Medicinal plants used against gastrointestinal complaints in district Budgam of Jammu and Kashmir - An ethnomedicinal study

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Research

Abstract

Background: The current study was the first to target on gastrointestinal illnesses and associated traditional recipes in Jammu and Kashmir's Budgam area. Gastrointestinal disorders affect any part of the gastrointestinal system, from the esophagus to the rectum, as well as the accessory digestive organs. The knowledge about plants used for the treatment gastrointestinal disorders is rapidly depleting in the study area and hence it becomes important to document this valuable knowledge.

Methods: Extensive surveys were conducted in the study area during March 2019 to July 2020 for the collection of medicinally important plants and the traditional knowledge associated with them. In a total 35 informants (22 males, 13 females) were interviewed aged between 29-80 years to collect the data using group discussions and semi-structured interviews. The interviews were carried out in local dialect and all the documented data was then translated into English. Various ethnobotanical indices, including informant consensus factor and use value, were employed to evaluate the gathered information.

Results: A total of 56 plant species belonging to 24 families and 47 genera were reported to be used against gastrointestinal disorders in Budgam region of Jammu and Kashmir. Among 24 families, Asteraceae was the dominant family (12 species) of the total reported taxa in the study area and leaves were the most utilized plant part with decoction as the major mode of herbal recipe preparation. Highest ICF (Informant consensus factor) of 1 was reported for vomiting and *Artemisia absinthium* recorded the highest UV (Use value) of 0.74.

Conclusion: Local inhabitants still prioritize herbal medicines as an effective way to treat a wide variety of ailments. Elders of the study area are well equipped with indigenous knowledge about medicinal plants, but young people are not much interested in herbal practices. Thus, valuable knowledge about the use of plants is on the verge of decline. Hence there is a dire need to document these valuable medicinal plants and the traditional treasure associated with them. In addition, plants reported with high UV should be subjected for further phytochemical and pharmacological investigation to authenticate indigenous uses.

Keywords: Medicinal plants, Ethnomedicine, Traditional knowledge, Gastrointestinal complaints, Budgam, J&K.

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Background

Plants are a significant resource of conventional medicines used against numerous diseases. Rural people who have century's old traditional knowledge transmitted from generation to generation still rely on plant resources for variety of uses such as food, fodder, and medicines. Due to a lack of modern medical facilities, residents in rural areas rely primarily on natural resources (Tali et al. 2019). More than 80% of the world's population relies on traditional medicines for health care, but it is now limited to rural regions due to a shift in people's attitudes toward contemporary health care in urban areas, as well as changing living patterns over time (Hocking 1958; Ibrar et al. 2007; Msomi and Simelane 2019). Modernization in rural cultures has put this centuries-old traditional knowledge in jeopardy. In India, a lot of tribal people from various ethnic origins live and follow their own traditional medical system for basic healthcare. According to reports, 80% of Indians consume non-allopathic (Ayurveda, Siddha, Unani, and Homeopathy) medications for their health, and herbs are a key component of these alternative medical systems (Gogtay et al. 2002). In India, major health hazards include widespread communicable diseases, inadequate sewage infrastructure, and a lack of safe drinking water (Jeelani et al. 2018). Inadequate nutrition and exposure to contaminated water are responsible for the high newborn morbidity and death rates (Woods 1991). Most of the infectious diseases are caused by microorganisms. Antibiotic resistance, on the other hand, is a serious clinical issue when it comes to treating illnesses caused by these bacteria. Dysentery, Stomach pain, Diarrhea, Constipation, Indigestion, Abdominal pain, Intestinal worms, Acidity etc. are some of the major gastrointestinal problems in today's population. Proton pump inhibitors, H2 receptors, cytoprotectants, demulcents, anticholinergics, antacids, and prostaglandin analogues are some of the synthetic medicines used to treat these problems (Acharyya et al. 2009). Besides, these medicines are responsible to treat an ailment in a short span of time, but they have several side effects. A number of secondary ailments take birth by the use or overuse of these medicines including, nausea, dizziness and sometimes the death of the fetus in mother's womb (Ishtiyak and Hussain 2017). Herbal treatments are thought to be more effective therapeutic options. Proton pump inhibitors (omeprazole, lansoprazole), for example, might induce nausea, abdominal pain, constipation, and diarrhea, and H2 receptor antagonists (cimetidine) can cause gynecomastia and libido loss. Due to the numerous adverse effects associated with the use of synthetic medicines for a variety of ailments, medicinal plants are increasingly being regarded as a primary source of novel pharmaceuticals, and significant research is conducted in quest of strong plant-based treatments (Savikin et al. 2013). However, sometimes the higher doses may cause serious implications or even death of the soul. If not taken in proper doses these plants may pose adverse effects on the human body (Holst et al. 2008). That is why, one need to be more sensitive while using the herbal medicinal plants at home. In India and other places, medicinal plants are utilized to treat gastrointestinal problems including diarrhea and dysentery. However, no such study has been conducted in Jammu & Kashmir's Budgam region. The current study was the first to target on gastrointestinal illnesses and associated traditional recipes in Jammu and Kashmir's Budgam area. In addition, the medicinal plants and the associated knowledge is degrading and is on the verge of extinction, so our study also attempts to conserve this degrading flora and the associated knowledge.

In this study we sought to discover answers to the following questions concerning medicinal plants used to treat gastrointestinal complaints: (i) Which species are utilized locally in the treatment of gastrointestinal disorders? (ii) Which sort of gastrointestinal disorder does a certain herb treat? (iii) Which part of the plant is used for medicinal purposes? (iv) What is the mode of administration of the drug? Furthermore, the data was analyzed by using various ethnobotanical indices to determine the more useful plants of the area which can be subjected to further pharmacological and phytochemical analysis.

