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Ethnobotanical, Phytchemical, and Allelopathic Potentinal of Traditional Medicinal Plants

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ABSTRACT

The study aims to report the ethnobotanical significance of medicinal plants for the treatment of various diseases, phytochemical constituents of those plants, their allelopathic effect, and impact of those plants on the socioeconomic aspect in Gulmi and Okhaldhunga district of Nepal. Altogether 41 species of medicinal plants from two areas were documented, using a semi-structured questionnaire. They have been using those species for the treatment of different ailment ranging from gastrointestinal problems, respiratory tract related problems, cuts and wounds, and dermatological problems. 18 of the potentially valuable medicinal plants were brought for performing secondary metabolites tests in methanol extract. The extracts have shown the presence of alkaloid, carbohydrate, glycosides, flavonoids, tannins, terpenoids, saponins, oil and protein, out of which alkaloid was found to be present in every sample. In contrast, only 5 possessed protein. Out of 18 plant extracts, 11 most valued ones were isolated to carry out allelopathy tests on mungbean seed. Only the control treatment bored germination of the mungbean with full radicle and plumule development. This study also reports the impact of the use of medicinal plants in people's daily life.

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Introduction

Nepal is one of the most diversified countries in the world. Biodiversity is a hub that makes Nepal unique and different from the rest of others. The different physiographic zones due to attitudinal variation have resulted in vegetation ranging from the subtropical to alpine. A developing country like Nepal addresses its corresponding health needs by utilizing several medicinal plants available in their respective areas. They are readily available at affordable prices and possess no side effects so that it is the only source of medicine for the poor people (Acharya and Acharya, 2009). The study done in 2019 shows that more than 6000 species of flowering plants and about 530 ferns are found in Nepal (Tiwari et al., 2019). The Medicinal and Aromatic Plant Database of Nepal (MAPDON) has enlisted 1624 medicinal and aromatic plants that are commonly available in the market under both cultivation and wild forms (Sharma et al., 2004).

Medicinal plants synthesize and accumulate some bioactive compounds and secondary metabolites like alkaloids, sterols, terpenes, flavonoids, saponins, tannin and can be used for the synthesis of various antimicrobial and antifungal drugs, which have some physiological effect in the body (Kalimuthu er al., 2010). Medicines made from them are safe, less expensive, more efficient and rarely have side effects (Vaghasiya et al., 2011). Phytomedicine is derived from seeds, flowers, fruits, roots, and bark of plants (Cragg and Newman, 2001). The number of phytochemicals belonging to different classes of chemicals has shown inhibitory effects on all types of microorganisms in the in-vitro condition (Cowan, 1999). Lack of advanced labs and screening centers to examine them, to refine them, and to know the actual application of these valuable gold isn't available in every corner of the country, so they have to be rushed into the main cities for the simple activities.

The phenomenon of one plant having a direct or indirect effect (harmful or beneficial) on another plant by producing a chemical compound is allelopathy (Lehoczky et al., 2011). Seeds, flowers, fruits, and leaves of living or decomposing plant material produce chemicals called allelochemicals and used as weed control without any negative impact on the main crops (Weston, 1996). Allelopathy and its effect would be a lot useful to farmers in several cases, which include residual allelopathy, allelopathic attributes in soil health improvements, disease management, weed management, and microbial allelopathy (Amb and Ahluwalia, 2016). Due to a lack of extension and encouraging actions from the experts, farmers of the research sites do not have any idea.

A Germination test is done to view the germination potential and capacity, the viability of the seed in a controlled or natural environment. Mungbean (*Vigna radiata* L. Wilczek) is a short duration leguminous crop that is grown in rainy and spring seasons both (DB et al., 2014). More than 75% of mungbean is cultivated in the Eastern and Central Terai region where irrigation facility is available, while the remaining 25% is produced in the Western Terai and foothills of Nepal (Shrestha et al., 2011). This study reports the impact of the use of medicinal plants in people's daily life. Also, it justifies that the extraction of secondary metabolites can be significantly used for synthesizing bioactive drugs, including biopesticide, as they have an allelopathic effect.

Methodology

Selection of Site

Field Survey was conducted in the Ruru Rural Municipality and Likhu Rural Municipality of Gulmi and Okhaldhunga district of Nepal respectively (Figure1). Ruru Rural Municipality is located in Gulmi district of Province No.5 of Nepal. The site has a latitude of 28°4'0" N and longitude of 83°15'0" E, located at an elevation 650-1650 m above sea level. The climate of Ruru ranges from warm temperate to subtropical with a temperature ranging from 8ºC to 28ºC. The area of this municipality is 67.38 km^2, with a population of 18,581, according to Ministry of Federal Affairs and Local Development of Ruru, Census of Nepal 2011.

