Original Research Article

ETHNOBOTANICAL PRACTICES AMONG THE PEOPLE OF DAGANA DISTRICT, BHUTAN

ABSTRACT

Medicinal plants are one of the most affordable and accessible method available for the treatment of various ailments and diseases by the local people. In this regards, the study aimed to document the ethno-medicinal knowledge of plants used by the local people of Dagana district of Bhutan. Data were collected between June to November of 2020 using semi-structured interviews from the local people, following snowball sampling. The study documented 74 medicinal plant species, used for treating 30 different body ailments and diseases. Maximum number of species (14) was used in treating cut/body wounds and commonly used plant parts was leaves (30 species). Current study area was found to be rich in ethno-medicinal knowledge, but equally threatened with declining practices and management of resources. Thus, appropriate conservation of resources and preservation of traditional knowledge is required.

Keywords: Ailments, Bhutan, Dagana district, disease, ethno medicinal knowledge, medicinal plants.

1. INTRODUCTION

Traditional knowledge on medicine plays an important role in rural areas and is the most affordable and accessible method available for the treatment of various diseases [25]. It has been estimated that as many as 60-85% of the world's population rely primarily on plant-based medicines [3, 22]. Traditional medicine can be defined as indigenous medicine that is used to maintain health and to prevent diseases based on theories, beliefs, and experiences [29]. It has been used for thousands of years with great contributions made by practitioners

to human health, and maintaining its popularity worldwide [7]. Thus, traditional medicine is strongly bonded to nature and dependent on natural resources and culture [1,2,19].

Most of the inhabitants of Bhutan still utilize the forest resources in various forms such as medicine, food, fuel, fodder and timber. Over the year, it has been observed that the traditional knowledge on ethnobotanical practices is being gradually disappearing in Bhutan (k.S pers. com., 2019) [9] and similar is being reported by [28] in other part of the world. [4] stated that the loss of traditional knowledge has impacted on the development of modern medicine. Moreover, medicinal plants are at increasing risk from destruction of their habitats (agricultural expansion, fire, construction, overgrazing, and urbanization) and over harvesting of known medicinal species [6,11,20]. This indicates that due consideration should be given for conservation of these plants since they are being widely exploited for various purposes other than their medicinal value.

Comment [HW1]: Over the year or over the years? If it refers to the year of the study it should be explained how this was registered.

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Previous studies on ethnobotanical practices have been carried out in most of the areas in Bhutan [8,10,11,27] apart from Dagana district. In view of this, it is evident the need to document the traditional knowledge of every human communities, to preserve the cultural characteristics as stated by [3]. Especially the old age and local healers have information and understanding on a wide range of medicinal values of natural resources that are useful in curing the common ailments [25]. Historically, plant derived products were the only source of nearly all medicinal preparations [18]. At present, these informations are gradually fading with people relying on modern medicines and younger generation not taking up interest in learning such things. Therefore, preservation of indigenous knowledge has become an urgent need for the society.

2. MATERIALS AND METHODS

2.1 Study area

Dagana district has a total area of 1723 square kilometers, located in the altitude of 185-3800 meters above sea level. The district lies in the South western part of Bhutan between latitude of 26°50'5.90"N to 27°15'9.41"N and longitude of 89°46'50.42"E to 89°49'41.15"E (Figure 1). The district was initially selected based on the concern raised by the old age group of local people on the declining ethnobotanical practices in the district.

Dagana district has more than 80% of its area under forest cover. Hardy trees like Champ, Augury, Chirpine and Sal grow throughout the region [24]. Dagana being in a strategic location plays an important role in terms of conservation of key flora and fauna species. It is home to some critically endangered species such as *Ardea insignis*, *Paphiopedilum fairrieanum* and *Manis pentadactyla*. It also harbors important fauna species such as *Panthera tigris, Elephas maximus, Tor putitora, Panthera pardus, Bos gaurus, Cuon alpinus* and flora that includes *Taxus wallichiana* and *Gastrochilus calceolaris* [12].

Comment [HW3]: Add scientific names.