Material and methods

Study area

Current study was carried out in district Budgam of Jammu and Kashmir (Fig. 1). It is located in the Northwestern section of the greater Himalaya, between 34°40' and 34°80' north latitude and 74°24' to 74°56' east longitude (Fig. 1). Bounded by dense forests, it is situated about 25 Kms from capital city Srinagar in the mountains of the Himalayan range. It covers 1,370 km^2 and accounts for 1.35 percent of Jammu and Kashmir's overall land area. The average elevation in the district is 1610 meters above sea level. Sky-touching deodars fence this area presenting a view of a green carpet in summer. During the summer, the camps of the Gujjar community and shepherds with their grazing sheep present a riveting picture. Also, the fragrance of wildflowers refreshes the whole environment. During the winters the study area faces severe cold and a pleasant weather during summers. The temperature ranges between -4° C minimum in winter and up to 32° C maximum in summers (Ahmad and Qayoom 2019).

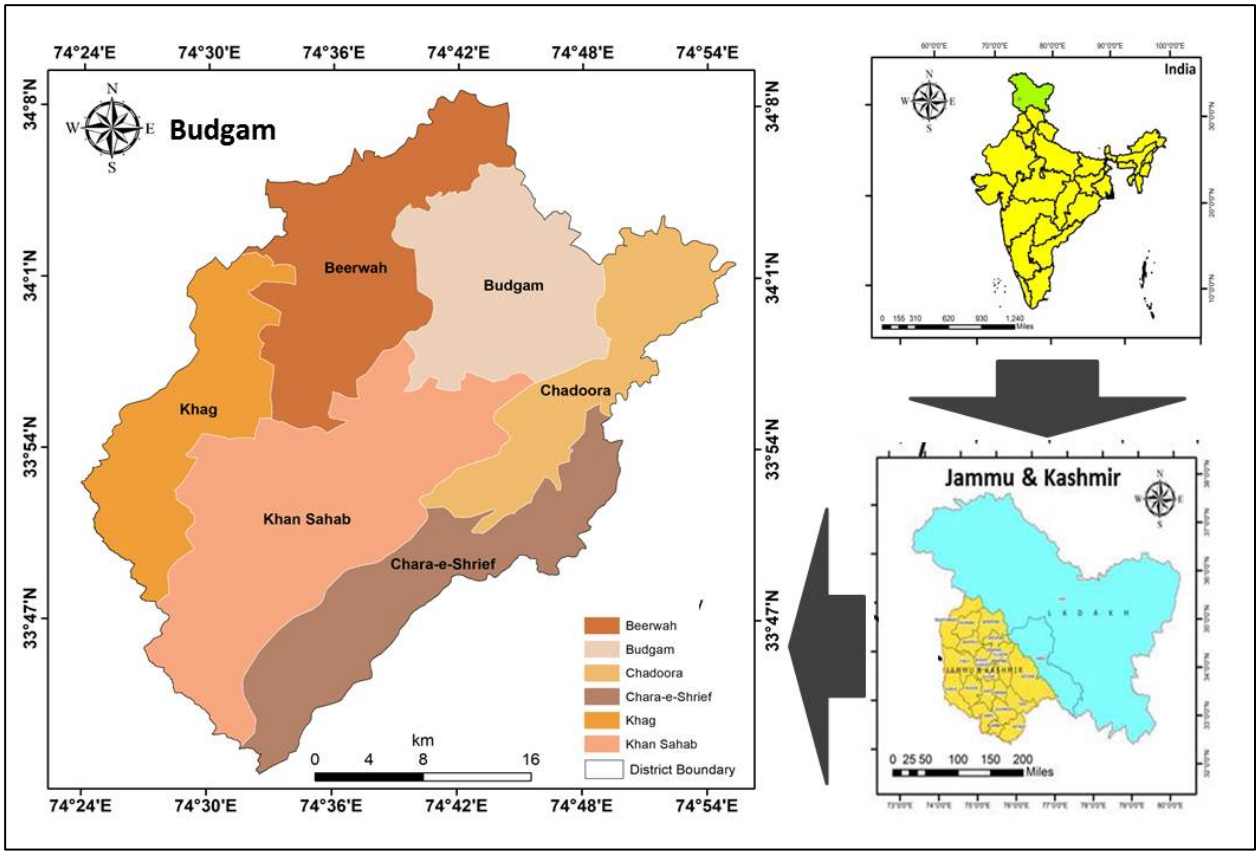

Figure 1. Map highlighting the study area, District Budgam, Jammu and Kashmir.

A total of 32 visits with each visit of 2 days was made to the study area to collect the plants and information from total 14 sites (Arizal, Chak Hokalatri, Faja Pora, Machi Pora, Badran, Khahi Pora, Larik Pora, Ramdar Chakpora, Peth Saharan, Kanchati Pora, Brenpathri, Gund Shamus, Bupat, and Dragar) richly populated with ethnic communities, where these people are solely dependent on medicinal plants to cure a variety of diseases. Plants were collected with the help of local guides who were aware about the region. Plants with mature leaves, stem, roots and flowers were selected for collection. Agriculture (animal husbandry and crop production) is the main source of livelihood for these people in the region.

Sample size determination

A probabilistic approach was employed considering simple and stratified random sampling methods (Levy and Lemeshow 2008). Given the demographic details (Table 1) of the families studied, we were able to determine the sample size using a simple random sampling method.

