Research Paper

Ethnomedicinal exploration of plants utilized by the people of Suryabinayak Municipality in Bhaktapur district, Nepal

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Abstract: Ethnomedicine refers to the use of medicinal plants by a society, ethnic group or tribe for health benefits and for the prevention, treatment, and cure of different ailments. The healthy relationship between plants and humans has been continuing since the start of human civilization. The present study aims to document the medicinal information about plants used by ethnic people in different wards of Suryabinayak Municipality, Bhaktapur district, to conserve and utilize the traditional knowledge. Ethnomedicinal data were collected by a Rapid Rural Appraisal (RRA) method such as door to door surveys, direct observation. Individual interviews, field visits, and a questionnaire survey with the guidance of key informants. The present study has documented 107 medicinal plant species under 60 families which are used for prevention and treatment of 39 different diseases like Jaundice, diarrhea, dysentery, and cancer and 46 distinct health benefits like cough, cold, anti-bleeding, stomachache, diarrhea, fever, blood pressure, fracture, toothache, etc. Suryabinayak Municipality has a rich diversity in culture, ethnic groups, and medicinal plants, along with a wide geographic and climatic condition. However, with modernization, urbanization, deforestation, and increasing residential areas, the occurrence and use of medicinal plants have been diminished. Thus, documentation of this research is vital for further pharmaceutical research and enhancement and preservation of traditional knowledge of local people living in Suryabinayak Municipality and Nepal.

Keywords: diseases, ethnomedicine, Suryabinayak Municipality, traditional knowledge

1. Introduction

Nepal embraces huge plant biodiversity, totaling about 10,167 plant species, of which over 7,000 are flowering plants, and over 1,600 species are medicinal and aromatic herbs [1,2]. Altogether 126 castes / ethnic groups reported in Nepal speaking 123 languages as mother tongue [3]. Nepal is a multilingual, multireligious, and multicultural country, where each ethnic group has its own culture, tradition, and folk practices for the utilization of wild plants [4,5]. Different groups of people in Nepal utilizes different plant resources as a source for food, fodder, timber, fiber, dye, housing material, ornament, religious activities, etc. According to Chaudhary et al. [5], Tharu people of eastern Nepal has been using several plant species for food, fodder, medicine, ornament, religious, and other household purposes. Many other researchers have reported the use of plants by several ethnic groups of Nepal as a source of their daily needs. Besides, the traditional way of utilizing the plants for treatment and prevention of disease by Nepalese and South Asian people dates back to prehistoric times [6,7]. General estimation of about 80-90% of people living in the rural area of Nepal relies on traditional medicinal practices directly or indirectly, where 85% involves the use of plant extracts has

been made [8]. Therefore, Nepal has been pointed out as a hotspot for the research of medicinal plants [9,10].

The use of plants as a source of medicine is very crucial for all living organisms known. All ethnic groups of Nepal have been giving continuation to the tradition of using plants for medicinal uses. Many researchers have contributed to the field of ethnobotany and ethnomedicine in Nepal. Thapa [11] has documented the ethnomedicinal use of 75 different plant species among the Magar community of Salija Village Development, Central Nepal. Kunwar and Adhikari [12] have documented 58 medicinal plant species used by the local people of Dunai, Juphal, Suu, Sahartara, and Majphal villages of Dolpa district. Singh et al [13] have identified 70 medicinal plant species used for the management of healthcare problems among the Magar tribal community of Palpa district, Nepal. Chaudhary et al [5] have documented the use of 37 plant species by Tharu community of eastern Nepal for various purposes like medicine, food, fodder, ornament, etc. The ethnomedicinal and ethnobotanical studies of plants have been performed in many parts of Nepal. Some study of medicinal plants has been conducted in the neighboring district to Bhaktapur. Balami [14] has reported 119 medicinal plant species used by the Newar community of Pharping village of Kathmandu district, Nepal. The plants and animals used for the medicinal purpose by 'Balami' community origin Okharpauwa VDC, Sindhupalchok has been documented and found altogether 185 plant species are in use brought from forest, cultivation, and purchase of 65 families and 151 genera [15]. However, in Bhaktapur district, Central Nepal, very scarce scientific studies conducted in Ethnomedicine. The present study aims to explore, identify, and document ethnomedicinal information about plants among the people of the Suryabinayak Municipality of Bhaktapur District, Nepal.

2. Results

Ethnomedicinal data of 107 plant species belonging to 98 genera within 60 families were recorded in the present study. Appraisal methods like the door to door survey, individual interview, field visit and group discussion were held with differebt group of people (Fig. 1A). Among 107 plant species, the highest number of plants was collected from Katunje followed by Gundu and lowest collected from Nangkhelward (Fig. 1B).

