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Folklore Medicinal Plants Used Against Typhoid and Fever in Lwangghalel, Kaski District, Central Nepal

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Abstract

Typhoid is an infectious contagious disease of concern throughout the developing nations around the world.Different types of plant species are used traditionally against typhoid and fever by ethnic peoples of Lwangghalel, Kaski district, central Nepal. This study aims to document traditional medicinal plants used traditionally by local indigenous people and traditional healers to treat typhoid and fever. Group discussions, forest walk and in situ individual interviews were part of the methodology using open-ended semi-structured questionnaires. Thirty plants were cited by elder people and traditional healers to treat typhoid and fever. Most of them were used in the form of decoction taken orally. The most frequently utilized medicinal plant parts were root (33.33%) and bark (16.67%) followed by whole plant (13.33%), shoot (13.33%), rhizome (10%), fruit (10%) and tuber (3.33%). Herbs (73%) were the primary source of medicine, followed by shrubs (10%) and trees (17%). Knowledge about medicinal plants and its practices existed only among elder people and traditional healers. Further detail documentation with involvement of local stakeholder is important, so that it can be accessible to a large number of populace.

Keywords: Antipyretic, Ethnobotany, Herbal healers, Medicine, *Salmonella enterica,* Traditional knowledge

Introduction

Humans have been using plant resources and its products to fulfil multifarious daily requirements since time immemorial. Plant and plant products enhanced human culture earlier than the domestication of agriculture and fire (Khadka, 2019). Typhoid is an infectious contagious disease of concern throughout the developing world. One of the major causes of typhoid is *Salmonella enterica* serotype typhi which continues to be major public health problem in much of the developing world, especially in Asia including Nepal (Parry et al., 2002; Lewis et al., 2005). Fever represents a complex adaptive response of the host to various immune challenges whether infectious or non-infectious (Ogoina, 2011). Fever is a regulated rise in body temperature above normal daily fluctuations occurring in conjunction with an elevated thermoregulatory set point (Mackowiak, 2000; Ogoina, 2011; Mabey & Whitty, 2012). Outbreaks of drug-resistant typhoid fever and other fever have been recorded in different Asian countries (Mermin et al., 1999; Lewis et al., 2005), so traditional medicinal plants can be used as potential alternative to find new drugs against typhoid and fever.It is a type of enteric fever, known as Myadhe jaro in Nepali. The term "ethnobotany" was first given by John Harshberger in 1896 though the history of the field began long before that. Ethnobotany is the study of relationship between aboriginal society and their plant environment (Schults, 1962). It reflects the relation between plant and people. Ethnobotany is a part of traditional knowledge which is passed from generation to generation orally.

Plant and people interaction among indigenous inhabitants around the world has lured the attention of natural resources researchers to add a noble compound for the collective benefit of modern humans (Khadka, 2019). Ethnobotany uses both the anthropological and botanical approaches to understand the hidden knowledge system between plants and indigenous communities (Ford, 1978; Davis, 1995). Ethnomedicinal studies are significant value to discover contemporary drugs from indigenous medicinal plant resources (Umair et al., 2017). Traditional medicinal plants provide healthcare for up to 80% of the world's population (Saslis-Lagoudakis et al., 2014). This study aims to

document traditional medicinal plants used traditionally by local indigenous people and traditional healers to treat typhoid and fever.

In Nepal, the concept of ethnomedicine has been developed since the late 19th century (1885-1901 A.D). Ethnobotanical study started in 1955 by Banerji with the publication of paper on medicinal and food plants of eastern Nepal (Manandhar, 2002). The first book "Chandra-Nighantu" regarding medicinal plants was published by the Royal Nepal Academy in 1969 (2025 B.S.). Later, a number of ethnobotanical studies on different ethnic groups of Nepal have been carried out by different botanist and other researchers. Some major studies worked out were by Pandey (1964), Adhikari & Shakya (1977), Ghimire et al., (2000), Lama et al., (2001), Rajbhandari (2001), Manandhar (2002), Shrestha & Dhillion (2003), Mahato & Chaudhary (2005), Malla & Chhetri (2009), Singhet al., (2012), Panthi & Singh (2013) and Kunwar et al., (2013; 2014).

