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Ethnomedicinal study of common medicinal plants of Kapilvastu district, Nepal

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ABSTRACT

Background & Aim: Medicinal plants have served as the primary constituents of traditional healthcare methods. Such plants have served mankind since primordial times. But such traditional knowledge is lacking conservation and promotion in present times. Documentation of such traditional knowledge can serve as safeguards for the conservation of such knowledge. The study primarily aims at the documentation of locally abundant medicinal plants available in the Kapilvastu district of Southern Nepal.

Experimental: Data on medicinal plants regarding their local name, parts used along with their usage were collected through a questionnaire survey with a total of n=54 individuals of the locality. Excel software was used to analyze the pooled data and results were demonstrated in tables, charts and graphs. Google Scholar and Researchgate were assessed for secondary data collection.

Results: A total of 50 plant species from 46 genera representing 30 families used for curing 55 types of diseases were identified in the study area. Family Fabaceae was reported with the maximum number of species used (n=6). Trees (n=26) was the major used life form and leaf was the most frequently used (n=28) in terms of parts used.

Recommended applications/industries: This study serves as a future basis for research promotion, resource production, policy formulation and protection of these highly valuable plants. The paper will also be useful for those looking for traditional remedial measures using locally available plants in Kapilvastu district, and also will serve as informational bank for homeopathy-based curative measures.

1. Introduction

The global area occupied by Nepal is only 0.1% but in terms of biodiversity, it is ranked 25th globally and harbors 3.2% of the world's faunal species, accompanying 118 types of ecosystems within its small geography (MoAD, 2017). National Herbarium and Plant Laboratories (KATH, Kathmandu) has documented over 1,50,000 plants specimens around the country (MoAD, 2017). Among them, around 1600 plant species are reported to be medically valuable (Ghimire 2008; Gubhaju and Ghimire, 2010), and 238 species have been tested for their medicinal significance (Joshi *et al.*, 2019). People have been dependent on traditional medicines for curing various ailments since primordial times. The knowledge regarding medicinal use of plants is considered to be known even before the Vedic period, but the oldest documentation mentioning about medicinal properties of plants can only be traced back to Rig-Veda written during 4500-1600 BC (Patel *et al.*, 2021). Around 80% of the global population majorly comprising rural areas relies on herbal medicines as primary healthcare sources (Geneva, 2000).

Medicinal plants are the key remedial sources in the treatment of various kinds of diseases with no side

effects on the body (Poudel *et al.*, 2021). Research at various national and international levels has authenticated plants' scientific and medicinal values (Manandhar, 2002). In addition, medicinal plants are the major sources of antioxidants and phytochemicals used by the pharmaceutical industries for drug production (Cunningham *et al.*, 2008; De Boer and Cotingting, 2014). More than 25% of modern medicines are developed using plant extracts as their primary source (WHO, 2002).

The traditional medicinal practices are extensive in the context of Nepal. Approximate 90% of the rural population in Nepal is devoid of primary healthcare services (Bhattarai *et al.*, 2006) and relies on using traditional medicines as their primary source of healthcare facilities (WHO 2011; UNEP 2012). Different ethnicities settled in various geographical regions of Nepal have been using wild plant species available in the neighborhood to meet their feeding as well as medicinal needs (Manandhar, 2002; Bhattarai *et al.*, 2006; Acharya and Acharya, 2009; Ghimire and Bastakoti, 2009; Kunwar *et al.*, 2009; Rokaya *et al.*, 2010; Uprety *et al.*, 2010). They have profound knowledge of ethnopharmacological and ethnomedicinal properties of locally available plants but are mostly undocumented (Singh *et al.*, 2012). From Manang alone, Bhattarai et al. (2006) recorded 91 species of medicinal plants. Uprety *et al.* (2011) found 96 plant species with medicinal values used by the Magar community of Tanahu. Use of 98 medicinal plants species was documented by Acharya and Acharya, 2009 in Bantar community of Morang and Balami (2004) show records of 119 plant species documented to be medicinally useful in the Newar community of Kathmandu valley.