Figure 1. A) Details of respondents. B) Number of plants collected in different wards

In total 107 plant species, 69.15% (n=74) species were wild and 30.84 % (n=33) species were cultivated (Fig. 2A). Similarly, 57% (n=61) herbs, 26% (n=28) tree, 14% (n=15) shrub, 2% (n=2) fern and 1% (n=1) grass were recorded as the life form of present study (Fig. 2B). In the present study, 9.32 % (n=11) bark, 0.85 % (n=1) bulb, 5.95% (n=7) flower, 1.70% (n=2) fruit covering, 11.05% (n=13) fruit, 24.65% (n=29) leaf, 16.15% (n=19) seed, 2.55% (n=3) rhizome, 4.25% (n=5) root, 0.85% (n=1) node, 0.85% (n=1) stem, 2.55% (n=3) whole plant were used as plant parts for herbal preparation of drugs (Fig. 3). The present

study has recorded 107 plant species with their scientific names, local names, plant parts used, plant source, life forms and their medicinal uses (Table 1).

Figure 2. A) Nature of plant species. B) Life forms of medicinal plants

Figure 3. The proportion of different plant parts used for the ethnomedicinal purpose in Suryabinayak Municipality

91
92
93
94
95

Table 1: List of collected voucher plants, their scientific name, local name, family, life form, parts used, plant source and their application

Scientific Name	Voucher		Local Name	Life		Plant	
	No .	Family		Form	Parts Used	Source	Use / Application
<i>Abrus precatorius</i> L.	SBP1	Leguminasae	Ratigedi	H	Seed	Wild	Clean dust and foreign particles on eyes
<i>Acacia catechu</i> (L.f.) Willd.	SBP2	Fabaceae	Khayar	T	Bark	Wild	Fracture
<i>Achyranthes aspera</i> L.	SBP3	Amaranthaceae	Bhende Kuro	H	Seed	Wild	Toothache
<i>Acorus calamus</i> L.	SBP4	Araceae	Bojho	H	Root	Wild	Neck Problem, Cough, Cold, body pain, Gastritis
<i>Ageratina adenophora</i> (Spreng.) R.M. King & H. Rob.	SBP42	Asteraceae	Banmara	H	leaf	Wild	Stop bleeding, Fever
<i>Ageratum conyzoides</i> L.	SBP5	Asteraceae	Gandhejhar	H	leaf	Wild	Blood clotting
<i>Allium sativum</i> L.	SBP6	Amaryllidaceae	Lasun	H	Bulb	Cultivated	Gastritis, Herpes Zoster
<i>Aloe vera</i> L.	SBP7	Liliaceae	Ghiukumari	H	Leaf	Cultivated	Latex is used to make silky hair, heal fire burn and juice is taken to treat hypertension, diabetes, Dandruff, Headache
<i>Artemisia vulgaris</i> L.	SBP8	Asteraceae	Titepati	H	Leaf	Wild	Paste to stop bleeding, juice is used to clear alimentary canal, Typhoid, Antidandruff, Asthma, avoiding crying habit of baby, bone swelling, bad smell from armpit
<i>Astilberi vularis</i> Buch. -Ham, exD. Don	SBP9	Saxifragaceae	Thulo Okhati	H	Flower	Wild	Pregnancy, vitamins, Diarrhea
<i>Azadirachta indica</i> A. Juss.	SBP10	Meliaceae	Neem	T	Bark, leaf	Wild	Bark or leaf crush into powder and take juice for Fever, Headache, Body Pain; Leaf to clean face; Insomnia; Asthma; Herpes Zoster

							Tonic, Blood purifier, Dysentery, Blood in Stool, Stomach-ache
<i>Bauhinia variegata</i> L.	SBP11	Fabaceae	Koiralo	T	Bark	Wild	
<i>Bergenia ciliata</i> (Haw.) Sternb.	SBP12	Saxifragaceae	Pakhanbed	H	Rhizome	Wild	Diarrhea, Fever, Vomiting
<i>Bignonia ignea</i> Vell.	SBP13	Bignoniaceae	Khorsani Phool	S	Flower	Wild	Diarrhea, dysentery
<i>Brassica sinapis</i> Noulet	SBP14	Brassicaceae	Tori	H	Seed	Cultivated	<i>Seed Pina</i> is used to removing dandruff
<i>Butea frondosa</i> Willd.	SBP15	Leguminasae	Buletro	T	Seed	Wild	Anthelmintic
<i>Calotropis gigantea</i> (L.) W.T. Aiton	SBP16	Asclepiadaceae	Ank	T	Leaf	Wild	Body pain, removing a thorn
			Akabare				
<i>Capsicum microcarpum</i> DC.	SBP17	Solanaceae	Khorsani	H	Fruit	Cultivated	Gastritis, diabetes
							Leaf is useful in Throat, Urine, Fever, Stress relief, Memory boost, Blood Clotting, Stone
<i>Centella asiatica</i> (L.) Urb.	SBP18	Apiaceae	Ghodtapre	H	Leaf	Cultivated	
<i>Cheilanthes dalhousiae</i> Hook.	SBP19	Pteridaceae	Ranisinka	H	Whole part	Wild	Ulcer, stomachache, Gastritis
<i>Cinnamomum tamala</i> (Buch.-Ham.) T. Nees & C. H. Eberm.	SBP20	Lauraceae	Dalchini	T	Bark, Leaf	Wild	Fever, Cough
<i>Cissampelo spareira</i> L.	SBP21	Menispermaceae	Gujro Gano	H	Rhizome	Wild	Abdominal cramping, Typhoid, No appetite
<i>Cissampelo spareira</i> var. <i>hirsute</i> (Buch.-Ham. Ex DC) Forman	SBP22	Menispermaceae	Badal Pate	H	Leaf	Wild	Blood clotting, bleeding on women
<i>Citrus sinensis</i> (L.) Osbeck	SBP23	Rutaceae	Suntala	T	Fruit covering	Wild	Anthelmintic
<i>Cleisto calyxoperculatus</i> (Roxb.) Merr. & L.M. Perry	SBP24	Myrtaceae	Kyamuna	T	Leaf	Wild	Sinusitis
<i>Coixlacryma-jobi</i> L.	SBP25	Poaceae	Bhirkauli	G	Root	Wild	Stomachache, Fever
							Vitamins and minerals source, Blood in Stool, Sting/bee bite,
<i>Colocasia esculanta</i> (L.) Schott	SBP26	Araceae	Karkalo, Pidalu	H	Stem/Nodes	Cultivated	Dog bite
<i>Coriandrum sativum</i> L.	SBP27	Apiaceae	Dhaniya	H	Seed	Cultivated	Pimple
							Leaf and young shoot part are boiled or take as a vegetable to treat cancer, blood pressure, Herpes Zoster anti-cancerous
<i>Crataevauni locularis</i> Buch.-Ham.	SBP28	Capparidaceae	Sipleegaan	T	Leaf	Wild	