Materials and Methods

Study area

Present research work was carried out in Lwangghalel, Machhapuchhre Rural Municipality-8 and 9, Kaski (Figure 1) to assess the knowledge on traditional medicinal plants used for typhoid and fever. Lwangghalel lies between 28°13' N to 28°47' N latitudes and 83°84' E to 83°94' E longitudes with an elevation range of 1100-5554 m asl upto the tip of Mardi Himal.

According to Central Bureau of Statistics [CBS] (2017), the total area of Lwangghalel is 151.37 square kilometre (Sq km) with 78.84 sq km of forest area which is 52.08 % of total area. Climate is warm-temperate at lower elevation and cool-temperate to alpine at higher elevation.The mean annual precipitation recorded in the nearest Lumle station for the last 30 years was 459.48 mm (range: 462.86 mm in 1988 to 393.51 mm in 2017) (Department of Hydrology and Meterology [DHM], 2019).

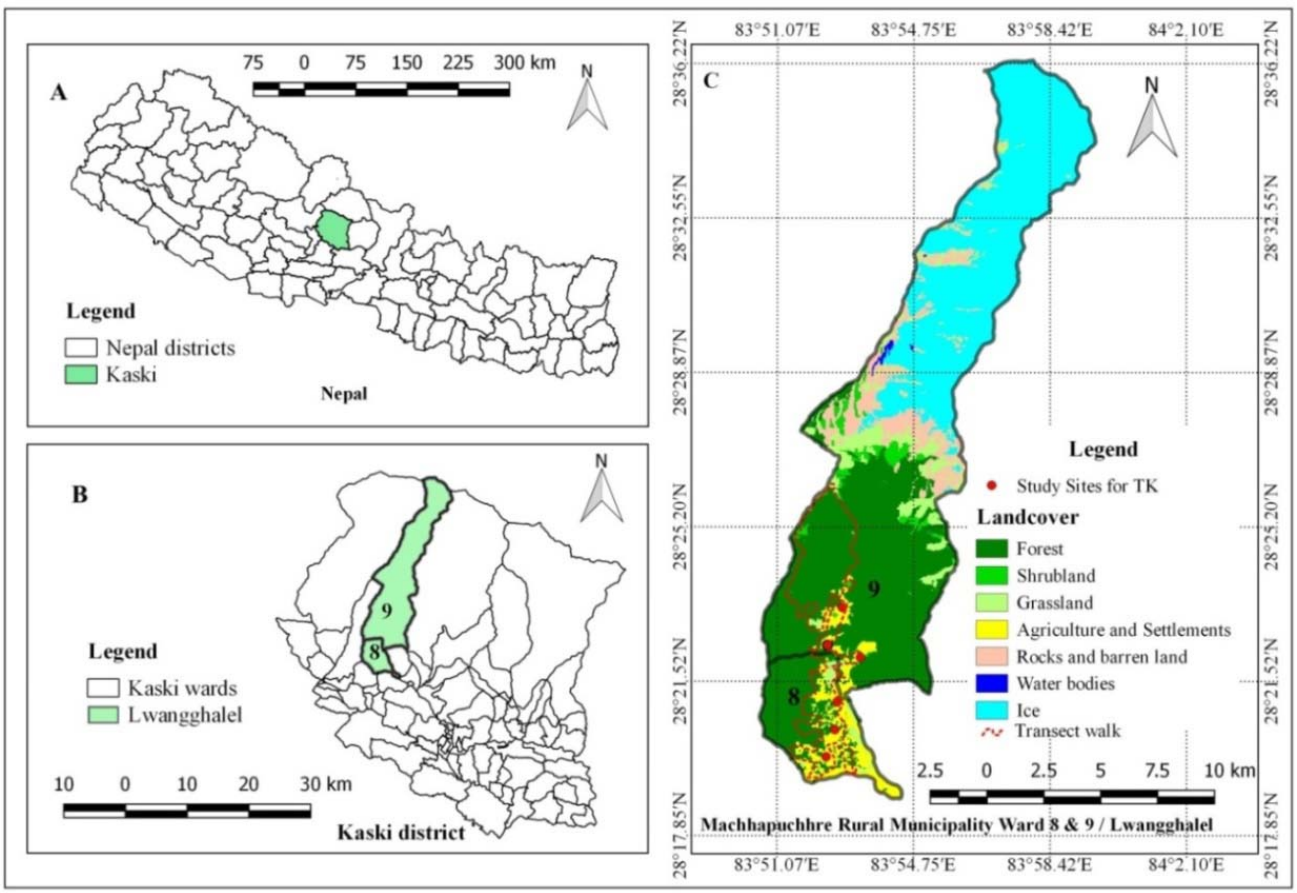

Figure 1: Map of Study Area (A) Nepal, (B) Kaski district and (C) Machhapuchhre Rural Municipality(MRM) ward 8 and 9 or Lwangghalel (Source for landcover map: ICIMOD 2010).

Sampling

The study was done in Machhapuchhre Rural Municipality (MRM), Kaski district covering rural and remote ten villages (Sidhing, Ghalel, Kalimati, Lwang, Koleli, Takru, Kuibang, Saitighatta, Lumre and Idhikhola). Since the area lies within Annapurna Conservation Area Project (ACAP), collection of rare and medicinal plants is restricted. The total population of study area was 4,211 dominated by Brahmin and Chhetri (38.26%), followed by Gurung (16.33%), Kami (15.48%), Tamang (11.10%), Damai (6.58%), others (6.36%) and Magar (5.89%) (CBS, 2011). Indigenous local people have limited access to modern health serviceshaving only one primary health center and seven health posts(CBS, 2017). So, local people rely on traditional system of medicine for their basic health care needs.

Data collection and analysis

The study area was visited from October 2018 to July 2019. A total of five field visits were made in each study site.For ethnobotanical study, both anthropological approach and ethnobotanical approaches (Ford, 1978; Davis, 1995) were followed. Group discussions, focus group discussions, transect walk and individual interviews were the part of the methodology. Open-ended semi-structured questionnaire were used for the interviews (Martin, 1995; Cunningham, 2001). Nepali and local languages were used for interviews as far as