Growing dependency on allopathic modes of treatment due to the modernization of health facilities is causing a rapid depletion of old times' traditional knowledge. Documentations on ethnobotanical exploits of indigenous knowledge can be seen as a deliberate need of present times for conservation and promotion of traditional knowledge (Bussmann and Sharon, 2006; Rajkumar and Shivanna, 2010; Rana *et al.*, 2010). Such evaluations and investigations will provide a baseline for manufacturing new drugs (Khan *et al.*, 2015). Although various studies in different regions of the country regarding the ethnomedicinal properties of plants have been carried out, a fewconcerns have been made around the Kapilvastu district. Researchers will be able to use this study in their future research endeavors and contribute to modern drug synthesis.

2. Materials and Methods

2.1. Study area

The study area was chosen to be Ward-2 of Kapilvastu Municipality, Kapilvastu district, Nepal conducted during July-August (2021). The district coordinates are 27° 54' latitudes and 83° 04' longitudes and at an elevation of 93m to 1491m asl. The area coverage of the study area is 136.91 Km^2. Kapilvastu is bordered to the east by Rupandehi District, to the northwest by Dang Deukhuri District, to the north by Arghakhanchi District, and to the west and south by India. Rainfall averages 1850 millimeters per year in the district and it averages 25-19°C year around. Ramsar wetland site i.e. Jagadishpur Reservoir is located here (Bhandari, 2013). The main forest vegetation in the Kapilvastu district include species of Khair (*Acacia catechu*), Sissoo (*Dalbergia sissoo*), and Sal (*Shorea robusta*) trees, along with mixed tropical hardwood species, and the climate here is tropical to subtropical (Chaudhary *et al.*, 2016). Kapilvastu Municipality have had a total population of 76,394 with 38,085 men and 38,309 women as per household survey done by Kapilvastu Municipality.

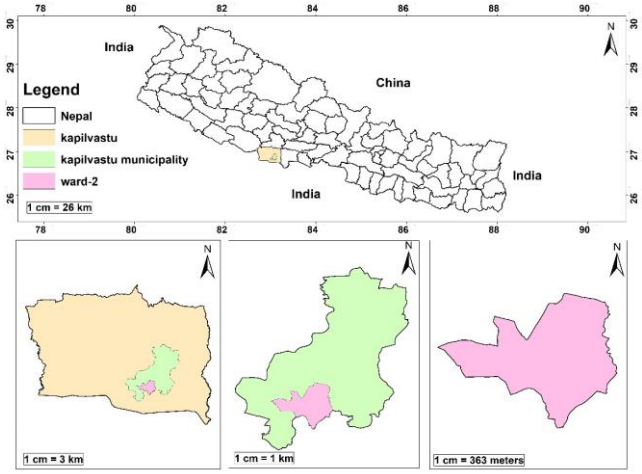

Fig. 1. Map showing the study area.

2.2. Data collection

Data specific to medicinal plants such as their local names, parts used, and uses were collected through a questionnaire survey with the local people. Elders (40 above) were consulted for reliable information. A total

of *n*=54 individuals were selected randomly on their knowledge basis. The selected individuals were preferably local healers visited by the locals for remedial purposes. The majority of the selected individuals were male (*n=45*). Additional information was collected through two of the focus group discussions. Photographs were captured in the field and were identified and verified using plant databases of KATH (National Herbarium and Plant Laboratories) and through renowned published articles on medicinal plants. Online portals (Google Scholar, Researchgate) were accessed for secondary data collection.

2.3. Data analysis

Collected data was pooled and fed to Microsoft Excel 2019 software for analysis purposes. ArcGIS 10.5 was used to prepare the study area map. Tables, pie charts, and graphs are used for data presentation.

3. Results and discussion

A total of 50 plant species from 46 genera representing 30 families used for curing 55 types of diseases were articulated in the study area.

Table 1. Plant species along with their local modes of use.