Likhu is a rural municipality located in Okhaldhunga District of Province No. 1 of Nepal. It is situated at 27.3132°N latitude and longitude of 86.299°E with an elevation of 1500m above sea level. The Subtropical climate is found with a mean annual temperature of 15.5°C in this area. Ministry of Federal Affairs and Local Development has stated that Likhu has an area of 88.03 km^2 with a population of 14049 as the Census of Nepal 2011. These places are located in the eastern and western, mid-hill region and occupy many medicinal plant consumers.

Data Collection

A household survey was carried out by preparing a semi-structured questionnaire for respondents who were selected by purposive sampling method and altogether 70 samples; 35 households from each locality were selected. The survey was conducted to collect the information related to medicinal plants, major parts used and purpose of use, impact on their daily lives, and the use of those plants by the young generation. Similarly, a key informant survey was carried out with a local healer to identify the plants brought from the sites.

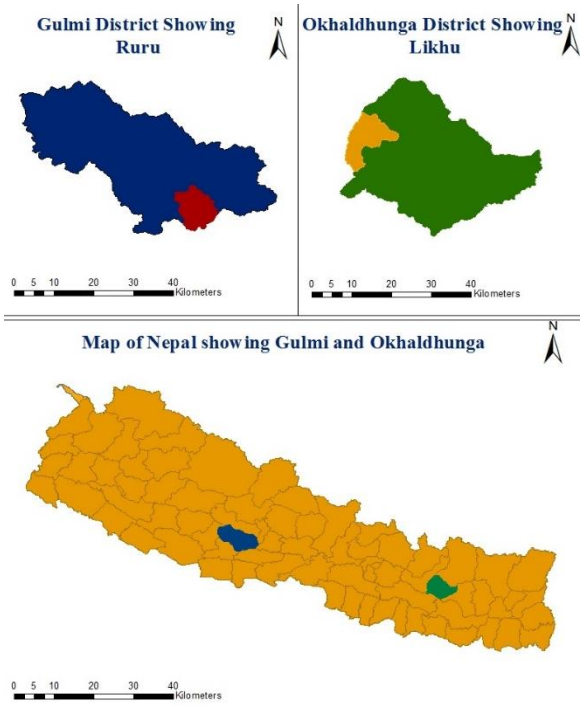

Figure1. Map showing the study sites

Collection and Preparation of Plant Material

During field research, altogether 41 medicinal plants used in daily lives were collected for taxonomic identification. Plants were collected from the local forest and cultivated site of the area, i.e., Damlachaur and Shringeshwor (Lekha) forest of Ruru and Chautara Paatal forest of Likhu. Department of plant resource Kathmandu confirmed the plants. Among the collected plants, 18 majorly used plants were separated for phytochemical screening. Most used plant parts were separated thoroughly, cleaned with running tap water followed by distilled water, and thoroughly dried in the shade at room temperature to lower their moisture. The dried parts were grinded into a fine powder and were stored in airtight bottles.

Extract Preparation

About 10-15 g of powder of each plant sample was soaked in 100 ml of methanol for 72 hrs with frequent agitation, so that soluble matter is well dissolved (Ncube et al., 2008). Filtration was done, and each extract was evaporated at 50°C in the oven to get a paste form which was stored at room temperature. For further studies, additional methanol was added in the paste obtained earlier.

Qualitative Phytochemical Test

Preliminary qualitative phytochemical screening of those samples was carried by following standard protocols.

Test for Alkaloids

The methanolic extract of the crude dry powder was treated with an equal amount of Wagner's reagent and a few drops of Mayer's reagent. The cream precipitate and

reddish-brown/brown precipitate in Wagner's reagent and Mayer's reagent respectively indicated the presence of alkaloid (Lellau and Liebezeit, 2001).

Test for Carbohydrate

Methanolic extract, when added to Molisch's reagent, violet colour ring, and when Fehling's solution was added to the extract, deep violet colour at the junction of two layers indicated the presence of carbohydrates (Auwal et al., 2014).

Test for Glycosides

1 ml of extract was allowed to react with 1 ml of concentrated Sulphuric acid; the formation of reddish colour when allowed to stand for 2 minutes validated the presence of glycoside (Lokman et al., 2013).

Test for Flavonoids

2 ml of extract was taken in a test tube, and few drops of liquor ammonia were added to it. Addition of concentrated sulphuric acid to the obtained solution gave a yellow colour with a cracking sound(Ayoola et al., 2008).

Test for Phenol

Ferric Chloride Test**:** In the 2ml of methanolic extract, 3 ml of 5% w/v ferric chloride solution was added. The appearance of a blue-black colour indicated the presence of tannins and phenols(Lellau and Liebezeit, 2001).

Test for Terpenoids

Salkowaski Test: 5 drops of concentrated sulphuric acid were added in 2 ml of extract, shaken, and allowed to stand. The appearance of the greenish-blue colour indicated the presence of terpenoids (Lokman et al., 2013)

Test for Saponins

Olive Oil Test**:** 5 ml of extract was added to a few drops of olive oil. The appearance of froth indicated the presence of saponins (Gul et al., 2017).