Data collection tools

The use of plant-based medicine to cure various diseases is a widely accepted system by the local communities of district Budgam upper reaches. Extensive surveys were conducted in the study area from March 2019 to July 2020 for the collection of medicinally important plants and the traditional knowledge associated with them. Before the commencement of the study, village heads were visited. Informants were interviewed through different types of interview methods including semi-structured interviews and group discussions by using standard questionnaire (Martin 1995). Brief group discussions were held with the informants prior to the interview to explain the objective of the study and a formal consent was taken from all the informants. The interviews were carried out in local dialect and all the documented data was then translated into English language. Guided field walk was also performed to the forest area, which allowed us to collect best possible information about the identification and utilization of important medicinal plant species. The information collected included local name of the plant, life form, part used, ethnomedicinal use, method of preparation and administration. During the interviews, a total of 4 informants refused to take part in the study citing the issues of personal data sharing. In place of these four, we selected another exact sum.

Table 1. Demographic status of informants.

Variable	Total	Percentage
Gender		
Male	22	63
Female	13	37
Age groups		
29-40	4	11
41-50	6	17
51-60	5	17
61-70	8	23
71-80	12	34
Educational qualification		
Illiterate	22	63
Primary	5	14
Secondary	4	11
Above secondary	4	11
Occupation		
Males		
Shopkeepers	6	17
Farmers	13	37
Job holders	3	9
Females		
Housewives	11	31
Job holders	2	6
Religion		
Muslim	35	100

Piloting, Validity and Reliability of data collection tools

A four-day reconnaissance tour was performed to obtain a basic idea of the study's possible respondent. Following the initial visit, a week was spent preparing interviews and questionnaires for the survey, followed by another week of teaching research assistants on how to use the instruments successfully. Whenever necessary, the services of a translator were used. The results of the pilot were used to improve efficiency of the data collection tools for the main survey.

A questionnaire was created and sent to ethnobotany experts for cross-checking and analyzing the content's dependence to examine the validity of the data collection tools. The split half approach was used to test the reliability of data collection tools during the pilot, and the Cronbach alpha coefficient was calculated (Taber 2018). The tools were distributed to 24 family heads, divided into two groups. The reliability of items was determined by estimating the variability of responses between the two groups.

Preservation and identification of collected plants

The medicinal plant species reported by informants were collected during field trips guided by local people. The specimens were dried, pressed and mounted on herbarium sheets and good quality voucher specimens were made according to standard techniques (Jain and Rao 1997). For identification, plant specimens and usable pieces were also collected. Flora of Jammu and Kashmir (Singh et al. 2002), Flowers of the Himalayas (Polunin and Stainton 1984), and Flora of the Pir Panjal range of the north-west Himalaya were used to identify the plant species (Singh and Kachroo 1994). Additional identification was carried out by matching voucher specimens with previously identified specimens deposited in KASH Herbarium of Department of Botany, University of Kashmir, Srinagar. Herbarium specimens and plant parts collected during this study have been deposited in thementioned herbarium for future references. The botanical names of the plant species were updated according to the Plant List (www.theplantlist.org). A comparative assessment through literature review on the subject was made to ascertain new findings of ethomedicinally important plants.

Determination of informant consensus factor and use value

The informant consensus factor was used to determine whether the informants agreed on which plant species to use for each ailment category. The informant consensus factor shows which plants are often used, which may help with plant selection for potential phytochemical and pharmacological research (Giday et al. 2007). To check the informant consensus factor in this study, all the diseases were grouped into different ailment categories. The ICF value varies from 0 to 1. A high value (1.0 or close to 1) indicates that a large proportion of the informants use a relatively small number of plant species. The low value, on the other hand, indicates that the informants disagree about the usage of plant species within a specific ailment group. ICF was calculated using the following formula (Heinrich et al. 1998).

$$ICF = \frac{Nur - Nt}{Nur - 1}$$

Where *Nur* denotes the total number of usage reports for a given ailment category and *Nt* is the total number of species used by all informants for that particular ailment type.

The use value index is used to calculate the relative value of each medicinal plant species used by the local population. In the current study use value was calculated using the following formula:

$$UV = \frac{Ui}{N}$$

Where *Ui* is the total number of use reports by each informant and *N* shows the total number of informants taking part in the study (Phillips and Gentry 1993). Use value is high when there are many use reports for a given medicinal plant species and use value is low when there are very few reports associated with its use.

Data analysis

Data were entered into Microsoft word version 2010 and thereafter transferred to Microsoft excel version 2010 for further analysis. Descriptive statistics (simple percentages, tables and figures) were employed in the excel 2010. The data was then summarized using different graphical methods (bar and pie charts).

Results and Discussions

Demographic details of informants

To explore the traditional knowledge regarding the ethnomedicinal uses of plant species in the area, a total of 35 informants (22 men, 13 women) were interviewed aged between 29-80 years (Table 1). Among these, male informants (22 informants) were found to have more experience in terms of knowledge sharing than female informants (13 informants). Most of the selected informants were illiterate, and a small number were having education up to higher secondary level and few were job holders. All the selected informants were of one religion (Muslims), as it is the most practiced religion of the area. Gujri, Pahari, and Kashmiri are the three main languages of communication. The informants were selected based on their traditional knowledge about the use of plants for treating various diseases. To ensure the validity of traditional knowledge, continuous relationship was maintained with the local population throughout the survey course.

The informants above the age of 50 were found to be more informed. Other writers confirmed similar findings (Ayantunde et al. 2008; Ahmad and Pieroni 2016; Jan et al. 2017). Most of the people reported also share experiences of other people about the use of medicinal plants. The dissemination of traditional knowledge, on the other hand, was found to be jeopardized since the younger generation had less interest in studying and consequently knew less about medicinal plants. Other researchers reported similar findings (Mehdioui and Kahouadji 2007; Ayantunde et al. 2008).