<i>Cucumis sativus</i> L.	SBP29	Cucurbitaceae	Kakro	H	Fruit	Cultivated	Stone problem
<i>Cuminum cyminum</i> L.	SBP30	Apiaceae	Jeera	H	Seed	Cultivated	Boil in hot water for cough and cold
<i>Curcuma caesia</i> Roxb.	SBP31	Zingerberaceae	KaloHaletto	H	Rhizome	Wild	Gastritis, Abdominal cramping
<i>Curcuma domestica</i> Vaeleton.	SBP32	Zingiberceae	Beshar	H	Rhizome	Cultivated	Boil in hot water for cough and cold
<i>Cuscuta reflexa</i> Roxb.	SBP33	Convolvulaceae	Akasbeli	H	Whole part	Wild	Plant decoction for Jaundice, Joint pain
<i>Cynodon dactylon</i> (L.) Pers.	SBP34	poaceae	Dubo	H	Leaf	Wild	Stop bleeding, Mental relief, juice drop in nose blocking, Jaundice, Urine Problem, Albinism (Dubi), Burning while urination
							Seed paste is used in massage when the body is feeling tired and pain.
<i>Datura metel</i> L.	SBP35	Solanaceae	Kalo dhaturu	H	Seed	Cultivated	
<i>Dichrocephala integrifolia</i> Kuntze	SBP36	Asteraceae	Chiku Jhar	H	Whole part	Wild	Plant juice is used in fever.
<i>Diplazium esculentum</i> (Retz.) Sw.	SBP37	Athyriaceae	Niuro	F	leaf	Wild	Hypertension, Diabetes
<i>Dolichos lablab</i> L.	SBP38	Fabaceae	Tate Simi	H	Rhizome	Cultivated	The paste is applied in fracture
<i>Drymaria cordata</i> (L.) Roem. & Schult.	SBP39	Caryophyllaceae	Abijalo	H	Laf	Wild	Make a paste and inhale smell for Cough, juice drop in the nose for Sinusitis, Jaundice, Appetizer, Burning feel on chest
<i>Duchesnea indica</i> (Andr.) Focke	SBP40	Rosaceae	BhuinKafa	H	Fruit	Wild	Hotness in body
<i>Duranta repens</i> L.	SBP41	Verbenaceae	Nilkanda	S	Whole part	Wild	Jaundice, Hypertension
<i>Euphorbia hirta</i> L.	SBP43	Euphorbiaceae	Dudhe	H	Plant latex	Wild	Hypertension, Diabetes
<i>Euphorbia royleana</i> Boiss.	SBP44	Euphorbiaceae	Siundi	S	leaf	Wild	Fever, stop bleeding, remove the thorn in body
<i>Ficus auriculate</i> Lour.	SBP45	Moraceae	Timila, Bhutuk	T	Fruit	Wild	Diarrhea
<i>Ficus religiosa</i>	SBP46	Moraceae	Pipal	T	Bark	Wild	Measles
<i>Gaultheria fragrantissima</i> Wall.	SBP47	Ericaceae	Dhasingre	S	Young shoot	Wild	Antiseptic, Injury
<i>Gonostegia hirta</i> (Bl.) Miq.	SBP48	Urticaceae	Maslahari	H	Rhizome,	Wild	Paste is applied in fracture
					Flower		
<i>Helianthus annuus</i> L.	SBP49	Asteraceae	Surya Mukhi	H	Seed	Cultivated	Throat problem
<i>Hordeum vulgare</i> L.	SBP50	Poaceae	Jamara	H	Aerial part	Cultivated	Gastritis, Jaundice, Cancer, increase immunity