S. N.	Scientific name	Local Name	Family	Habit	Parts used	Ailments/ Diseases	Mode of application
1	*Acacia catechu* (L.F) Wild.	Khair	Fabaceae	Tree	Bark, heartwood, fruits, and flower	Dental and oral infections, gastric problems	The bark is ground in powder form and is used to treat sore throats, gastric problems. Soft stem cures oral cavity problems.
2	*Acacia nilotica* (L.) P.J.H. Hurter and Mabb.	Babul	Fabaceae	Tree	Bark	Cuts and wounds	Powdered bark is used in treating cuts and wounds.
3	*Achyranthes aspera* L.	Chirchira	Amaranthaceae	Herb	Whole plant	Leprosy, stomach troubles, tetanus, the bite of a mad dog	Chirchira powder with honey improves digestion. The juice of leaves helps in wound healing. Root paste with water or milk to treat skin problems.
4	*Adhatodavasica* (L.)	Asuro	Acanthaceae	Herb	Whole plant	Diarrhea, asthma, cold and cough	Leaves are smoked as cigarettes for the relief of asthma and juice for the treatment of diarrhea.
5	*Aegle marmelos* (L.)	Bel	Rutaceae	Tree	Fruits, root	Fever, ulcers and headache	Root extract is used in fever and leaves extract for ulcers. Leaf juice relieves headache.
6	*Aloe vera* (L.)	Gheu-kumari	Asphodelaceae	Herb	Leaves	Fever, skin diseases, tumors, liver problems	Aloe is used in tumors, fever and skin diseases and also to treat menstrual irregularities.
7	*Artemisia vulgaris* (L.)	Patti	Asteraceae	Herb	Leaves, root	Measles, ulcers, ringworm	Roots are used as tonic and antiseptic. Leaves can be used as tea. The juice of leaves is used to treat ringworm.
8	*Artocarpus lakoocha Buch-Ham*	Badahar	Moraceae	Tree	Leaf	Gastric problems, external bleedings	Leaf juice helps to cure bleeding and is also used for gastric problems.
9	*Azadirachta indica* (L.)	Neem	Meliaceae	Tree	Bark, leaf	Cough, vomiting, stomach problems	Bark extract cures stomach problems, ulcers, inflammation and wounds. Leaves are crushed and used to heal wounds.
10	*Bombax ceiba* (L.)	Simal	Malvaceae	Tree	Flowers, fruits, bark, root	Dysentery, skin diseases, snakebites	Bark paste is used for skin problems and wounds. Flowers are good for leucorrhoea and fruits for purifying blood. The root is used in inflammation.
11	*Carica papaya* (L.)	Papita	Caricaceae	Tree	Leaf, fruits, flowers	Heart problem, cough, asthma	Fruit juice is used for heart problems and flower decoction is taken orally for coughs, bronchitis and asthma.
12	*Centella asiatica* (L.)	TapreJhaar	Apiaceae	Herb	Leaf	Sugar, gastritis, skin diseases	Leaves extract treats sugar and gastric problems and also useful in skin treatment.
13	*Chenopodiastrum murale* (L.)	Bethuwa	Amaranthaceae	Shrub	Seed	Fever	Seed is ground into powdered form and boiled in milk which when consumed orally twice-thrice a day treats fever.