Diversity of ethnomedicinal flora

During the present study a total of 56 medicinally important plant species belonging to 24 families and 47 genera were reported to be used for gastrointestinal disorders in Budgam region of Jammu and Kashmir (Table 2). A total of 8 species, *Allium cepa, Coriandrum sativum, Daucus carota, Foeniculum vulgare, Mentha arvensis, Trigonella foenum-graecum, Ficus carica, Cyndonia oblonga* and *Solanum tuberosum* were belonging to domesticated and cultivated categories and rest were wild species. Medicinal plants are generally harvested from nearby forest areas by the local people. However, to collect high altitude species people need to travel some 15-20 km by foot. The reported species were represented by 24 families. Among 24 families, Asteraceae was the dominant family (12 species) of the total reported taxa followed by Lamiaceae (8 species), Amaranthaceae and Malvaceae (4 species each) (Fig. 2).

Our results were in line with previous studies where Asteraceae has been reported as the dominant medicinal plant family in various other study regions (Bhatia et al. 2014; Bolson et al. 2015; Ishtiyak and Hussain 2017; Jan et al. 2021a, b). The reason behind the dominance of the family Asteraceae is that members of this family are well known for aromatic quality and are easily available in nature or might be due to its herbaceous life form, extensive distribution, and richness in the study area (Tariq et al. 2018; Shedayi and Bibi 2012). Furthermore, Asteraceae has been reported to contain many bioactive compounds used against different ailments (Leonti et al. 2003; Hamill et al. 2000). Also plants like *Mentha arvensis Daucus carota, Trigonella foenum-graecum, Ficus carica, Cyndonia oblonga, Artemisia absinthium,* and *Acorus calamus* contain a number of phenolic compounds, essential oils and other flavonoids which are useful for the treatment of gastrointestinal disorders and have antioxidant properties (Hussain et al. 2011; Nour et al. 2019; Bahukhandi et al. 2021). Local people believed raw materials collected from dense forests or the areas less accessible by humans had better efficacy.

Table 2. Enumeration of plant species used by local people in district Budgam of Jammu and Kashmir against gastrointestinal disorders.

Family	Botanical name / Voucher number	Vernacular name	Life form	Source	Part used	Preparation	Administration	Disease treated	Total citations	Use value
Amaranthaceae	*Achyranthes aspera* L. 3353-KASH	Phutkunda	Herb	WL	Whole plant	Decoction	Oral	Dysentery	24	0.69
	Amaranthus blitum L. 3360-(KASH)	NA	Herb	WL	Leaf	Cooked	Oral	Stomach pain	21	0.60
	Amaranthus caudatus L. 3361-KASH	Liss	Herb	WL	Leaf	Decoction	Oral	Diarrhea	19	0.54
	Amaranthus spinosus L. 3362-KASH	Liss	Herb	WL	Aerial portion	Cooked	Oral	Constipation	20	0.57
Amaryllidaceae	*Allium cepa* L. 3358-KASH	Gande	Herb	CL	Blub	Raw	Oral	Stomach pain	18	0.51
Apiaceae	*Coriandrum sativum* L. 2975-KASH	Daniwal	Herb	CL	Seed	Decoction	Oral	Indigestion	22	0.63
	Daucus carota L. 3390-KASH	Gazar	Herb	CL	Leaf	Juice	Oral	Dysentery	21	0.60
	Foeniculum vulgare Mill. 3397-KASH	Badiyan	Herb	CL	Whole plant	Juice	Oral	Constipation	23	0.66
Araceae	*Acorus calamus* L. 3365-KASH	Vai	Herb	WL	Rhizome	Infusion	Oral	Abdominal pain	19	0.54
Asteraceae	*Achillea millefolium* L. 2966-KASH	Pahal gass	Herb	WL	Leaf	Infusion	Oral	Dysentery	13	0.37
	Artemisia absinthium L. 2969-KASH	Tethwan	Herb	WL	Leaf	Infusion	Oral	Intestinal worms	26	0.74
	Artemisia annua L. 3368-KASH	NA	Herb	WL	Root	Infusion	Oral	Abdominal pain	17	0.49
	Artemisia moorcroftiana Wall. ex DC 3369-KASH	Jangli-tethwan	Herb	WL	Whole plant	Decoction	Oral	Acidity	12	0.34
	Bidens pilosa L. 3373-KASH	Kumber	Herb	WL	Leaf	Powder	Oral	Stomach pain	12	0.34
	Carpesium abrotanoides L. 3378-KASH	Ban-sario	Herb	WL	Seed	Decoction	Oral	Indigestion	12	0.34
	Cichorium intybus L. 2973-KASH	Kaw-hand	Herb	WL	Whole plant	Decoction	Oral	Diarrhea	15	0.43
	Conyza bonariensis (L.) Cronquist 3385-KASH	Shashedra	Herb	WL	Leaf	Infusion	Oral	Intestinal worms	13	0.37
	Conyza canadensis (L.) Cronquist	Shal-lutt	Herb	WL	Root	Infusion	Oral	Dysentery	14	0.40