Test for Oils

Filter paper Test**:** Few drops of the extract was pressed between two filter papers and kept undisturbed. After 12 hours, the oil stain on the paper confirmed the presence of oil and fat (Marka et al., 2013).

Test for Protein

Biuret Test**:** To 2 ml of extract, 1 ml of 5% w/v sodium hydroxide and 1ml of 1% w/v copper sulphate were added. The change of colour in the solution to Violet/pink/purple indicated the presence of proteins (Narasimhan, 2014).

Allelopathic *Effect on Germination*

The phytotoxic activity of different plant extracts on the selected plant was investigated by using methanol extracts.

Extraction

Out of the total extracts, only 11 extracts were selected based on their higher chemical constituents (phytochemical test) to observe both allelopathy as well as germination test. Already prepared and stored paste (2.4) was used for this test. 50 ml of distilled water was added to the paste and was kept for 24 hours at room temperature. Then, each solution was filtered to remove debris. Each stock solution was kept in the refrigerator until use (Devkota and Sharma, 2015).

Seed Culture

Mungbean seeds (*Vigna radiata*) of locally grown variety were collected from the agronomy lab of IAAS Paklihawa. The mungbean seed lot was selected because the current season was the sowing period of this crop, and it was assumed that it would perform better with the prepared extract solution in the laboratory. Seed culture was carried out as similar to earlier study (Aasifa et al., 2014)**.** Seeds were surface sterilized with bleach water to avoid contamination and were thoroughly rinsed several times with sterile water. For testing, 36 Petri dishes were washed, dried, and then sterilized in an autoclave at 60°C for 24 hours. Altogether, 11 treatments and one control with distilled water and 3 replications were arranged in the environmental science and agroecology lab of Paklihawa Campus in a completely randomized design (CRD) format. Filter papers were kept in each Petri dish, and twenty seeds were placed in separate Petri dishes at equal distances. Irrigation was provided daily by the extract and water for 15 days. All the experimental Petri dishes were kept at room temperature for 15 days. Germination percentage on a given period and time for germination compared to control was noted. The treatments were as follows:

T_1- Water (Control)
T_2- Chiraito- *Swertia chirayita* (Roxb. Buch. Ham ex C. B. Clarke)
T_3- Bojho- *Acorus calamus* (L.*)*
T_4- Asuro- *Justicia adhatoda* (L.)
T_5- Pudina- *Mentha spicata* (L.)
T_6- Barro- *Terminalia bellirica* Gaertin.) (Roxb.)
T_7- Harro- *Terminalia chebula* (Retz.)
T_8- Titepati- *Artemisisa vulgaris* (L.)
T_9- Sugandha- *Valeriana jatamansi* (Jones.)
T_{10}- Kalo Niuro- *Tectaria macrodonta* (L.)
T_{11}- Thulo Okhat- *Astilbe rivularis* (Ham. ex D. Don*)*
T_{12}- Paiyun- *Prunus cerasoides* (Buch. Ham ex D. Don)

Statistics

Statistical analyses were performed using GraphPad Prism 7.0 software (Chicago, IL, USA). Methods of statistical analyses were chosen based on the design of experiment and are indicated in the figure legends. $P \leq 0.05$ was considered to be statistically significance.

Result

In this, the study medicinal plants majorly used by the people of Gulmi and Okhaldhunga are listed according to the respondent's responses which are available in the mentioned area. List of medicinal plants with their local name, scientific name, family, parts used and uses are presented in table (Table 1, Table 2, and Table 3) which is arranged according to the location and alphabetical order. Such type of study was done earlier in Resunga of Gulmi district (Acharya, 2012), Palpa district (Ale et al., 2009).

The phytochemical analysis of the medicinal plants collected from Ruru (*Acorus calamus, Cheilanthes bicolor, Emblica officinalis, Justicia adhatoda, Mentha spicata, Occimun sanctum, Terminalia bellirica Terminalia chebula* and *Zanthoxylum armatum)* and Likhu (*Amaranthus viridis* L., *Artemisia vulgaris, Astilbe rivularis, Chenopodium album, Hyoscyamus niger, Prunus cerasoides, Swertia chirayita, Tectaria macrodonta* L., *Valeriana jatamansi* L.) are given in Table 4. From the study, alkaloid was found in all plants tested. *Acorus calamus* showed a positive response to all the phytochemical tested (Mamta and Jyoti, 2012).