<i>Imperata cylindrical</i> (L.) P. Beauv.	SBP51	Poaceae	Siru	H	Root	Wild	Intestinal worm
<i>Jasminum mesnyi</i> Hance	SBP52	Oleaceae	Jai Plant	S	Flower	Cultivated	Tongue problem, Earache, Cough and Cold
<i>Justicia adhatoda</i> L.	SBP53	Acanthaceae	Asuro	S	Whole part	Wild	Boil in water to treat Fever, Typhoid, Piles
<i>Lagenaria siceraria</i> (Molina) Standl.	SBP54	Cucurbitaceae	Lauka	H	Fruit	Cultivated	Juice in hypertension
<i>Leucas cephalotes</i> Spreng.	SBP55	Lamiaceae	TaukeJhar	H	leaf	Wild	Herpes Zoster
<i>Lobelia pyramidalis</i> Wall.	SBP56	Campalunaceae	Eklebir	T	Bark	Wild	Fertility
<i>Macrotylomauni florum</i> (Lam.) Verdc.	SBP57	Papilionaceae	Gahat	H	Fruit	Cultivated	Stone problem
<i>Mahonia sikkimensis</i> Takeda	SBP58	Berberidaceae	Chutro	S	Bark/Root	Wild	Diabetes, Hypertension
<i>Melia azedarach</i> L.	SBP59	Meliaceae	Bakaina	T	Seed	Wild	Chewing seed as anthelmintic
<i>Mentha arvensis</i> L.	SBP60	Lamiaceae	Pudina	H	Aerial part	Cultivated	Fever, Headache, cold
<i>Momordica charantia</i> L.	SBP61	Cucurbitaceae	Titekarela	H	Fruit	Cultivated	Juice or vegetable in hypertension
<i>Musa</i> spp.	SBP62	Musaceae	Kera	H	Stem	Cultivated	Stem water to cure ear problem
<i>Myrica esculenta</i> Buch.-Ham. ex D. Don	SBP63	Myricaceae	Kafal	S	Leaf	Wild	Leaf paste is used to stop bleeding, bark and seed juice is used in treat bone injury
<i>Myristica fragrans</i> Houtt.	SBP64	Myristicaceae	Jaifal	T	Seed	Wild	Fruit juice is used in Diarrhea, Relief from stress
<i>Nardostachys jatamansi</i> DC.	SBP65	Caprifoliaceae	Jatamasti	H	Root/Rhizome	Wild	Mental weakness, Insomniac
<i>Nyctanthes arbor-tristis</i> L.	SBP66	Oleaceae	Parijat	T	Flower	Wild	Jaundice, Piles
<i>Ocimum sanctum</i> L.	SBP68	Lamiaceae	Tulsi	H	leaf	Cultivated	Fever, Cough
<i>Ocimum basilicum</i> L.	SBP67	Lamiaceae	Babari	H	Leaves	Cultivated	Diabetes
<i>Oroxylum indicum</i> (L.) Benth. Ex Kurz	SBP69	Bignoniaceae	Tatelo	T	Seed	Wild	Blood stool
<i>Osyris wightiana</i> Wall. Ex Wight	SBP70	Santalaceae	Nundhiki	H	Leaf	Wild	Fracture
<i>Phyllanthus emblica</i>	SBP71	Phyllanthaceae	Amala	T	Bark, seed	Wild	Asthma, Gastritis
<i>Phytolacca acinosa</i> Roxb.	SBP72	Phytolaccaceae	Jaringo	H	Rhizome	Wild	No Fertility

