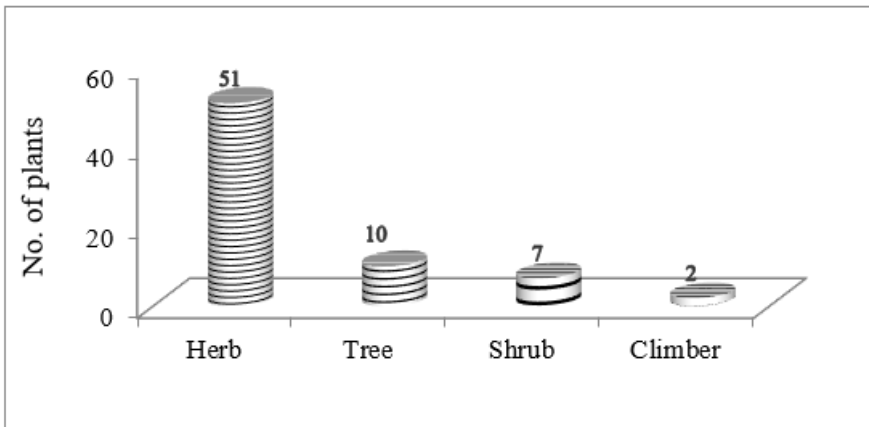


Figure 2

Distribution of medicinal plants in different life form

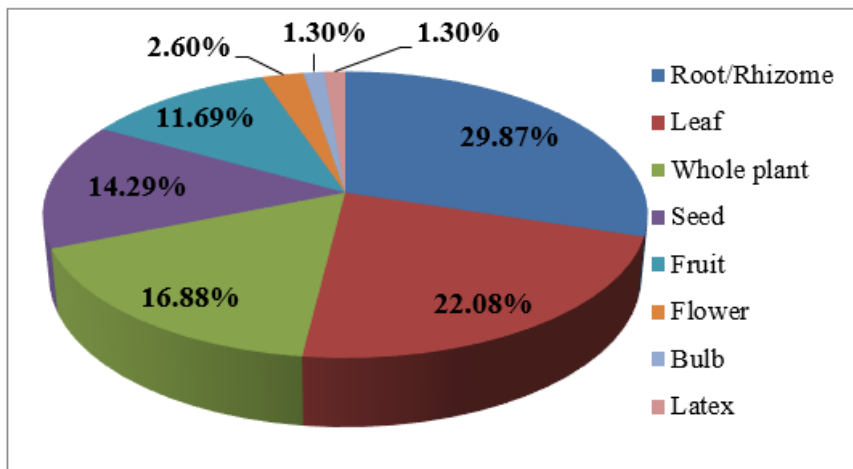


Figure 3

Plant part used in preparation of medicine