Table 1. Showing the major medicinal plants used by both Ruru and Likhu

S.N	Botanical Name	Common name	Family	Major Parts they use
1.	*Acorus calamus* L. *Uses*: Used as anti-spasmodic, carminative, used for sore throat and voice disorders, anthelminthic	Bojho	Acoraceae	Rhizome
2.	*Aloe vera* (L.) Burm. f. *Uses*: Heal burning wounds, regulate pressure, gel is used in the form of cream to soothe, heal and moisturize skin	Ghyu kumari	Xanthorrhoeaceae	Leaves
3.	*Amaranthus viridis* L. *Uses*: Fever, pain, asthma, diabetes, dysentery, urinary disorders, liver disorders and eye disorders	Chaulai	Amaranthaceae	leaves
4.	*Artemisia vulgaris* *Uses*: Stomach-ache, Skin diseases, cut wounds, itching, delayed or irregular menstruation, anorexia, gastritis, rheumatism, bronchitis, fever, headache, and as a remedy for diarrhoea. Used in fomentations given in skin diseases and foul ulcers as an alternative; applied to the head of young children for the prevention of convulsion	Titepati	Asteraceae	Entire plant
5.	*Centella asiatica* L. *Uses*: Skin diseases, indigestion, toothache problems, and stone problem, purify blood, and improve appetite	Ghodpatre	Apiaceae	Entire plant
6.	*Ocimum sanctum* L. *Uses*: Gastric disorder, urino-genital system disorder, throat ache	Tulsi	Lamiaceae	leaves
7.	*Prunus cerasoides* Buch. Ham ex D. Don *Uses*: Seed oil is used for stone diseases, twigs and leaves are said to be abortive, bark is used in swelling	Paiyun	Rosaceae	Seed, twigs and bark
8.	*Swertia chirayita Roxb. Buch. Ham ex C. B* *Uses*: Fever and headache	Chiraito	Gentianaceae	Stem and twigs

Table 2. Showing the major medicinal plants used by Likhu

S.N	Botanical Name	Common Name	Family Name	Major Parts they use
1.	*Astilbe rivularis* Ham. ex D. Don *Uses*: Menstruation problems, cut wounds, powder of rhizomes are administered in pre and post pregnancy	Thulo Okhat	Saxifragaceae	Rhizome
2.	*Bergenia ciliata* (haw.) Sternb. *Uses*: Diarrhoea, demulcent, aphrodisiac; also used to cure fever	Pakhan Beth	Saxifragaceae	Rootstock
3.	*Chenopodium album* L. *Uses*: Backache, gastritis, and anthelminthic	Bethu	Amaranthaceae	Leaves and seed
4.	*Costus Speciosus var. nepalensis* (J. Koenig) Sm. *Uses*: To cure urinary disorders, rhizomes are astringent, purgative, stimulant, anthelminthic, and are also used against snake bite	Bet Lauri	Costaceae	Rhizome
5.	*Drymaria cordata* (L.) Willd. ex Schult *Uses*: Stomach disorder, indigestion, plant wrapped with muslin cloth and roasted in charcoal is smelled in case of sinusitis	Abhijaalo	Caryophyllaceae	Entire Plant
6.	*Drymaria diandra* Blume *Uses*: Fever, indigestion, headache, and sinusitis	Thulo Abhijalo	Caryophyllaceae	Entire Plant
7.	*Hyoscyamus niger* L. *Uses*: Muscular disorders, gastric and intestinal problems, healing, spasmodic, cough, skin inflammation and boils	Khorsani	Solanaceae	Leaf and seed
8.	*Lindera fructicosa* Hemsl. *Uses*: Wounds heal, swelling, nasal problems. Leaves and fruits are used in the treatment of skin diseases	Siltimure	Lauraceae	Root, bark, leaf and fruit
9.	*Lycopodium clavatum* L. *Uses*: Skin diseases, cramp in muscles, gastric and abdominal disorders	Naagbeli	Lycopodiaceae	Spore
10.	*Mukia maderaspatana* (L.) M. Roem. *Uses*: Roots used to cure pneumonia, diabetes, urine discharges, appetizer, diarrhoea	Golkankri	Cucurbitaceae	Entire plant
11.	*Nyctanthes arbortristis* L. *Uses*: Fever, gastritis, asthma, cough, antibacterial, anti-inflammatory, and anthelmintic	Parijat	Oleaceae	Leaves, Bark, Root
12	*Ocimum frutescens* L. *Uses*: Cut and wounds, cough, allergy. Leaves are helpful for asthma, influenza, and bronchitis and vomiting	Silam	Lamiaceae	Leaf, stem and seed
13.	*Pouzolzia zeylanica* (L.) Benn *Uses*: Urinary disorder, dysentery, indigestion, toothache, fever, stomach-ache.	Chiplejhar	Urticaceae	Entire Plant
14.	*Rumex bequaertii* De Wild *Uses*: Venereal diseases, leaves in syphilitic ulcers	Halhale	Polygonaceae	Root, leaves
15.	*Tectaria macrodonta* L. *Uses*: Diarrhoea, indigestion and stomach related problems	Kaloniuro	Tectariaceae	Rhizome
16.	*Tinospora sinensis* (Lour.) Merrill *Uses*: Used in chronic diarrhoea, chronic dysentery and also for various urinary troubles.	Gurjo	Menispermaceae	Leaf, stem and root
17.	*Urtica dioica* L. *Uses*: Roots are used in joining the broken joints and decoction of plant are used in jaundice.	Sisnu	Urticaceae	Entire Plant
18.	*Valeriana jatamansi* Jones *Uses*: As remedy for hysteria, nervous unrest and emotional trouble, as carminative, sedative	Sugandha	Valerianaceae	Rhizome
19.	*Viscum album* L. *Uses*: Fracture healing, joins the breakage points, ear disease, paste is applied on the broken limb as plaster	Harchur	Santalaceae	Entire Plant and berry