<i>Phytolacca decandra</i> Descourt.	SBP73	Phytolaccaceae	ChinkeGhas	H	Leaf	Wild	Jaundice, sinusitis, Herpes Zoster
<i>Piper longum</i> L.	SBP74	Piperaceae	Pipla	H	Fruit	Cultivated	Respiratory problem
<i>Piper nigrum</i> L.	SBP75	Piperaceae	Marich	S	Seed	Wild	Used to cure pus
<i>Pogostemon bengalensis</i> (Burm.f.) Kuntze	SBP76	Labiatae	Rudhilo	H	Leaf/Bark	Wild	Cough, Toothache
<i>Polystichum</i> spp.	SBP77	Dryopteridaceae	Bhyaute	F	Whole part	Wild	Jaundice
<i>Prunus armeniaca</i> L.	SBP78	Rosaceae	Aaru	T	Leaf	Wild	Leaf juice is against lice
							Diarrhea, Silky Hair, Bark in intestinal worm, fever, indigestion, liver problem, Gastritis, Stomachache, Abdominal cramping, Hypertension
<i>Psidium guajava</i> L.	SBP79	Myrtaceae	Amba	T	Leaf, Fruits	Cultivated	
<i>Punica granatum</i> L.	SBP80	Lythraceae	Aanar	T	Bud	Cultivated	Diarrhea, Dysentery
<i>Quercus lanata</i> Sm.	SBP81	Fagaceae	Banjh	T	Bark	Wild	Gastritis, Abdominal cramping
<i>Raphanus sativus</i> var. longipinnatus L.H. Bailey	SBP82	Brassicaceae	Mula	H	Seed	Cultivated	Appetite, paste in pimple
<i>Reinwartia indica</i> Dum.	SBP83	Linaceae	Pyayooli	S	Flower	Wild	Jaundice
							Remove fish bones which are stuck in the gullet, Menstrual Disorder
<i>Rhododendren arboretum</i> Sm.	SBP84	Ericaceae	Laligurans	T	Flower	Wild	
<i>Rubus ellipticus</i> Sm.	SBP85	Rosaceae	Aiselu	S	Root	Wild	Stomachache
<i>Schima wallichii</i> (DC.) Korth.	SBP86	Theaceae	Chilaune	T	Bark	Wild	Gastric
<i>Shorea robusta</i> C.F. Gaertn.	SBP87	Dipterocarpaceae	Sal	T	Leaf	Wild	Piles, cancer, stone, SaalDhoop in Herpes Zoster
<i>Smallanthus sonchifolius</i> (Poepp.)	SBP88	Asteraceae	BhuinShyau	H	Rhizome	Cultivated	Fear of height, altitude, diabetes
<i>Solanum xanthocarpum</i>	SBP89	Solanaceae	Kantakari	S	Seed	Wild	Seed paste for toothache, Silky hair
<i>Solanum nigrum</i> L.	SBP90	Solanaceae	KaloMunte	H	Fruit	Wild	Fever, Gastric, Cough
<i>Solanum tuberosum</i> L.	SBP91	Solanaceae	Aalu	H	Fruit cover	Cultivated	Jaundice
<i>Solena amplexicaulis</i> (Lam.) Gandhi ex Saldanha & Nicolson	SBP92	Cucurbitaceae	Golkakri	H	Fruit	Wild	Stone problem, appetizer, Fever

<i>Spilanthes calva</i> DC.	SBP93	Asteraceae	Marauthi	H	Fruit	Cultivated	Toothache
<i>Spilanthes oleracea</i> L.	SBP94	Asteraceae	Goraspán	H	Fruit	Wild	Toothache
<i>Syzygium aromaticum</i> (L.) Merr. & L.							
M. Perry	SBP95	Myrtaceae	Lwang	T	Seed	Cultivated	Toothache, Blood pressure
<i>Tagetes erecta</i> L.	SBP96	Asteraceae	Sayapatri	H	Flower	Wild	Appetite loss, Pneumonia
<i>Taxus wallichiana</i> Zucc.	SBP97	Taxaceae	Lothsalla	T	Leaf, Twig	Wild	Fever, stop bleeding, anti-cancerous
							Fruits are chewed in sore throat, stomach disorder, piles,
<i>Terminalia bellerica</i> Roxb.	SBP98	Combretaceae	Barro	T	Fruit	Wild	diarrhea, fever and cough, Asthma
<i>Terminalia chebula</i> Retz	SBP99	Combretaceae	Harro	T	Bark	Wild	Burn Seed in Cough, Bark in Tonsils, Asthma
<i>Thalictrum foliolosum</i> DC.	SBP100	Ranunculaceae	Dampate	H	Whole part	Wild	Antiseptic while piercing the ear of children
							Milk increase of lactating women, children or people
<i>Trachyspermum ammi</i> Spargue	SBP101	Apiaceae	Jwano	H	Seed	Cultivated	suffering from cold, nutritious food, flatulence
<i>Trigonella foenum-graecum</i> L.	SBP102	Fabaceae	Methi	H	Leaf, Seed	Cultivated	Uric acid, Blood pressure
							Root, Aerial part paste in Fracture; Root juice and cooked
							aerial part reduced blood pressure, Jaundice, increase the
<i>Urtica dioica</i> L.	SBP103	Urticaceae	Sisnu	H	Root, Leaf	Wild	milk of lactating women
<i>Vitex negundo</i> L.	SBP104	Lamiaceae	Simali	S	Leaf	Wild	Sinusitis
<i>Woodfordia fruticosa</i>	SBP105	Lythraceae	Dhairo	S	Leaf, Flower	Wild	Fever
<i>Zanthoxylum armantum</i> DC.	SBP106	Rutaceae	Timur	S	Seed	Wild	Seed boil with water for indigestion
<i>Zingiber officinale</i> Roscoe.	SBP107	Zingiberaceae	Aduwa	H	Rhizome	Cultivated	Cold, Cough

H represents Herbs, S represents shrubs, T represents trees, and F represents fern.