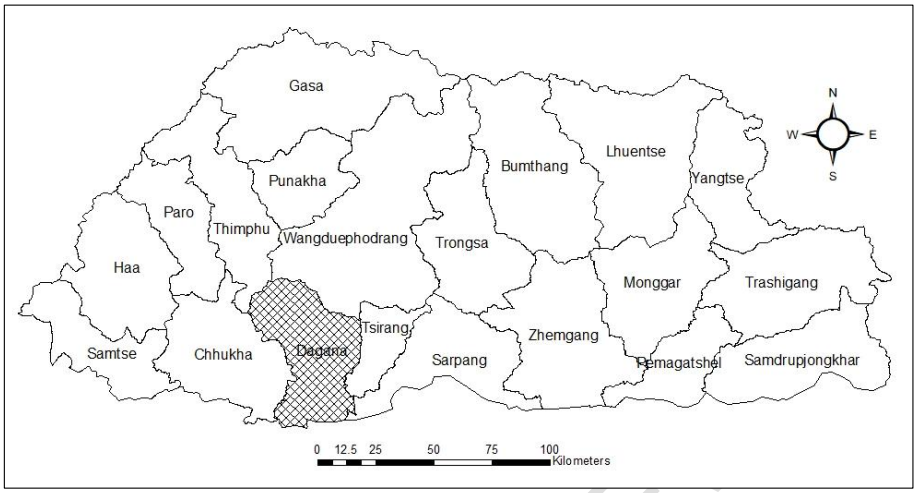

Figure 1: Bhutan map showing the study area (Dagana district)

2.2 Data collection and plants identification

The rapid field survey was carried out between June to November 2020 to document existing ethnobotanical practices by the local people. Data was collected using semi-structure interviews and only the knowledgeable persons were selected based on the snowball sampling. The study gathered data from 32 individuals, and all of them practice the ethno-medicine occasionally. The informants were also asked to demonstrate the procedure of medicinal uses, and same is being recorded and described here. Plants specimen were also collected and later identified referring the Flora of Bhutan [13,14,15,16,17].

Comment [HW4]: Provide information about age and sex.

3. RESULTS AND DISCUSSION

The study recorded a total of 74 medicinal plants belonging to 50 families (Table 1). Within the plant families recorded, Asteraceae was the largest medicinal plant family having nine species. The remaining 49 families possessed equal to or less than four species each. The most common plant part used for medicinal purposes was leaves (30 species) followed by stem and bark (12 species each), fruits (9 species), root (8 species), seed and whole plant (6 species each), flower (4 species), rhizome (3 species), and berries, bulb, tuber and shoot (1 species each) (Figure 2).