possible. Before taking interviews permission was taken either from the head of the ethnic communities or local level stakeholders. Their rights on their knowledge and natural resources were not violated. As an anthropological approach individual interviews, three focus group discussions and two group discussions were done. Questionnaires were explained in Nepali and local dialects. During the survey, a total of 65 individual including Lamas and Jhakri (9), Vaidhya (4), Pujari (8), community leader (6) and a local herbalist (13) were reached out for study and only 59 allowed us to interview further. Similarly, as an ethnobotanical approach different plant specimens cited by local indigenous peoples were collected. Ethnobotanical data along with its botanical name, voucher number, family, habitat, local name, parts used and modes of administration were entered in MS Excel sheet. The collected plant specimens were identified with the help of relevant literature (Stainton, 1987 and 1988; Press et al.,2000) and deposited at Tribhuvan University Central Herbarium (TUCH), Central Department of Botany, Tribhuvan University, Kirtipur, Kathmandu.But the rare and restricted plants were only photographed and identified during transect walk.

Results and Discussion

Diversity and uses of medicinal plants

In this study, total 30 plants belonging to 27 families and 29 genera were found to have medicinal use for typhoid and fever. Out of 27 families, Gentianaceae, Roasaceae and Rubiaceae each has 2 species and other families like Amaranthaceae, Asparagaceae, Asteraceae, Berberidaceae, Fagaceae, Malvaceae, Solanaceae and Zingiberaceae each has 1 species. Most frequently cited medicinal plants to treat typhoid and fever by local indigenous people of Lwangghalel were *Aconitum gammiei, Neopicrorhiza scrophulariiflora, Swertia chirayita, Mussaenda frondosa, Rubus ellipticus* and *Iris domestica* as reflected in Figure 2. Among 30 reported medicinal plants 8 were used against typhoid, 10 against fever and 12 against both typhoid and fever. *Abelmoschus manihot, Achyranthes bidentata, Berberis aristata, Eurya acuminata, Imperata cylindrical, Oxalis corniculata and Rubus ellipticus* were preferred in typhoid known as *kupath* among local indigenous communities of Lwangghalel. The scientific name, voucher number, family name, local name, parts used, habitat and preparation of the medicinal plants are summarized in Table 1.