Table 3. Showing the major medicinal plants used by Ruru

S.N	Local Name	Botanical name	Family	Major Parts they use
1.	*Aegle marmelos* L. Correa	Bel	Rutaceae	Ripen fruit
	Uses: Treatment of diarrhoea, dysentery, chronic constipation and dyspepsia. Unripe fruit is good for stomachic and digestive system			
2.	*Bauhinia variegate* L.	Koiralo	Fabaceae	Root and bark
	Uses: Toothache bleeding, blood dysentery, piles, dyspepsia, ulcers, scrofula, sore throat, cough			
3.	*Cheilanthes bicolor* (Forss K.) Kaulf	Rani sinka	Pteridaceae	Stipe and lamina
	Uses: Stipe to plug ear-piercing holes without infection. Whole lamina is swallowed to settle stomach upset and cure fever			
4.	*Curcuma angustifolia* Roxb.	Haledo	Zingiberaceae	Rhizome
	Uses: Externally applied to sprains wounds and injuries. Fresh juice used as anthelmintic, antiparasitic, and skin affections.			
5.	*Datura stramonium* L.	Dhaturo	Solanaceae	Seeds and flowers
	Uses: Toothache, insomnia, asthma and bronchitis			
6.	*Eupatorium adenophorum* Spreng	Banmara	Asteraceae	Leaves
	Uses: Paste from leaves are used to treat cut wounds			
7.	*Justicia adhatoda* L.	Asuro	Acanthaceae	Leaves
	Uses: Cough and bronchitis to facilitate the sputum to come out			
8.	*Mentha spicata* L.	Pudina	Lamiaceae	Leaves
	Uses: Gastritis, sore throat, and headache			
9.	*Myrica esculenta* Buch.-Ham. ex D. Don	Kaphal	Myricaceae	Fruits and Bark
	Uses: Used for fever, diarrhoea, and ear, nose, and throat disorders			
10.	*Oxalis latifolia*	Amilo jhar	Oxalidaceae	Whole plant
	Dysentery, cholera and gastritis			
11.	*Terminalia bellirica* Gaertin. Roxb	Barro	Combretaceae	Fruit
	Uses: Stomach disorder, fever and leprosy			
12.	*Terminalia chebula* Retz.	Harro	Combretaceae	Fruit
	Uses: As carminative, tonic, common cold and throat pain			
13.	*Zanthoxylum aramatum* DC	Timur	Rutaceae	Fruit and bark
	Uses: Tonic in fever, dyspepsia and cholera, toothache, and stomach disorder			
14.	*Emblica officinalis*	Amala	Euphorbiaceae	Fruits and roots
	Uses: Diarrhoea, dysentery, jaundice, asthma, blood purifier, hair care and skin care			

Table 4. Phytochemical Analysis of Medicinal Plants

Name of plants	Parts used	Secondary Metabolites								
		Al	Ca	Gl	Fl	Ta	Te	Sa	Oi	Pr
Acorus calamus	Rhizome	+	+	+	+	+	+	+	+	+
Amaranthus blitum syn *lividus*	seed	+	-	-	+	+	+	+	-	+
Artemisia vulgaris	Leaves	+	-	+	+	+	-	+	+	-
Astilbe rivularis	Bark	+	+	-	+	-	+	+	+	+
*Cheilanthes bicolo*r	Whole Plant	+	+	+	+	+	-	+	+	-
Chenopodium album	Leaves, stem	+	+	-	-	+	+	+	-	-
Emblica officinalis	Fruit	+	+	+	+	+	-	+	+	-
Hyoscyamus niger	Leaves	+	+	-	+	+	-	-	+	-
Juslica adhatoda	Leaves	+	-	-	+	+	+	-	+	-
Mentha spicata	Leaves	+	+	+	-	+	+	+	+	-
Occimun sanctum	Leaves and Seed	+	+	-	+	+	+	-	-	-
Prunus cerasoides	Bark	+	+	+	-	+	+	+	+	+
Swertia chirayita	Stem	+	-	-	+	+	+	+	+	-
Tectaria macrodonta	Rhizome	+	+	+	+	+	-	+	+	-
Terminalia bellirica	Fruit	+	+	+	+	+	+	-	+	-
Terminalia chebula	Fruit	+	+	-	+	+	+	-	+	-
Valeriana jatamansi	Rhizome	+	+	+	+	-	+	-	+	+
Zanthoxylum aramatum	Seeds	+	+	+	+	+	+	-	+	-