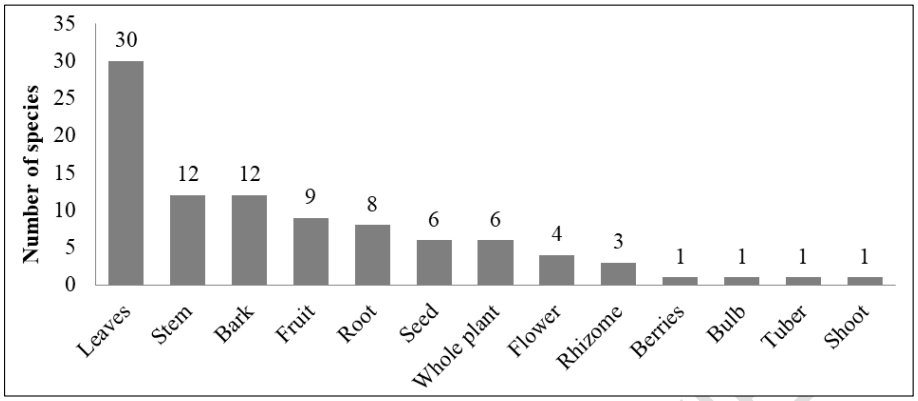

Figure 2: Number of parts used of plant

Local people used these medicinal plants to treat 30 different types of body ailments and diseases. Different species of plants were used to cure same body ailments and diseases. Maximum number of species (14) was used in treating cut/body wounds followed by 11 species in cough and cold and 9 species in diarrhea and dysentery (Figure 3). It has been observed that only the single plant or its parts are used to treat the body ailments or diseases. Total of 9 ethno-medicinal preparation methods were identified and found that preparation of paste after crushing was mostly used (27.03%) to treat various body ailments or diseases, followed by extraction of juice after crushing (24.32%), taken raw (21.62%), decoction (14.86%), poultice (5.41%), extraction of latex/gel (2.70%), burning to coal (1.35%), extraction of oil (1.35%) and preparation of powder (1.35%), which are either applied to the affected parts or taken orally.

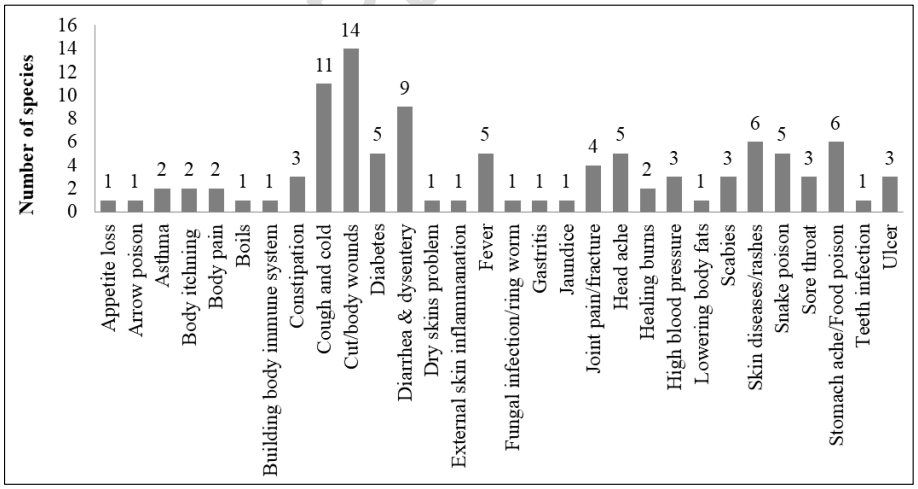

Figure 3: Number of species for curing different body ailments and diseases.

Table 1: List of ethno-medicinal plants used by local people of Dagana district in Bhutan.

Sl. no.	Scientific name	Family	Ethno-medicinal uses	Parts used	Methods of preparation
1	*Adhatoda vasica* L.	Acanthaceae	Relieving pain in joints	Stem and root	Crush and apply as poultice on the affected parts.
2	*Acorus calamus* L.	Acoraceae	Treatment of food poison	Root	Root is crushed into paste and taken orally.
3	*Sambucus* sp.Wall. ex DC.	Adoxaceae	Building immune system and treatment of constipation	Berries and flower	Raw berries and flowers are chewed.
4	*Allium sativum* L.	Amaryllidaceae	Treatment of diabetes and high blood pressure	Bulb	Bulb is crush into paste and drank after mixing with hot water.
5	*Rhus chinensis* Mill.	Anacardiaceae	Treatment of diarrhea, dysentery and cough.	Fruits	Raw fruits are eaten or can be made into paste and taken orally.
6	*Coriandrum sativum* L.	Apiaceae	Treatment of constipation and diarrhea	Leaves	Crushed and drink the juice.
7	*Colocasia esculenta* L. Schottt	Araceae	Relieving cough and fever	Rhizome	Rhizome is eaten as raw.
8	*Tupistra aurantiaca* (Baker) Wall. ex Hook. f.	Asparagaceae	Relieving intense stomach ache	Flowers	Drink the decoction from flowers.
9	*Ageritina adenophora* Spreng. R.M.King & H.Rob.	Asteraceae	Blood coating and healing of cut wound	Leaves	Crush and apply the juice gently on the wound.
10	*Ageratum conyzoides* L		Blood coating and healing of cut wound	Leaves	Crush and apply the paste on effected area.
11	*Artemisia vulgaris* L		Cough relieve and blood coating of cut wound	Stem and leaves	Crush and drink the liquid or apply on cut wound.
12	*Bidens pilosa* L.		Treatment of external wounds and inflammation	Whole plant	Fresh plant is crush and paste is applied.