	2982-KASH									
	Lactuca saligna L. 3406-KASH	Dodhkandiej	Herb	WL	Whole plant	Decoction	Oral	Diarrhea	19	0.54
	Tagetus erecta L. 3004-KASH	Guttaposh	Herb	WL	Flower	Infusion	Oral	Colic infection	19	0.54
	Xanthium spinosum L. 3461-KASH	Lokut-cxeer	Herb	WL	Root	Decoction	Oral	Abdominal pain	14	0.40
Berberidaceae	*Berberis lycium* Royle 2970-KASH	Kawdach	Shrub	WL	Fruit	Infusion	Oral	Diarrhea	16	0.46
	Podophyllum hexandrum Royle 3429-KASH	Wanwangun	Herb	WL	Root	Decoction	Oral	Laxative	12	0.34
Brassicaceae	*Capsella bursa-pastoris* (L.) Medik 2971-KASH	Kralmond	Herb	WL	Whole plant	Decoction	Oral	Vomiting	15	0.43
	Nasturtium officinale W.T. Aiton 3419-KASH	Kulhakh	Herb	WL	Leaf	Decoction	Oral	Indigestion	17	0.49
Cannabaceae	*Cannabis sativa* L. 3376-KASH	Bhangh	Herb	WL	Leaf	Infusion	Oral	Intestinal worms	13	0.37
	Celtis australis L. 3380-KASH	Brimij	Tree	WL	Fruit	Decoction	Oral	Colic infection	14	0.40
Caprifoliaceae	*Sambucus wightiana* Wall. 3001-KASH	Gandula	Herb	WL	Fruit	Infusion	Oral	Stomach pain	12	0.34
Chenopodiaceae	*Chenopodium album* L. 2972-KASH	Konh	Herb	WL	Leaf	Decoction	Oral	Diarrhea	20	0.57
Convolvulaceae	*Convolvulus arvensis* L. 3384-KASH	Haroli	Herb	WL	Leaf	Decoction	Oral	Constipation	15	0.43
Cyperaceae	*Cyperus rotundus* L. 3389-KASH	Gassh	Herb	WL	Whole plant	Decoction	Oral	Diarrhea	13	0.37
Equisetaceae	*Equisetum arvense* L. 2981-KASH	Bandakey	Herb	WL	Aerial portion	Infusion	Oral	Stomach pain	18	0.51
Fabaceae	*Trifolium pratense* L. 3454-KASH	Batak lautt	Herb	WL	Flower	Juice	Oral	Indigestion	15	0.43
	Trigonella foenum-graecum L. 3456-KASH	Meth	Herb	CL	Seed	Decoction	Oral	Indigestion	21	0.60
Geraniaceae	*Erodium cicutarium* (L.) L'Hér. ex Aiton 3393-KASH	Peinz ungajj	Herb	WL	Flower	Infusion	Oral	Constipation	16	0.46
	Geranium pratense L. 2985-KASH	Ringrish	Herb	WL	Leaf	Infusion	Oral	Diarrhea	14	0.40
Hypericaceae	*Hypericum perforatum* L. 2988-KASH	Ring chai	Herb	WL	Leaf	Decoction	Oral	Abdominal pain	16	0.46

Lamiaceae	*Ajuga bracteosa* Wall. ex Benth. 3356-KASH	Jani-adam	Herb	WL	Whole plant	Infusion	Oral	Abdominal pain	23	0.66
	Mentha aquatica L. 3416-KASH	Kul pudni	Herb	WL	Leaf	Infusion	Oral	Abdominal pain	21	0.60
	Mentha arvensis L. 3414-KASH	Pudni	Herb	CL	Leaf	Decoction	Oral	Stomach pain	22	0.63
	Mentha longifolia (L.) Huds. 3415-KASH	Jangli pudni	Herb	WL	Leaf	Powder	Oral	Dysentery	17	0.49
	Nepeta cataria L. 2993-KASH	Brair-gass	Herb	WL	Whole plant	Infusion	Oral	Diarrhea	16	0.46
	Origanum vulgare L. 3422-KASH	Wanbaber	Herb	WL	Seed	Infusion	Oral	Diarrhea	15	0.43
	Prunella vulgaris L. 2997-KASH	Kalweuth	Herb	WL	Leaf	Decoction	Oral	Diarrhea	18	0.51
	Stachys floccosa Benth. 3645-(KASH)	NA	Herb	WL	Leaf	Infusion	Oral	Dysentery	13	0.37
Liliaceae	*Gagea elegans* Wall. ex G.Don. 3615-(KASH)	NA	Herb	WL	Whole plant	Cooked	Oral	Indigestion	16	0.46
Malvaceae	*Abutilon theophrasti* Medik. 3352-KASH	NA	Shrub	WL	Whole plant	Decoction	Oral	Diarrhea	18	0.51
	Hibiscus syriacus L. 3399-(KASH)	NA	Shrub	WL	Leaf	Infusion	Oral	Diarrhea	12	0.34
	Hibiscus trionum L. 3400-KASH	NA	Herb	WL	Leaf	Decoction	Oral	Stomach pain	11	0.31
	Malva neglecta Wall. 2991-KASH	Sochal	Herb	WL	Leaf	Decoction	Oral	Stomach pain	19	0.54
Moraceae	*Ficus carica* L. 3395-KASH	Anjeer	Tree	CL	Fruit	Infusion	Oral	Indigestion	21	0.60
	Ficus palmata Forssk. 3396-KASH	Angeer	Tree	WL	Fruit	Juice	Oral	Abdominal pain	20	0.57
Oxalidaceae	*Oxalis corniculata* L. 3423-KASH	Chuk-xanjj	Herb	WL	Whole plant	Infusion	Oral	Diarrhea	15	0.43
Plantaginaceae	*Plantago lanceolata* L. 2995-KASH	Gull	Herb	WL	Leaf	Tea	Oral	Laxative	19	0.54
Rosaceae	*Cyndonia oblonga* Mill. 2978-KASH	Bamchoont	Tree	CL	Seed	Decoction	Oral	Constipation	23	0.66
Solanaceae	*Solanum tuberosum* L. 3451-KASH	Alua	Herb	CL	Tuber	Cooked	Oral	Acidity	21	0.60