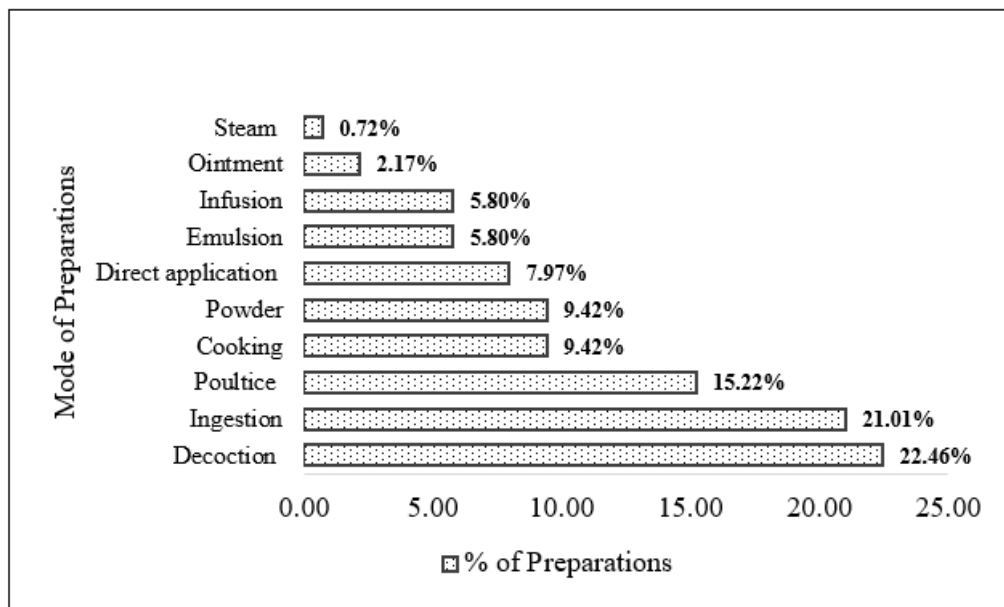


Figure 4

Processing of plant parts in preparation of medicine

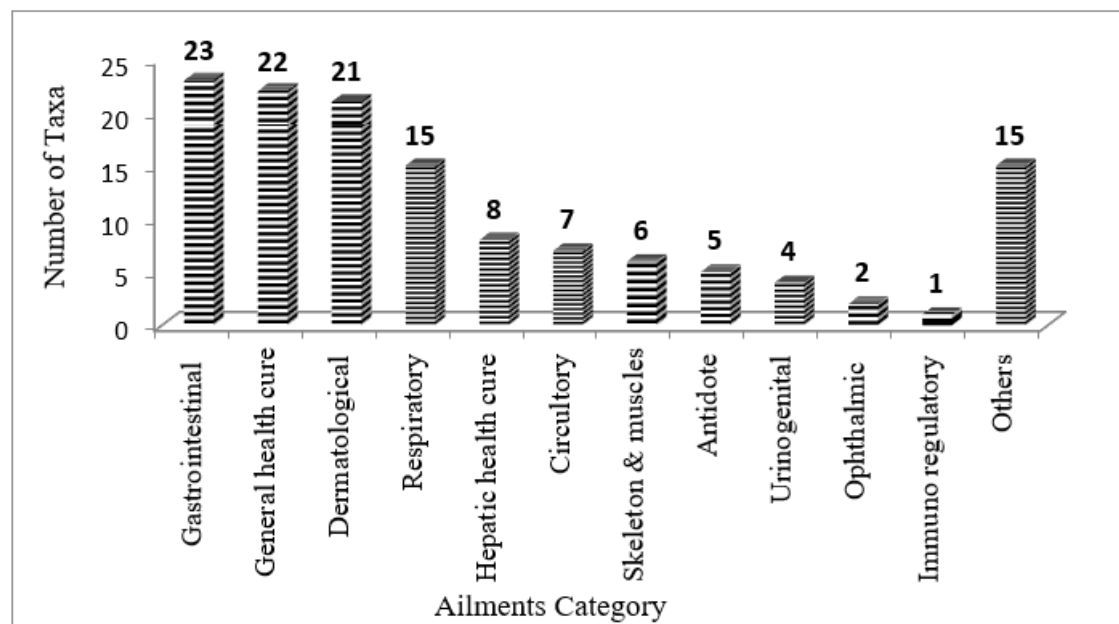


Figure 5

Distribution of medicinal plants in different ailments category