Discussion

The present study documented altogether 107 medicinal plant species that belong to 98 genera and 60 families. These plants are widely used for curing and preventing different diseases and for health benefits by the denizens of the Suryabinayak Municipality. An ethnomedicinal study conducted in Kavrepalanchwok district previously, regarding the utilization of the indigenous knowledge found that 68 plant species belonging to 59 genera from 37 families [16], out of which ten genera are similar to our present work. Similarly, in Dang district, West Nepal, research on ethnomedicine found 85 plant species belonging to 79 genera and 56 families as potential plants used by the indigenous people [17], where 21 species belonging to 28 genera have similar findings compared to our present work. In the present study, herbs (57%) were found to be dominating life forms in the comparison of trees, grasses, shrubs, and ferns. This might be due to the naturally abundant occurrence of herbs. Shrestha and Dhillion [18] have reported that herbs are found abundantly and naturally in the environment. Adhikari et al. [19] and Magaret al. [20] have also documented herbs as dominating life forms in their study. However, Cheikhyoussef et al. [21] have reported 28 trees, 15 herbs, 10 shrubs, and 4 climbers in their research. It is evident from the study that the ethnic communities are dependent on a variety of plants to meet their daily lives and health requirements.

In the present study, leaves have been used vigorously as the plant parts for the medicinal purpose directly or indirectly, followed by seed, fruit, bark, and so on. This might be due to the easy availability of the leaves and as a major part of nutrients synthesis and thus higher biochemical activity. The dominance of leaf as a plant part in the present study has been supported by Chaudhary et al. [5], Acharya and Acharya [22], Singh [23]. The documented 107 species plants are used in the treatment of 39 different diseases and 46 distinct health benefits activities. These plants have been involved in the prevention and treatment of cough, fever, cold, gastrointestinal, respiratory, dermatological cardiovascular nervous, urinary problems, and even cancer. The leaf of Ghiukumari (*Aloe vera*) was used in curing the burn in the present study and was previously reported in the study of Ghimire [24], Rai [25], Tamang [26], Tamang and Singh [27]. The leaf of *Artemisia vulgaris* was found to stop bleeding and antidandruff in the present study, which is similar to the survey conducted by Tamang and Singh [27]. The root of siru (*Imperata cylindrica*) was reported to cure intestinal worms in the present study has also supported by the findings of Tamang [26], Oli [28], and Tamang and Singh [27]. However, Rai [25] has reported the use of this species in the treatment of curing piles, diarrhea. The use of flower of laligurans (*Rhododendron arboretum*) was used to remove fish bones that get stuck in the gullet. The present finding in this study was also reported by Bhattacharya [29], Gurung [30], Shrestha, and Dhillion [18], and Thapa [31].

All the respondents were asked semi-structured questionnaire politely in their own local language. In return, respondents provided all ethnomedicinal data and information which they had. In the present study, the maximum respondent was found to be over the age of 50. Only one respondent was below 30 years of age. This might be due to the modernization and easy availability of chemically synthetic drugs in medical shops. Chaudhary et al. [5] have also reported a similar difference in age groups of the respondent while studying the ethnobotanical plant of Tharu community of eastern Nepal. This might be the sign of decreasing the use-value of medicinal plants in the Suryabinayak

municipality. The young generation should be enhanced to continue their traditional use of plants for the medicine to conserve their ethnic knowledge.

4. Materials and Methods

Study area

Suryabinayak Municipality is in the Southern part of the Bhaktapur district (Fig. 4). It lies between the northern latitude of 27°37' N to 27°40'N and eastern longitude of 85°23' N to 85°29' in a geographical area of 42.6 km². It is situated at an elevation range from 1369 m to 2025 m above the sea level. The average temperature in summer (June - August) and winter (November – February) is 19-27°C and 2-15°C and the average rainfall is 20-30 cm³ [32]. This study area favors subtropical (1,000 to 2000 m above the sea level and temperate (2,000 to 3,000 m asl) type of climate. About 783 hectares of land is covered by forest, and altogether 63 forest patches have been identified [33]. Different species of plants are found in forests such as *Rhododendren arboretum* (Laligurans), *Myrica sculenta* (Kafal), *Rubuselliptus* (Aaiselu), *Schimawallich* (Chilaune), Fern, Bryophytes, Pteridophytes, etc. According to the 2011 National census, the predecessors of the Suryabinayak Municipality had a population of 78,845 out of them 39,237 (49.8%) are male, and 39,608 (50.2%) are female. The significant cases are Newar, Chhetri, Tamang, and the major religion is Hindu, followed by others.

Figure 4. A) Map of Nepal Showing Bhaktapur district. B) Bhaktapur district. C) Suryabinayak municipality showing all 10 wards

Field survey

An ethnomedicinal survey was carried out from 17th Nov 2017 to 15th May 2018 for six months. The present study has covered 10 wards of Suryabinayak Municipality at monthly interval using Rapid Appraisal methods like the door to door survey, individual interview, field visit and group

discussion with (Fig. 5 and Fig. 6) different age group, gender, address, occupation, native/migrant, education and family structure and user/healer (Fig. 1A).