S. N.	Scientific name	Local Name	Family	Habit	Parts used	Ailments/ Diseases	Mode of application
14	*Colocasia esculenta* (L.)	Aaruee	Araceae	Herb	Leaves	Asthma, skin disorders, baldness	Juice of corm is widely used for treating body aches and baldness. Leaves paste is used in skin disorders and decoction in asthma.
15	*Cynodon dactylon* (L.)	Dubo	Poaceae	Herb	Whole plant	Skin infections, heart problems	A decoction is used for curing heart problems. Plant paste applied on skin cures infections.
16	*Eclipta alba* (L.)	Bhangariya	Asteraceae	Herb	Whole plant	Fever, common cold	Juice of the whole plant is used to treat fever and common cold.
17	*Eichhornia crassipes*	Talpatana	Pontederiaceae	Herb	Leaves, flowers	Cholera, sore throat, snake bites	The juice of leaves is used to treat cholera, sore throat and snake bites.
18	*Ficus bengalensis* (L.)	Bargad	Moraceae	Tree	Bark, Milky juice, young buds	Toothache pain, diabetes	The milky juice is applied to external pains and used as a remedy for toothache. Young buds and bark decoction controls diabetes.
19	*Ficus religiosa* (L.)	Pipar	Moraceae	Tree	Leaves, bark	Bleeding, heart diseases, skin diseases	Leaves and bark are useful in heart diseases. Paste of bark powder and honey is applied to the skin.
20	*Helianthus annus* (L.)	Suraj Mukhi	Asteraceae	Herb	Leaves	High fever, swellings, snakebites	Leaves are used in tea and consumed during high fever. Crushed leaves are used in swelling and snake bites.
21	*Imperata cylindrical* (L.) P. Beauv.	Bhaluhi	Poaceae	Herb	Rhizomes, roots, seeds	Diarrhea, dysentery, bleeding	Seeds are used to stop bleeding. Decoction of root is used in diarrhea and dysentery.
22	*Lawsonia inermis* (L.)	Mehendi	Lythraceae	Tree	Leaves, seeds, bark	Liver disorders, skin diseases, inflammation	Powdered seeds and leaves are consumed during dysentery and liver disorders. Boiled bark is used to cure leprosy.
23	*Leucaena leucocephala* (L.)	Shirsha	Fabaceae	Tree	Leaves, seeds, trunk	Skin problem, hair problem	Paste of leaves is used for healing dry, wrinkled and dark skin. Gum extract from the tree trunk is useful in body hair removal.
24	*Leucas cephalotes* (Roth) Spreng.	Guma	Lamiaceae	Herb	Leaves	Snakebite, cough, wounds	Leaves are dried, powdered and boiled in water to clean up the wounds. Leaf paste is applied over the snake bite part.
25	*Mangifera indica* (L.)	Aam	Anacardiaceae	Tree	Seed, fruit	Cold andcough, diarrhea, bleeding piles	Seeds are crushed and used in the form of powder.
26	*Melia azedarach* (L.)	Bakkaen	Meliaceae	Tree	Leaves, Flowers, Seed, Bark	Skin diseases and joint pain	Leaf decoction serves as a tonic. The bark is used against ascariasis. Dried flowers are used for skin diseases.
27	*Mentha spicata* (L.)	Pudina	Lamiaceae	Herb	Leaves	Asthma, fever, cough and digestive problems	The leaves are ground into powder and sometimes extracted in the form of oil. Powder and oil are mixed to make juice used for treating stomach aches, common cold, respiratory problems, etc.
28	*Mimosa pudica* (L.)	Lajwar	Fabaceae	Herb	Leaves, Root	Piles, urinary problems,	The paste of leaves provide relief during burning and bleeding piles. Root tea is used against urinary tract infections.
29	*Moringa oleifera* (L.)	Sitalchini	Moringaceae	Tree	Whole plant	Stomach disorders and joint pain	*Moringa* extracts are boiled in water and consumed.
30	*Morus* alba (L.)	Tut	Moraceae	Tree	Bark, leaves	Stomach ache, cold, cough, wound, red-eye problem	Bark paste is applied to stomach aches. Boiled leaves are used for treating cough, red-eye problems and wounds.
31	*Nelumbo nucifera*	Kamal	Nelumbonaceae	Herb	Leaves, flowers, fruit	Diarrhea, sunstroke	The juice of leaves is used in the treatment of diarrhea and sunstroke. Decoction of flower cures premature ejaculation and fruit treats fever.