13	*Chromolaena odorata* (L.) R.M.King & H.Rob.		Healing of wound and skin disease	Leaves and stem	Crush and apply on affected parts.
14	*Chrysanthemum* sp.		Relieving headache	Leaves	Paste of fresh leaves is soaked in the hot water for 1-2 hours and drank.
15	*Gynura nipalensis* DC.		Treatment of cut wounds and diabetes	Leaves	Paste is applied on the wounds; Decoction from leaves is drank.
16	*Smallanthus sonchifolius* (Poepp.) H.Rob		Treatment for lowing fat and pressure	Tuber	Tuber can be eaten directly.
17	*Xanthium indicum* J. Koenig		Treatment of wound	Seeds	Poultice of seeds is applied on the wound.
18	*Calamus acanthospathus* Griff.	Arecaceae	Healing wound and fever	Whole plant	Smash and apply on wound of forehead.
19	*Aloe vera* (L.) Burm.f.	Asphodelaceae	Ulcer	Whole plant	Gel is squash and apply on body.
20	*Begonia* sp.	Begoniaceae	Relieving headache	Flowers and leaves	Crush flower and leaves is gently rough on forehead skin.
21	*Mahonia nipalensis* DC.	Berberidaceae	Treatment of dysentery and sore pain	Root, stem and fruits	Decoction of root, stem or fruits (or eaten raw) is being drank.
22	*Alnus nipalensis* D.Don	Betulaceae	Healing of burns	Bark	Crush and juice is applied on affected areas.
23	*Brassica juncea* (L.) Czern.	Brassicaceae	Relieving headache	Leaves and stem	Crush and the paste is apply on head.
24	*Raphanusraphanistrum*L.		Snake poison	Storage root	Root is eaten raw to remove poison.

25	*Cannabis sativa* L.	Cannabaceae	Treatment of fungal infection/ringworm	Stem and leaves	Crush and apply the juice on infected parts.
26	*Terminalia chebula* Retz.	Combretaceae	Treatment of cough and cold	Fruits	Fruits is directly eaten.
27	*Cascuta reflexa* Roxb.	Convolvulaceae	Curing of jaundice	Whole plant	Crush and drink juice.
28	*Cupressus cashmeriana* Royle ex Carrière	Cupressaceae	Treatment of scabies	Stem	Portion of stem is burned and coal is applied on the affected area.
29	*Dioscorea hamiltonii* Hook.f.	Dioscoreaceae	Treatment for snake bite	Stem	Bind the stem above the bitten portion (it will not allow blood to pass to other body parts of the body).
30	*Gaultheria fragrantissima* Wall.	Ericaceae	Treatment of cough and stomach problems	Leaves and fruits	Drink the juice prepared from leaves or fruits can be chewed raw.
31	*Rhododendron arboretum* Smith.		Treatment of cough and headache	Bark and leaves	Paste of leaves is applied on forehead and juice from bark is taken orally.
32	*Euphorbia royleana*Boiss.	Euphorbiaceae	Treatment of cough and asthma	Stem	Latex from stem is taken in small quantity orally.
33	*Jatropha curcas* L.		Treatment of snake bite	Leaves	Leaves is crushed into paste and apply on the bitten portion.
34	*Ricinus communis* L.		Treatment of Joint pain and fracture	Seeds	Crush seeds into paste and apply on affected part.
35	*Entada rheedii* Spreng.	Fabaceae	Curing itching in body	Bark and seeds	Poultice is applied on the itching parts of the body.
36	*Erythrina arborescens* Roxb.		Improve loss of appetite and treatment of boil	Root and bark	Root part is taken to improve appetite and bark is crush to produce juice, which is applied on the boils.
37	*Quercus griffithii* Hook.f. &	Fagaceae	Treatment of diarrhea and	Seed	Decoction is taken orally.