Figure 5. (A) Door to door survey (B) Group discussion (C) Individual interview (D) Herbarium specimens

Figure 6. A) *Ageratina adenophora* Spreng (Banmara). B) *Cuscuta reflexa* Roxb (Akasbeli). C) *Justicia adhatoda* L. (Asuro)

Primary data collection:

During the field survey, open-ended, semi-structured questionnaires were employed for the collection of information in local languages. Newari language was used for the Newari people and the Nepali language was used for the other ethnic groups. Fifty-eight people were involved in the study for the collection of ethnobotanical data and information. These questionnaires were prepared in English, but interviews were conducted in local languages for convenience and accuracy.

Voucher specimen collection and plant identification:

The voucher specimen of available plant species was collected with the help of key participants who were experienced and had a rich knowledge of the medicinal flora. Those plant species unavailable during the study were collected on related activities. The medicinal plants were identified from the Dictionary of Nepalese Plant Names book [34].

Herbarium preparation: The collected specimens were dried and then disinfected using 0.1% HgCl₂ and ethyl-alcohol (70%), and then mounted on standard-sized herbarium sheets (42cm × 29cm). Herbarium specimens were prepared and submitted to the Department of Botany, Bhaktapur Multiple Campus. The code for the herbarium specimen was used as SBP for each plant.

5. Conclusions

The present study made clear that the local peoples of Suryabinayak municipality have sound knowledge about the traditional uses of plant species for treatment and prevention of many health problems. The villagers or informants were quite reluctant to share their knowledge because of their cultural norms and beliefs. However, there was high disappearance of traditional knowledge after the death of knowledgeable older generations. An urgent need for the conservation of such species as well as their habitats and indigenous knowledge is required. Finally, medicinal plants are still significant for livelihood for local villagers/ informants of the Suryabinayak Municipality.

Supplementary Materials: The following are available online at www.mdpi.com/xxx/s1, Figure S1: Set of a Questionnaire for a field survey

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Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Set of a Questionnaire for a field survey

References

1. Shrestha, K.K.; Tiwari, N.N.; Ghimire, S. K. MAPDON - Medicinal and aromatic plant database of Nepal. In: *Proceedings of Nepal-Japan Joint symposium on conservation and utilization of Himalayan medicinal resource*, 2000.
2. Magar, S.T. A report on indigenous knowledge on the utilization of medicinal plants in the Magar community: A case study of Salija VDC Parbat. Submitted to SNV Nepal, Bakhundole, Lalitpur, Kathmandu, Nepal, pp 13-15, 2008.
3. CBS. National Population and Housing Census 2011. Central Bureau of Statistics, Kathmandu, Nepal. 2011.
4. Manandhar, N.P. Herbal remedies of Surkhet district, Nepal. *Fitotrepia* **1993**, 64(3), 266-272.
5. Chaudhary, S.; Magar, G.T.; Sah, S.N.; Parajuli, S. Ethnic plants of Tharu community of Eastern Nepal. *Int. J. Appl. Sci. Biotechnol.* **2020**, 8(2), 223-230. <https://doi.org/10.3126/ijasbt.v8i2.28325>
6. Bawa, K.S.; Godoy, R. Introduction to case studies from southern Asia. *Economic Botany* **1993**, 47, 258-267. <https://doi.org/10.1007/BF02862290>
7. Gill, J.; Ogbor, H. Folk medicinal plants: practices and beliefs of the Benin people in Nigeria. *Ethnobotany* **1997**, 9(1-2), 1-5.
8. Bhattarai, N.K. Medical ethnobotany in the Karnali Zone, Nepal. *Economic Botany* **1992**, 46(3), 257-261. <https://doi.org/10.1007/BF02866624>
9. Holland, B.K. Prospecting for drugs in ancient texts. *Nature* **1994**, 369, 702. <https://doi.org/10.1038/369702a0>
10. Andrade-Cetto, A. Ethnobotanical study of the medicinal plants from Tlanchinol, Hidalgo, Mexico. *Journal of Ethnopharmacology* **2009**, 122, 163-171. <https://doi.org/10.1016/j.jep.2008.12.008>
11. Thapa, S. Medico-ethnobotany of Magar Community in Salija VDC of Parbat District, Central Nepal. *Our Nature* **2012**, 10, 176-190. <https://doi.org/10.3126/on.v10i1.7780>
12. Kunwar, R.M.; Adhikari, N. Ethnomedicine of Dolpa district, Nepal: the plants, their vernacular names and uses. *Lyonia: a journal of ecology and application* **2005**, 8(1), 43-49.
13. Singh, A.G.; Kumar, A.; Tewari, D.D.; Bharati, K.A. New ethnomedicinal claims from Magar community of Palpa district, Nepal. *Indian Journal of Traditional Knowledge* **2018**, 17(3), 499-511.
14. Balami, N.P. Ethnomedicinal uses of plants among the Newar community of Pharping village of Kathmandu District, Nepal. *Tribhuvan University Journal* **2004**, 24(1), 13-19. <https://doi.org/10.3126/tuj.v24i1.251>
15. Timilsina, S.H.; Singh, N.B. Ethnobiology and Indigenous knowledge about medicinal Animals and Plants in the balami Ethnic Group in Nepal. *Journal of Institute of Science and Technology* **2014**, 19(2), 78-85. <https://doi.org/10.3126/jist.v19i2.13857>
16. Malla, B.; Chhetri, R.B. Indigenous knowledge of ethnobotanical plants of Kavrepalanchowk District. Kathmandu University. *Journal of Science, Engineering and Technology* **2009**, 5, 96-109.
17. Sigdel S.R.; Rokaya, M.B. Utilization of plant resources in Dang district, West Nepal. *Banko Janakari* **2011**, 21(2), 45-54. <https://doi.org/10.3126/banko.v21i2.9143>
18. Shrestha, P.M.; Dhillon, S.S. Medicinal plants diversity and use in the high lands of Dolakha district, Nepal. *J. Ethnopharmacology* **2003**, 86(1), 81-96. [https://doi.org/10.1016/S0378-8741\(03\)00051-5](https://doi.org/10.1016/S0378-8741(03)00051-5)
19. Adhikari, M.; Thapa, R.; Kunwar, R.M.; Devkota, H.P.; Poudel, P. Ethnomedicinal uses of Plant Resources in the Machhapuchhre Rural Municipality of Kaski District, Nepal. *Medicines* **2019**, 6, 69.
20. Magar, S.B.; Bhandari, P.; Ghimire, K. Ethno-medicinal survey of plants used by Magar (Kham) community, Rolpa district, Western Nepal. *Ethnobotany Research & Application* **2020**, 19, 1-29.
21. Cheikhoussef, A.; Shapi, M.; Ashekele, H.M. Ethnobotanical study of indigenous knowledge on medicinal plant use by traditional healers in Oshikoto region, Namibia. *Journal of Ethnobiology and Ethnomedicine* **2011**, 7(1), 10. <https://doi.org/10.1186/1746-4269-7-10>
22. Acharya, R.; Kamal, P. Ethnobotanical study of medicinal plants used by Tharu Community of Parroha VDC, Rupandehi district, Nepal. *Scientific World* **2009**, 7, 80-84. <https://doi.org/10.3126/sw.v7i7.3832>
23. Singh, S. Ethnobotanical study of wild Plants of Parsa district, Nepal. *Ecoprint* **2017**, 24, 1-12. <https://doi.org/10.3126/eco.v24i0.20641>
24. Ghimire, K. Ethno medicobotany of Tharu tribe of Nawalparasi District Study report submitted to DNPWC, Kathmandu, Nepal. 1999.
25. Rai, MB. Medicinal Plants of Tehrathum District, eastern Nepal. *Our nature* **2003**, 1, 42-48. <https://doi.org/10.3126/on.v1i1.304>
26. Tamang, G. An Ethnobiological study of the Tamang people. *Our Nature* **2003**, 1, 37-41. <https://doi.org/10.3126/on.v1i1.303>