Al: Alkaloids, Ca: Carbohydrates, Gl: Glycosides, Fl: Flavonoids, Ta: Tannins, Te: Terpenoids, Sa: Saponins, Oi: Oils, Pr: Protein, + indicate presence, - indicate absence

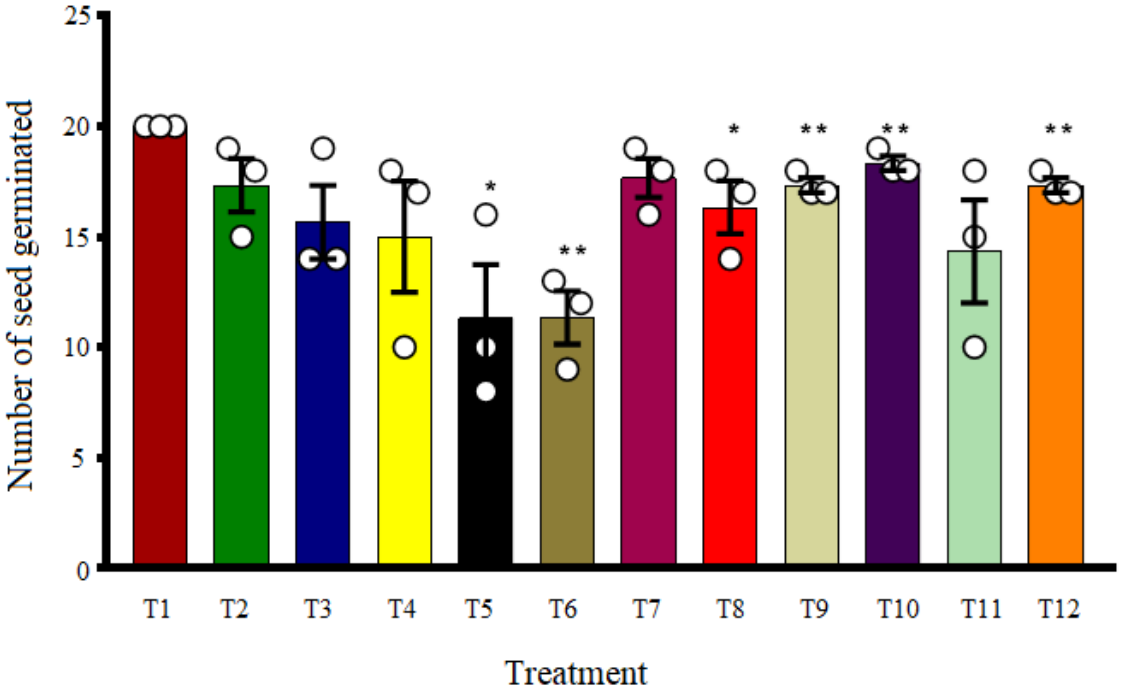

Figure 2. Average number of seeds germinated in each treatment

Results are presented as mean ± SEM, *P≤0.05, **P≤0.01 (Control versus Treatment) and by non-paired t test.