S. N.	Scientific name	Local Name	Family	Habit	Parts used	Ailments/ Diseases	Mode of application
32	*Ocimum sanctum* (L.)	Tulsi	Lamiaceae	Herb	Leaves, Root, Seeds	Stomach disorders, common cold and cough	Tulsi tea is used for stomach disorders, cough, common cold and gastric problems. Root decoction helps in ailing malaria. Seeds are used for urinary problems.
33	*Opuntia cactus*	Nagfani	Cactaceae	Shrub	Leaves, stem	Diabetes, diarrhea and viral infections	Stems are boiled and consumed.
34	*Oxalis latifolia* Kunth.	Khatlus	Oxalidaceae	Tree	Whole plant	Dysentery, cholera, gastric problems	The whole plant extract is consumed during dysentery and cholera. The form of soups, stews and curries is used to improve healthy digestion.
35	*Phyllanthus emblica* (L.)	Amala	Phyallanthaceae	Tree	Fruits, leaves	Teeth problems, blood vessel-related problems	Raw fruits are consumed and also taken as vegetable pickles.
36	*Piper longum* (L.)	Pipla	Piperaceae	Tree	Fruits, Roots	Cough, fever, snakebite, night blindness	Pipla powder, dried ginger powder and 1 spoon of honey in warm water is used to treat cough. The unripe fruit is used as vegetable pickles.
37	*Piper methysticum* G. Forst.	Paan	Piperaceae	Shrub	Leaves	Hypertension, epilepsy, vision problem	Leaves extracts are used in the treatment of epilepsy.
38	*Plumertia rubra* L.	Gulachin	Apocynaceae	Tree	Leaves	Toothache	Milk of leaves is mainly used in toothache.
39	*Pogostemon benghalensis* (Burm. F.) O.ktze	Rudhilo	Lamiaceae	Shrub	Leaves	Kidney problems	Juice of dehydrated raw leaves is taken for kidney problems.
40	*Pongamia pinnata* (L.) Panigrahi	Kadza	Fabaceae	Tree	Seed	Fever	Seeds of Pongamia and seeds of kalimirch are ground together with little water and consumed twice a day in fever.
41	*Punica granatum* (L.)	Anar	Lythraceae	Shrub	Fruit, leaves, root	Diarrhea, dysentery, stomach ache, cardiac disorders	The fruit pulp is used in cardiac disorders and stomach aches. Root decoction is helpful to cure dysentery and diarrhea.
42	*Ricinus communis* (L.)	Reyad	Euphorbiaceae	Tree	Seed	Skin problems, birth complications	Seed oil is used for birth control and to soft skin.
43	*Schleichera oleosa* (Lour.)	Kusum	Sapindaceae	Tree	Fruit	Heat stroke	Fruits are consumed to reduce fatality of heat strokes.
44	*Tamarindus indica* (L.)	Emli	Fabaceae	Tree	Pulp	Vomiting, sore throat, swelling, pain	Tamarind water is consumed to cure sore throat and vomiting. The pulp of ripe fruits reduces swelling and pain.
45	*Terminalia bellirica* (Gaertn.) Roxb.	Barro	Combretaceae	Tree	Fruit, seed	Respiratory tract infections and eye diseases	Dried ripe fruit is used in Ayurvedic medicine.
46	*Terminalia chebula*Retz.	Harro	Combretaceae	Tree	Dried fruits	Dementia, kidney and liver dysfunction	Powdered form of dried fruits is used with warm water or tea as tonic.
47	*Tinospora sinesis* (Thunb.) Miers	Gurjo	Menispermaceae	Herb	Leaves, root, stem	Stomach problems, gonorrhea, urinary problems	Stem powder and leaf paste are used for stomach aches and urinary problems. Juice of fresh plants is used to treat gonorrhea.
48	*Xanthuium strumarium* (L.)	Karauni	Asteraceae	Herb	Leaves, fruits	Voice problems, appetite related problem	Leaves are used to improve voice and their paste acts as cooling, antipyretic and improves appetite also.
49	*Zingiber officinale* Roscoe	Aadi	Zingiberaceae	Herb	Fruits, rhizome	Diabetes, common cold, heart diseases	The rhizome is used for treating heart diseases. Ginger tea is good for colds and coughs.
50	*Ziziphus mauritiana*L.	Bayer	Rhamnaceae	Tree	Root, leaves, bark, fruits	Fever, ulcer, abdominal wound, diabetes	Root paste is applied to relieve back pain and root decoction is used in fever, old wounds and ulcers.