27. Tamang, P.; Singh, N.B. Medicinal Ethnobiology and Indigenous knowledge system of the Lapcha of Fikkal UDC of Illam, Nepal. *Journal of Institute of science and Technology* **2014**, 19(2), 45-51. <https://doi.org/10.3126/jist.v19i2.13851>
28. Oli, B.R. Ethno-medicinal uses of Plants among the Limbus of Hellock Area of Tapethok VDC, Taplejung, Nepal. *Botanica orientalis* **2003**, 3, 112-115.
29. Bhattacharya, D.; *Rhododendron* Species and Their uses with Special References to Himalayas- A Rivew. *Assam University Journal of Science and Technology* **2011**, 7(1), 161-167.
30. Gurung, A. A study on Medicinal Plants and their traditional uses in Chitre VDC(Parbat) and Bhadauri/Tamagi VDC(Kaski), Western Nepal.M.Sc. Thesis, Central Department of Botany, T.U., Kirtipur, Kathmandu, Nepal, 2002.
31. Thapa, S. Medico-ethnobiological Knowledge of the Magars: A case study of Salija VDC, Parbat District. M.Sc. Thesis, Central Department of Environmental Science, T.U., Kirtipur, Kathmandu, Nepal, 2008.
32. <http://www.fallingrain.com/world/NP/00/Suryabinayak.html> (last accessed on: 02.08.2020).
33. <http://www.suryabinayakmun.gov.np/> (last accessed on: 02.08.2020).
34. Shrestha, K. *Dictionary of Nepalese Plant Names*. Natural History Museum, Tribhuvan University. 1998.Pp, 1- 260

295 Supplementary file:

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298 **Suppl. 1. Questionnaire for respondents in Suryabinayak Municipality**

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300

301 नाम (Name of respondent):

302 ठेगाना (Address of respondent):

303 Immigrant or Ethnic:

304 उमेर (Age):

305 लिंग (Sex):

306 पेशा (Occupation):

307 शिक्षा (Education):

308 पारिवारिकढाचा (Family structure):

309 औषधिकोरुपमा जडिबुटी प्रयोग गर्नुहुन्छ? (User or Healer):

310 स्थानिय वा प्रवासी (Native or Migrant):.....

311

[illegible]