#CL-Cultivated, WL-Wild, NA-Not available

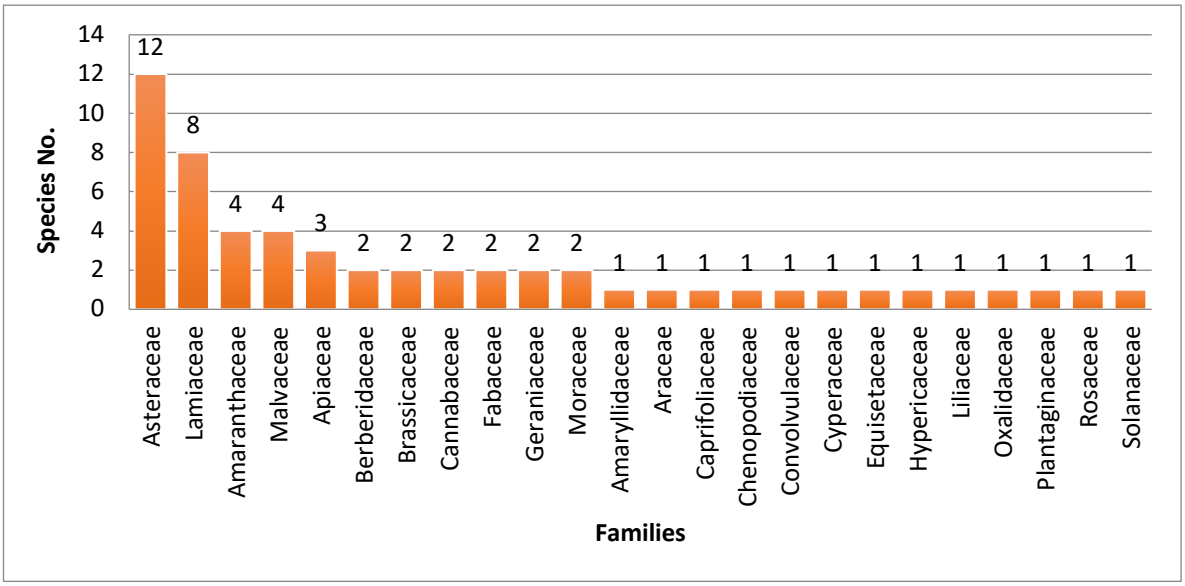

Figure 2. Contribution of different families to ethnomedicinal flora in the study area.

Life form, parts used, and remedy preparation

In the current study the most dominant life form used in the treatment of various ailments are herbs (49 species = 88%), followed by trees (4 species = 7%), and shrubs (3 species = 5%) (Fig. 3).

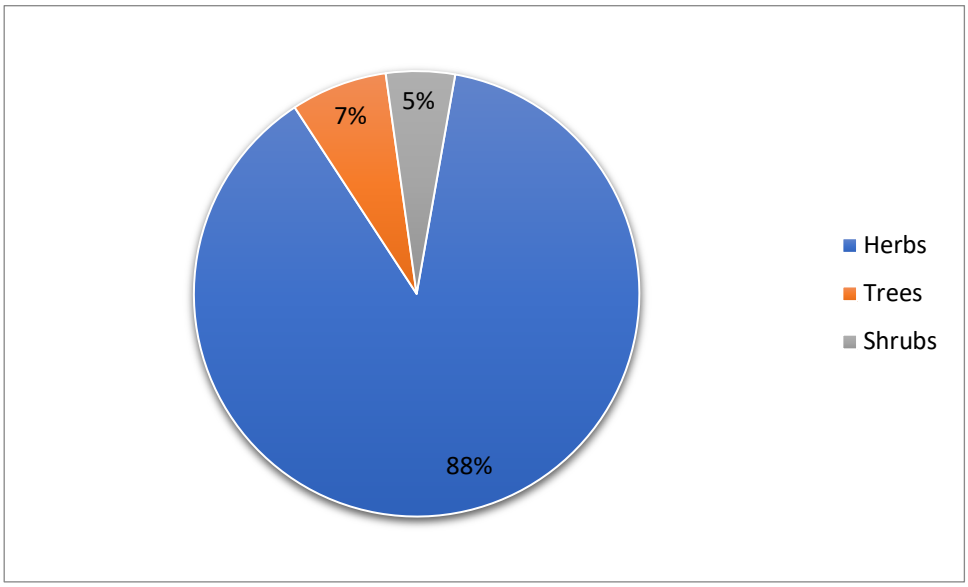

Figure 3. Distribution of species according to their life form.

The reason behind the use of herbs might be due to the presence of high content of bio-active compounds in them (Giday et al. 2009; Mesfin et al. 2009; Lulekal et al. 2013) and also their medicinal action is more effective than other forms of plant (Adnan et al. 2012; Adnan et al. 2014). Herbs also grow mostly along roadsides and in home gardens, so are easily available in nature to collect (Shrestha and Dhillion 2003; Kayani et al. 2014). Leaves (39%) were found the most commonly plant part used followed by whole plant (21%), seeds and fruits (9% each) and roots (7%) (Fig. 4). I n line with the current study leaves were reported to be the dominant part in various other previous studies (Giday et al. 2003; Bhatia et al. 2014; Shah et al. 2016). The reason behind the frequent use of leaves may be because leaf acts as the center of photosynthesis and other metabolic activities and hence most of the secondary metabolites are formed in leaves (Verpoorte et al. 2002; Ghorbani 2005; Cakilcioglu and Turkoglu 2010; Jan et al. 2021a, b). Also, it is easy to collect and to prepare medicinal remedies from leaves rather than other parts of the plant. It has also been reported that consumption of leaves is a sustainable collection of medicinal part

as it is not needed to uproot the whole plant and hence this use adds to the conservation of medicinal plants (Giday et al. 2003).