	Thomson ex Miq.		dysentery		
38	*Swertia petiolata* Royle.	Gentianaceae	Relieving headache	All parts	All parts of plants is eaten raw.
39	*Dichroa febrifuga* Lour.	Hydrangeaceae	Treatment of cough and fever	Roots, bark and leaves	Crush and juice is taken orally.
40	*Juglans regia* L	Juglandaceae	Treatment of dry skin problems	Seed	Oil is extracted and applied on the affected areas.
41	*Elsholtiza blanda*(Benth.) Benth.	Lamiaceae	Reducing high blood pressure	Leaves	Leaves are chewed and eaten raw.
42	*Gmelina arborea* Roxb. ex Sm.		Relieving cough and ulcer	Bark	Chewing of bark or boil and drink the extract.
43	*Cinnamomum impressinervium* Meisn.	Lauraceae	Treatment of diabetes	Leaves	Dried leaves is crushed into powder and taken orally.
44	*Cinnamomum tamala* (Buch.-Ham.) Th. G. G. Nees		Treatment of ulcer and gastritis	Bark	Bark is peeled and eaten as raw.
45	*Lindera neesiana* (Wall. ex Nees) Kurz		Treatment of stomach ache/or food poison	Fruits	Fruits is eaten as raw.
46	*Gossypium hisutum* L.	Malvaceae	Treatment of rashes on skin	Leaves	Leaves are crush and juice is applied on the affected parts.
47	*Myrica esculenta* Buch.-Ham. ex D. Don	Myricaceae	Treatment of fever and cut wounds	Bark	Bark is crush and applied on the cuts. Juice is taken orally for the treatment of fever.
48	*Psidum guajava* L	Myrtaceae	Treatment of diarrhea and dysentery	Fruits	Fruit is eaten fresh.
49	*Ficus racemosa* L	Moraceae	Treatment of diarrhea and dysentery	Bark	Bark is crushed and juice is taken orally.
50	*Musa* sp.	Musaceae	Treatment of arrow poison or snake bite	Young banana shoots	Squeeze the banana shoots and drink raw liquid.
51	*Peperomia tetraphylla* (G. Forst.) Hook. &Arn.	Piperaceae	Treatment of itching of skin	Leaves	Crushed leaves are applied on affected parts.
52	*Platago lanceolata* L.	Plantaginaceae	Treatment of diarrhea, asthma and skin diseases	Leaves	Leaves are crushed and applied on infected parts or juice is taken orally.

53	*Dimeria sp.*(L.) Willd. ex Schult	Poaceae	Relieving from diarrhea	Whole parts	Crushed and mixed with Maida flour and eaten.
54	*Thysanolaena latifolia* (Roxb. ex Hornem.) Honda		Healing wounds	leaves	Smash and apply the paste on wounds.
55	*Rumex nipalensis* Spreng.	Polygonaceae	Cough relieve and blood coating of cut wound	leaves	Crush and drink juice or apply.
56	*Maesa chisia* Buch. Ham. ex D. Don	Primulaceae	Treatment of scabies and skin diseases	Fruits	Fruits are crush into paste and applied.
57	*Clematis Montana* DC.	Ranunculaceae	Treatment of cough and cold	Root	Paste of roots is soaked into hot water for 1-2 hours and drank.
58	*Prunus persica* (L.) Stokes	Rosaceae	Treatment of wounds and sore throat	Bark and leaf	Decoction is taken orally.
59	*Rubus ellipticus* Smith		Treatments of diabetes and cut wounds	Bark and leaf	Crush and apply on cuts; juice is taken orally.
60	*Rubia cordifolia* L.	Rubiaceae	Relieve pain in joints	Stem and leaves	Crush and apply or boil and apply the liquid.
61	*Zanthoxylum armatum* DC.	Rutaceae	Reliving body pain and treatment of cuts or wounds	Stem and leaves	Decoction is applied on the body; leaves is crush and apply on the cuts/wound.
62	*Viscum nepalense* Spreng.	Santalaceae	Healing the fracture of joints in legs and hands	Stem	Chew and swallow the parts of stem.
63	*Houttuynia cordata* Thunb.	Saururaceae	Treatment of diarrhea	Leaves	Crush and juice is taken orally.
64	*Buddleja bhutanica* Yam	Scrophulariaceae	Treatment of skin disease	Flower and leaves	Extracts is applied on infected parts.
65	*Capsicum* sp.	Solanaceae	Treatment for snake bite	Fruit	Paste of small red peppers is applied on the bite portion to minimize the effect of poison.
66	*Datura stramonium* L.		Treatment of burns	Leaves	Leaves is used as poultice.