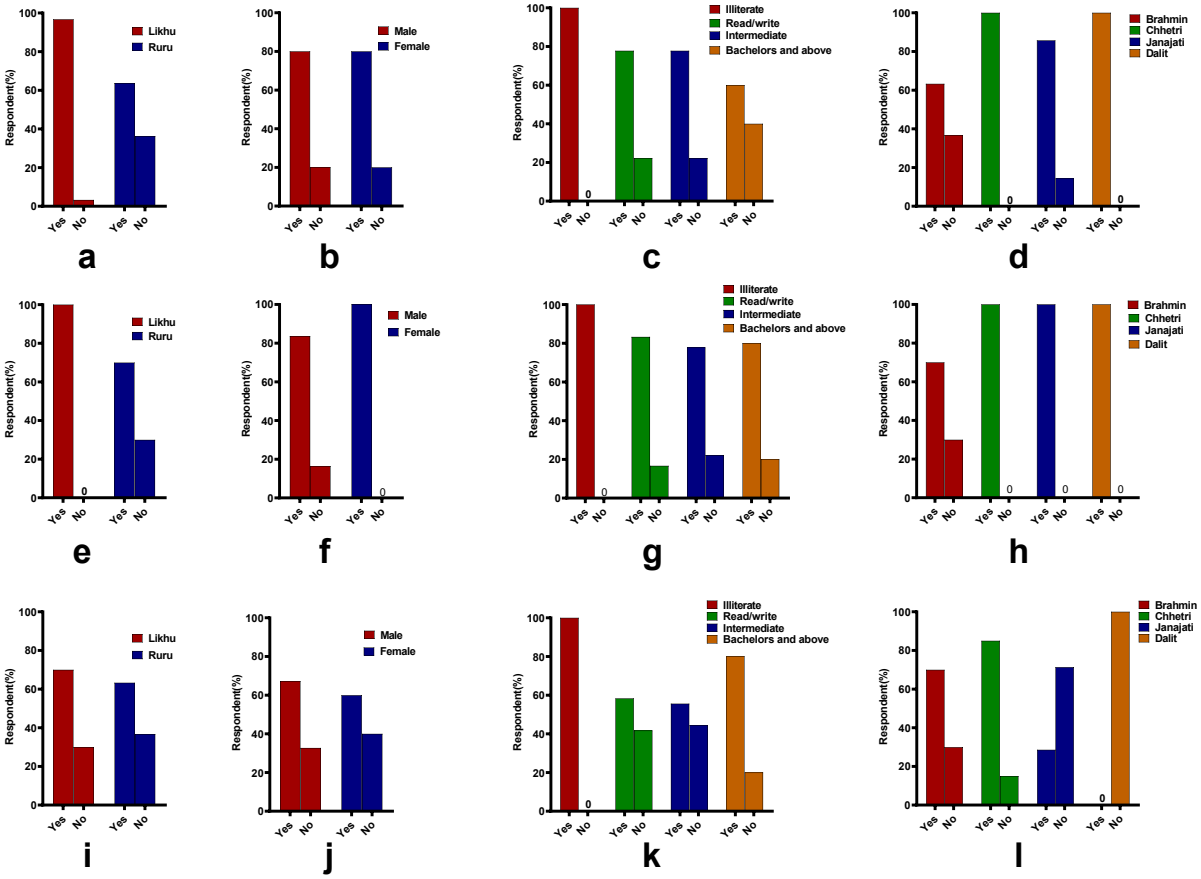

Figure 3. Socioeconomic Attributes about medicinal plants

(a-d) Use of medicinal plants over synthesized medicines: a. Village* ($\chi2$= 10.417, df=1), b. gender c. Education d. Ethnicity

(e-h) Effect of medicinal plants in their daily lives: e. Village* ($\chi2$=10.59,df=1) f. gender g. Education h. Ethnicity*($\chi2$=10.588,df=3)

(i-j) Young family members acquainted with the medicinal plants i. Village j. gender k. Education l. Ethnicity** ($\chi2$=13.746, df=3)

Data information: * indicate P≤0.05 and ** indicate P≤0.01 by chi square test

The Methanol extract of *Amaranthus viridis* L. showed the presence of alkaloids, tannins, protein, flavonoid, and saponin (Nehal et al., 2016) and the absence of carbohydrate, glycoside, and oils (Gavit and Patel, 2019).

Flavonoid was found to be absent in *Mentha spicata* (Kakatiet al., 2016) and *Prunus cerasoides* (Thakur and Sidhu, 2014). Glycoside, carbohydrate, saponin and protein was found to be absent in methanol extract *Justicia adhatoda* which is also found in research conducted in (Malathi, 2018) but a study done by (Abhishek et al., 2014) showed that glycoside was present. Phytochemical analysis *Astilbe rivularis* shown that glycosides and tannin were absent, which is supported by (Shrestha et al., 2015). *Hyoscyamus niger* showed the absence of glycosides, terpenoids, and saponin, but a study done by (Krishnaveni and Hariharan, 2017) showed that glycoside and saponin were present. Phytochemical analysis of fruits of *Emblica officinalis* and *Terminalia bellirica* showed that alkaloids, flavonoid, tannins, phenols, and saponin were present but protein was absent (Badon et al., 2016). Our study showed that glycoside and carbohydrates were also present in both of them. Glycosides and saponin were not detected in the fruits of *Terminalia chebula* (Vemuri et al., 2019) while another study by (Krishnaveni M et al., 2017) showed that glycoside is present including other as alkaloids, saponin, and oils. Saponin and protein were absent in *Zanthoxylum armatum* (Mehta et al., 2013). Main phytoconstituents such as tannins, carbohydrates, phenols, and alkaloids were found to be present while protein and flavonoid were absent in the methanolic leaf extracts of Chenopodium album, results are under the former studies (Kaur et al., 2018; Saini et al., 2019). The results of phytochemical analysis of *Swertia chirayita* showed the presence of various phytochemicals such as alkaloids, flavonoid, phenols, saponin, tannins and terpenoids (Kumar et al., 2015). Phytochemical study of *Occimun sanctum* discovered presence of alkaloids, flavonoid and tannins while it showed negative result in case of protein, saponin and oil (Panchal and Parvez, 2019). Phytochemical analysis of methanol extracts of *Tectaria macrodonta* revealed the presence of saponin, tannin, flavonoid, phenol, carbohydrate and glycosides (Poudyali and Singh, 2019). The qualitative phytochemical screening of the of *Prunus cerasoides* leaves showed the presence of alkaloids, terpenoids, phenol, tannins, saponin, glycosides, carbohydrate, protein in methanol extract (Joseph et al., 2016).

We also observed the allelopathic effect of the medicinal extracts inhibiting the growth of some mungbean seeds, i.e. not 100% of the seeds in all three replications were germinated except in control. The data are graphically shown in Figure 1.