3.1.Family wise use of plant species

The use of 50 plants of 30 different families for medicinal purposes was reported. Family Fabaceae was reported with the highest number of species used (n=6), followed by Asteraceae (n=4), Lamiaceae (n=4), Moraceae (n=4), Amaranthaceae (n=2), Combretaceae (n=2), Lythraceae (n=2), Meliaceae (n=2), Piperaceae (n=2), Poaceae (n=2) as shown in Figure 2. Use of single species (n=1) was exhibited by Acanthaceae, Anacardiaceae, Apocynaceae, Araceae, Asphodelaceae, Cactaceae, Caricaceae, Euphorbiaceae, Mackinlayaceae, Malvaceae, Menispermaceae, Moringaceae, Nelumbonaceae, Oxalidaceae Phyallanthaceae, Pontederiaceae, Rhamnaceae, Rutaceae, Sapindaceae and Zingiberaceae families.

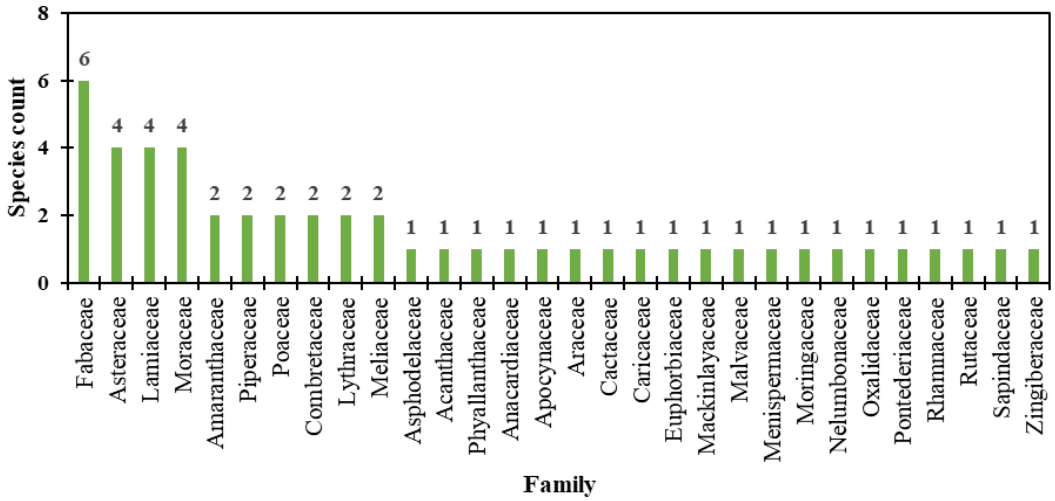

Fig. 2. Dominant families with their number of species used.

3.2. Plants used in habit-wise ways

Out of total plants used, 52% was trees (n=26), followed by herb (38%, n=19) and shrubs (10%, n=5) (Figure 3).

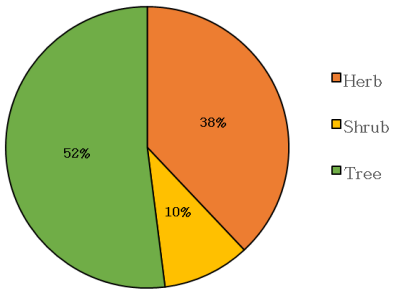

Fig.3. The habit of species used.

3.3. Parts-wise use of plant species

A total of (n=12) types of parts from plants were used. Among them, leaf was most frequently used (n=28) followed by fruit (n=17), seed (n=12), bark (n=11), root (n=10), flower (n=6), stem (n=2), rhizome (n=2), latex (n=1) and heartwood (n=1).

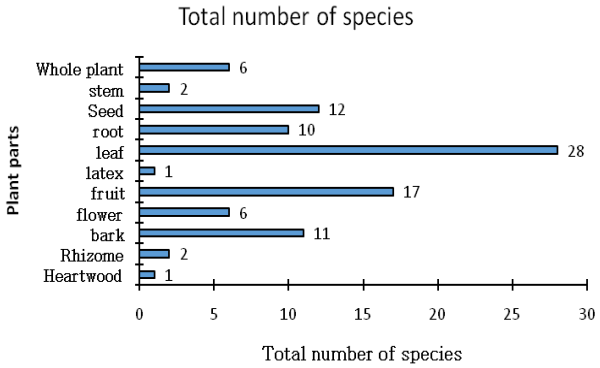

Fig. 4. Part wise use of different species

The study reveals the rich indigenous knowledge of local people regarding the uses of plant resources available in ward-2 of Kapilvastu district. According to our study, we found a total of 50 plant species (representing 46 genera and 30 families) used to treat 55 different types of ailments. The majority of the plant