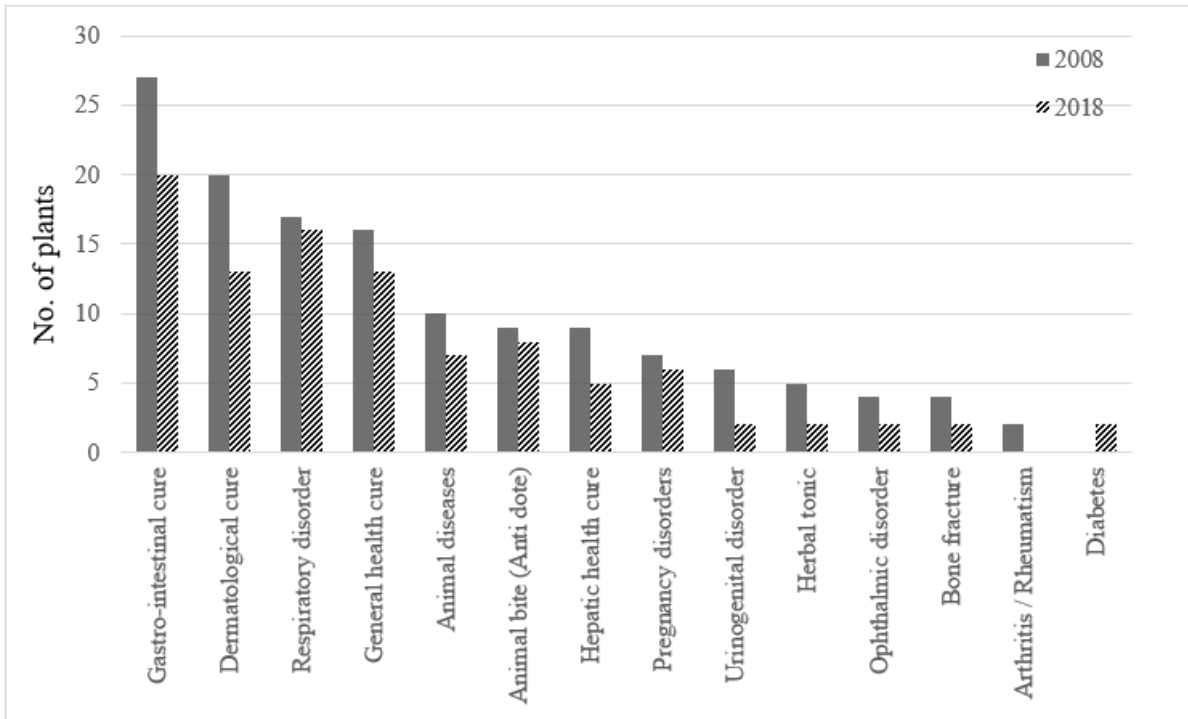


Figure 6

Past and present scenario of traditional healthcare system

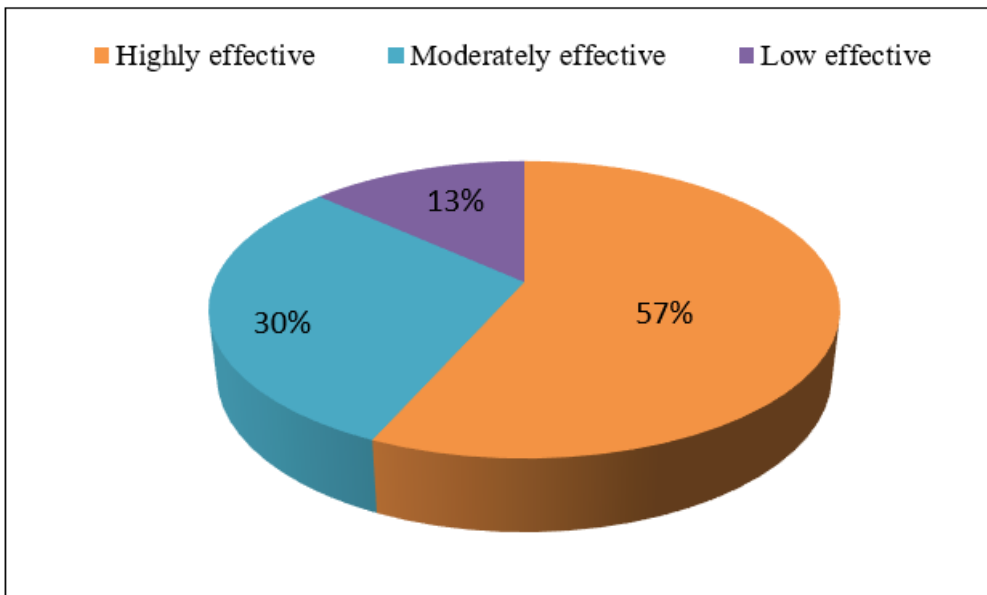


Figure 7

Effectiveness of traditional healthcare system