Among these twelve treatments, only treatment 1, i.e., controlled, resulted in full germination of the mungbean seed, along with the radicle and plumule development. In contrast, the remaining resulted in germination but inhibited the further growth to radicle and plumule in given time. The first germination was seen in 3 days, and within 7 days all were germinated in control. While in other extracts, the germination started only after 8 days and continued up to 15 days, but no further growth was seen. There was a significant difference between control and other treatments (Figure 2). Socio-economic attributes to medicinal plants with respect to the village, gender, education, ethnicity, and different aspect is shown in Figure 3. The responses in those two areas were found to significantly different in the use of synthetic drugs and impact on their lives.

Discussion

Different parts of plant, leaf, stem, bark, root/rhizome, flower, fruit, seed, and whole plants are used by them for different ailment, which include gastrointestinal problems (diarrhoea, dysentery, gastritis, abdominal pain, etc.), respiratory tract related problems (cough/cold, sore throat, asthma), cuts and wounds, dermatological problems (burns, swellings and other skin related problems) and other different purposes. The above study concludes people have profound knowledge of medicinal plants and one plant can be used to cure number of diseases without having any side effects. But, they are unknown about the fatalism and hazardous impact of some medicinal plants. The Strong focus should be given for the documentation of uses, traditional knowledge and practices of the medicinal plants and hazardous effect.

Phytochemical analysis of the different medicinal plants revealed the number of chemicals present in it, known to have therapeutic and physiological function. Some of those phytochemicals have more than one function, which has much more scope for further well-organized research in screening those medicinal plants and evaluating their potential for protection against different types of diseases (Kurmukov, 2013). Alkaloids are important natural products with many pharmacological activities like analgesic, antibacterial, antiasthma and antiarrhythmic (Sayhanet al., 2017), antimalarial and anticancer activities (Wink et al., 1998). Flavonoid possesses several significant properties like antiviral, antibacterial, antifungal, antioxidant, anticancer and antitumor (Xiao et al., 2016), anti-inflammatory (Panche et al., 2016), and antiallergic (Tapas et al.,2008). Glycosides are found to lower blood pressure (Nyarko and Addy, 1990). Tannin containing plant extracts have been used as astringents, diuretics, against diarrhoea, against stomach and duodenal tumors (De Bruyne et al., 1999), anti-inflammatory, antiseptic, antioxidant, and haemostatic pharmaceuticals (Dolara et al., 2005). Terpenoids have antimicrobial, antimalarial, anticarcinogenic, antiulcer, and diuretic activity (Dudareva et al., 2009). Saponin regulates blood glucose level and prevents diabetic complications due to their antioxidant activity (El et al., 2017) and also has an inhibitory effect on inflammation (M.J. Just et al., 1998). The allelopathic effect of methanol extract on those medicinal plants may be due to the presence of a single phytochemical compound or may be due to synergetic effect. Those compound interfere with the activities of a respiratory enzyme in seed germination that causes an inhibitory effect of germination (Devkota and Sharma, 2015), or they can alter the action of growth hormone, i.e., Gibberellic acid, which is responsible for the stimulation of germination (Olofsdotter, 2001).

The availability of medical stores, hospitals in Ruru may be the reason for using less medicinal plants and less impact in their daily lives. The literate people are not updated to the different treatment methods and are mainly

dependent on synthetic drugs rather than medicinal plants. Our study also suggests that the young generation learned about the use of medicinal plants from their family and family members are the most important source of knowledge for the new generations too (similar to Bruschi et al., 2019; Dopico et al., 2008).

Conclusion

The present study revealed that the study area is rich in various types of valuable medicinal plants and has played a pivotal role in the treatment of several diseases. But, knowledge is gradually decreasing in the young generation. So the concentration for the documentation of this knowledge along with the identification, conservation, and cultivation technique is essential. The phytochemical study showed the presence of some essential chemical constituents in the plants. The literature studied concludes that the presence of those phytoconstituents shows medicinal and physiological properties so that it can be used as a good source for useful drugs. Further study is essential for isolation, purification of those phytochemicals, and analysis of their individual and combined effect using a different technique which could add some value in trade and commerce as these resources have tremendous export potentiality in the Nepalese scenario. Allelopathic effects of the plant extracts were well visible when experimented under the mungbean seeds in the in-vitro condition. These plants could suppress the growth of other plants growing in the same crop field. They indirectly can be used as natural biopesticides that could prevent the infestation of various outcrops. These biopesticides can be less harmful to the environment as compared to synthetic pesticides or other agrochemicals. Other research could be conducted to explore its additional application of such extracts in controlling the insect pest population and disease preventing processes. The knowledge of the medicinal plants is not growing and changing. The youngest generation living in the society could not experience knowledge of different medicinal plants, their impact on health. The perception of people should be focused on the use of medicinal plants. All people, including the young generation, should be aware of the value and crucial contribution of medicinal plants to human societies from ancestors to this period.

Conflicts of interest

The authors declare that they have no conflicts of interest.

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