species found were used in curing more than one type of ailment and the majority were used for treating skin problems, cough, common cold, fever and snake bites, diarrhea and dysentery. However, a fewer species was found to be useful in the treatment of illnesses like diabetes, asthma, respiratory tract infections, dementia, constipation, kidney and liver dysfunction, dental problems, heart problems, eye problems, ulcers, body aches, vomiting, gastric problems, cholera, etc. Our study area being a part of the rural community, people of the locality experienced poor quality of life due to which they frequently suffered illness and depended on these plants for treatment. The frequency of the number of plants species used to treat ailments indicated major prevalent diseases in the study area.

The result obtained from our study area was similar to the findings of (Patel *et al.*,2021) which reported 79 medicinally useful plant species from the Kapilvastu district. Because we collected data from only Ward-2, fewer species of plants were observed in our study area, while the study of *(*Patel *et al.*, 2021) constituted other wards also. Leaf, fruit, seed, bark and roots were preferred majorly. It may have been due to presence of more bioactive compounds in these parts in comparison to other parts (Basualdo *et al.*, 1995; Srithi *et al.*, 2009). The majority of plants used were trees, which may be due to the location of our study area in the lowlands (Terai region).

We compared our study results with many different previously published publications documenting the use of medicinal plants. Poudel and Singh (2016) reported the use of *T. bellirica* and *T. chebula* in treating abdominal disorders while we found their additional use in treating respiratory tract infections & eye diseases and dementia & kidney/liver dysfunction respectively in our study area. Similarly, the present study reported the use of *Mimosa pudica* in treating piles, urinary problems and skin diseases while Panthi and Chaudary (2003) reported their use in cuts and wounds; and similarly, Poudel and Singh (2016) reported their use in gastritis. *Azadirachta indica* was found to be used in the treatment of cough, vomiting, and stomach problems in our study area while Khan *et al*. (2015) reported its use in treating eczema and allergy; measles and chickenpox (Faruque and Uddin, 2014) in Bangladesh. Ricinus communis, was used for treating skin problems and birth complications in our study area; while Islam *et al*. (2014) reported its use for diarrhea and dysentery and gastritis complications. Such data reveals the multi-remedial application of plant species found in the study area. However, the study results of Ghimire *et al*. (2001), Manandhar (2002), Baral and Kurmi (2006), Kunwar *et al*. (2006), Bhattarai *et al*. (2010), Luitel *et al*. (2014), Rokaya *et al*. (2010), Uprety *et al*. (2010) around various regions of Nepal differed in context of available plant species from our study area as these studies constituted highland medicinal species majorly dominated by herbs. Such similarities and differences in results between the reports of uses of medicinal plants appeared due to the effect of climatic conditions and geographic distributions (Shrestha *et al.*, 2014; Mandal *et al.*, 2020)

4. Conclusion

The study comprised the availability of different medicinal plants along with their local modes of usage by the local people of Ward-2, Kapilvastu Municipality. In the study, 50 species of plants belonging to 30 families representing 46 genera were found to be used. The majority of the plant species cure skin problems, cough, common cold, fever, snakebites, diarrhea and dysentery. Most of the species used were from the Fabaceae family. Leaves, fruit, seed, bark and root were preferred mostly due to the presence of a higher amount of bioactive compounds. Major diseases prevalent in the study area could be identified by the frequency of number of plants species used as cure. Upon comparing study results with previously published publications, few additional but significant uses were discovered. Practical applications include research promotion, resource production, policy formulation and protecting these highly valuable plants. The basic results of this study show that further investigations are needed to explore ethnomedicinal values of plant species of this locality for the synthesis of drugs from the plant compounds and this study will be the reference for that. This study assists future researchers in their research endeavors and provides some baseline information useful in modern drug synthesis.

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