67	*Solanum khasianum* C.B.Clarke		Removing the parasite from the teeth	Seeds	Placed the seed on the rock and inhale the hot air through closed pipe.
68	*Daphne bholua* D. Don	Thymelaeaceae	Treatment of fever	Bark	Decoction is taken orally.
69	*Debregeasia longifolia* (Burm. f.) Wedd.	Urticaceae	Treatment of scabies and skin diseases	Leaves and fruits	Juice of leaves is applied on infected areas.
70	*Urtica parviflora* Roxb.		Treatment of diabetes	Leaves	Leaves can be prepared into curry and taken orally.
71	*Amomum subulatum* Roxb.	Zingiberaceae	Treatment of sore throats	Seeds	Chew the seed and swallow.
72	*Curcuma longa* L.		Relieving body and stomach ache	Roots	Decoction from crushed roots is drunk.
73	*Cautleya spicata* (Sm.) Baker		Treatment of constipation	Rhizome	Juice is extracted and drank.
74	*Zingibe rofficinale* Roscoe		Treatment of stomach problems	Rhizome	Can be chewed or make into paste and eaten as raw.

The informants also stated the used of animal parts by their ancestors in earlier time such as animal bile, stomach, antler, honey comb, meat and egg yolk for treating various diseases and ailments such asthma, kidney problem, jaundice, cough and cold, tuberculosis, malaria and heart diseases. Some were also used for removing the splinter and scars from the body, treatment of snake poison and curing high mountain sickness. However, due to strict monitoring by the Department of Forest and park Services (DoFPS) of Bhutan, it's been told that these things are not being practiced. Similarly, the rock mineral known as Asphaltum (shilajit) is also being used. It is being extracted from the cliff and melted to remove impurities such as sand and stones contains. Then it is mixed with water and drink once before breakfast and the evening dinner. The shilajit is known to be best for curing illness as well as to build body immune system against diseases. It is also being applied on the cuts, wounds and burns to heal quicker.

It was found that the people of Dagana district are rich in ethno-medicinal knowledge, and only the elderly people practice it, but occasionally. Some of them were less conscious to share their knowledge, but equally concern with the possible extinction of their indigenous knowledge. Some of the important factors affecting the traditional knowledge on ethno-medicine are declining interest of youngsters towards value of traditional medicine, preferring modern medicine and seeking jobs in cities for better future. Similar was reported by [2] and [23] from nepal. Informants were equally concern with the declining of medicinal plants. One of the most important factor affecting this decline was neglecting the existence of such important species by the human community in current study area. When such species do not get management attention, they gets depleted due to various reasons such as habitat loss, overgrazing, unsustainable harvesting, illegitimate trade, soil erosion and drought [6,11,20,21,26].

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4. CONCLUSION

The world is facing massive loss of wildlife due to overexploitation [5] including the collection for medicinal purposes [4]. Equally, it is crucial to protect the traditional knowledge, as it is valuable not only to those directly involved with it, but also to the development of modern medicine [3]. In this regard, holders of traditional knowledge can play an important role as natural resource managers [3] to ensure its long term survival. For this, it is important not only to document the traditional use of species, but also to integrate the cultural and biological aspects of such practices into a broader discourse encompassing conservation, cooperative management, and sustainability.

CONSENT

It is not applicable to this research.

ETHICAL APPROVAL

It is not applicable to this research.

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