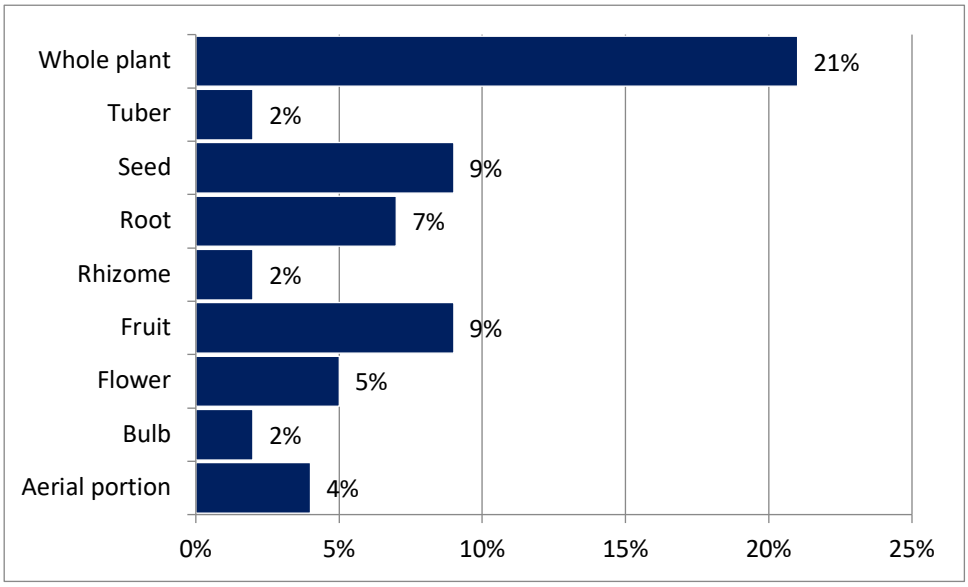

Figure 4. Percentage contribution of plant parts used.

In the current study decoction (41%), was found to be the most common method of preparation of herbal medicines followed by infusion (37%), cooked and juice (7% each), powder (4%), raw, and tea (2% each) (Fig. 5). The preference and preparation were based on the potency and shelf life of the remedy (Sonibare and Abegunde 2012). All the herbal drugs were used by oral means in the present study. In line with our studies, ethnic people in various parts of Kashmir Himalaya and other parts of the world use herbal medicine orally (Mahmood et al. 2012; Mir et al. 2021).

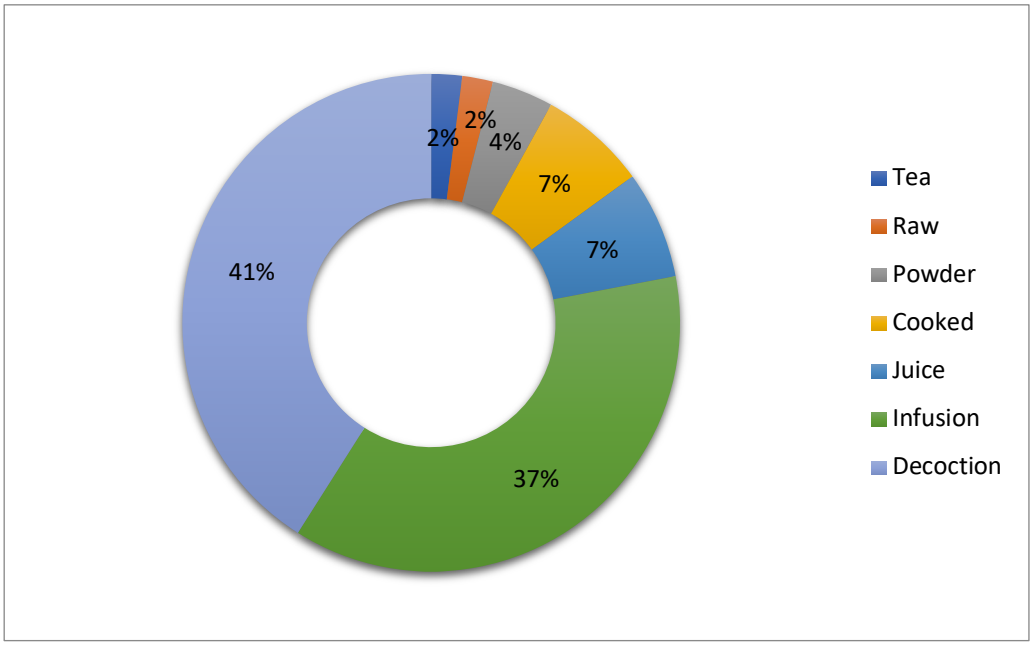

Figure 5. Percentage contribution of herbal recipes.

It was also reported from the informants that sometimes the higher doses may cause serious implications or even death of the soul. If not taken in proper doses these plants may pose adverse effects on the human body. That is why, one need to be more sensitive while using the herbal medicinal plants at home.

Informant consensus factor (ICF)

The aim of using ICF in this study was to ascertain the agreement of informants for the cure of an ailment category. This value explains the cultural consistency for the use of a group of therapeutic plants to cure a group of a particular ailment categories (Heinrich et al. 2009). In the current study, all the ailments were categorized into 11 different ailment categories to calculate the value of ICF. From the obtained results, highest ICF value of 1 was recorded for vomiting (15 use reports and 1 taxa) and the lowest ICF value of 0.94 (210 use reports and 13 taxa) was recorded for diarrhea (Table 3).

Table 3. Value of informant consensus factor (ICF) for each disease category.

Disease category	Nur	Nt	ICF
Diarrhea	210	13	0.94
Dysentery	102	6	0.95
Stomach pain	133	8	0.95
Indigestion	124	7	0.95
Constipation	97	5	0.96
Abdominal pain	130	6	0.96
Intestinal worms	52	3	0.96
Colic infection	43	2	0.97
Laxative	31	2	0.97
Acidity	33	2	0.97
Vomiting	15	1	1

Most of the informants reported *Amaranthus caudatus, Cichorium intybus, Lactuca saligna, Berberis lycium, Nepeta cataria, Origanum vulgare, Prunella vulgaris, Abutilon theophrasti,* and *Oxalis corniculata* to be more useful in the treatment of diarrhea.

The results reported in our study are in line with the similar studies conducted in various other parts of the world (Jan et al. 2020), where vomiting was also reported with highest ICF value. High ICF indicates that a small number of plants used to treat ailment and is well communicated among the informants in the study area to treat ailments by that species. This in turn might indicate the effectiveness of the plant species for the treatment of specific disease categories and indicates the possibility of presence of biologically active components in these plants (Cakilcioglu et al. 2011). It has been suggested that high ICF values are related to high plant use values for one disease category (Madikizela et al. 2012). In quantitative ethnobotanical studies, analysis of data by different ethnobotanical indices provides a well-defined criterion to define the traditional knowledge of medicinal plant species in the local population of the area (Kadir et al. 2014).

Use value (UV)

The use value index is used to find out the relative importance of medicinal plants in the study area. Its value ranges from 0-1. The medicinal plants with more use reports have high use value and medicinal plants with fewer use reports have low use value. In the current study the highest UV of 0.74 was calculated for *Artemisia absinthium* and the lowest UV of 0.31 for *Hibiscus trionum* (Table 2). As we can't ignore the medicinal plants with high use value, therefore, the medicinal plants with low use values should not be ignored as failing to provide this information to future generation could raise the threat of vanishing of this valuable knowledge (Ahmad et al. 2015). In addition, it is not true that medicinal plants with low use values are less important, but it indicates that the knowledge of these medicinal plants is at risk or availability of the particular medicinal plant is less (Chaudhary et al. 2006; Mahmood et al. 2013). The high UV of medicinal plants in the study region is attributed to their common distribution in the area and the local people are well familiar of their medicinal uses (Rahman et al. 2016). Several phytochemical substances have been extracted and reported from *Artemisia absinthium* including, sesquiterpene lactones, a class of natural compounds with several proved medicinal effects, guanolide dimmers as absinthin and its isomers anabsinthin, anabsin, artabsin and absintholide (Beauhaire et al. 1984), germacrene type as artabin (Akhmedov et al. 1970), matricin, beta-santonin and ketopepenolid-A (Perez-Souto et al. 1992). Due to the presence of these phytochemical constituents the plant has been reported to show Hyper-secretary activity (Blumberger and Glatzel 1966), Antiulcer activity (Shafi et al. 2004)), Neuroprotective activity (Wake et al. 2000), Anthelmintic activity (Meschler and Howlett 1999), Neurotoxic activity (Donald 1981), Antiprotozoal activity (Valdes et al. 2008), Anti-fungal activity (Essawi and Srour 2000) and Anti-microbial activity (Kordali et al. 2005). *Artemisia absinthium, Achyranthes aspera, Ajuga bracteosa, Cyndonia oblonga, Ficus palmata, Ficus carica, Mentha arvensis, Mentha aquatic, Trigonella foenum-graecum, Chenopodium album, Foeniculum vulgare, Daucus carota, Coriandrum sativum, Amaranthus spinosus,* and *Amaranthus blitum* were among the high use value medicinal plants used for the treatment of gastrointestinal disorders.

Novelty of the study

To the best of our knowledge, it is the first independent study of its kind in the area and the region. The current research focuses on the safe and effective use of medicinal plants against various gastrointestinal disorders. Our results coincide with other ethnobotanical studies in the region and around the world to some extent; however,

this study revealed a total of 56 medicinal plants used against various gastrointestinal disorders. The data revealed that the type of plant used, the method by which indigenous people prepare crude drugs, and how they are administered vary significantly across the region and globally, offering new ethnomedicinal information. Being the first study on medicinal plants used against various gastrointestinal disorders, present study offers baseline data for researchers for future phytochemical investigations and would provide insights that could help to raise and improve local healthcare. Furthermore, it might provide a source of income for communities and have a positive impact on socioeconomic conditions, all with the purpose of preserving these natural treasures.

Conclusion

Medicinal flora forms the pillar of our traditional healthcare structure with a huge part of population still dependent on traditional medicines in most of the developing countries. Present study was an attempt to underline the potential medicinal plants used against various gastrointestinal disorders in district Budgam of Jammu and Kashmir. During the study 56 different medicinal plants belonging 24 families and 47 genera were reported from the study area. It can be concluded from present research that people of the study area possess a rich traditional knowledge inherited from their forefathers and documentation of this valuable knowledge has provided novel information from the area. Native populations still rely on medicinal plants for their primary health care, but at the same time are alarmed about the degradation of the flora in wild. It was found that the elderly people possessed a great wealth of indigenous knowledge in comparison to the younger ones, this difference in knowledge might be due to the changing lifestyle of younger folk, changing views of ethnic communities and the increasing influence of industrialization, due to which traditional medicinal knowledge of plant species is frequently vanishing at an alarming rate. Therefore, there is a need to speedily document the important plants and associated knowledge and to take necessary measures for the conservation of these resources so as to save this treasure; otherwise, a great number of medicinally important plants will become extinct in wild. To validate this indigenous knowledge, we suggest that species with high use value (UV) be used for future phytochemical and pharmacological investigation.

Declarations

List of abbreviations: CL-Cultivated, WL-Wild, NA-Not available.

Ethics approval and consent to participate: This ethnomedicinal study was approved by the ethical committees of the Department of Botany, Government Model Science College, Jiwaji University, Gwalior, India. Before conducting interviews, individual prior informed consent was obtained from all participants. No further ethics approval was required. All work conducted was carried out under the stipulations of the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization to the Convention on Biological Diversity. The right to use and authorship of any traditional knowledge of all participants is maintained, and any use of this information, other than for scientific publication, does require the additional prior consent of the traditional owners, as well as a consensus on access to benefits resulting from subsequent use.

Consent for publication: Not applicable-no personal data is included in this manuscript.

Availability of data and materials: The data used to support the findings of this study are available from the corresponding author upon request.

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