Plant parts used and their growth forms

The most common plant parts used was root (10 species), followed by bark (5 species), shoot and whole plants each (4 species), rhizome and fruits each (3 species) and tuber (1 species) as reflected in Figure 3. Among different plant parts used, roots were preferred as it generally contains a greater amount of active compounds in comparison with

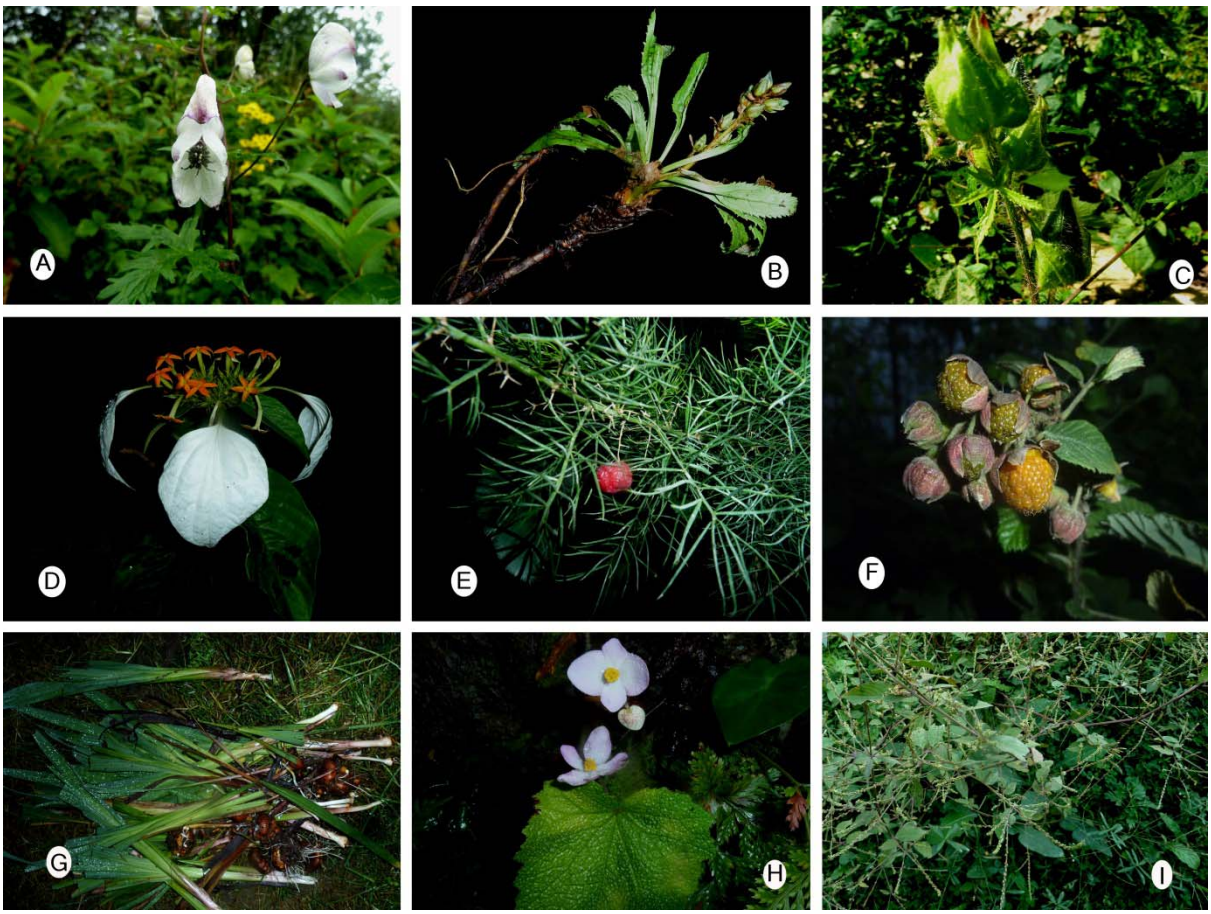

Figure 2: More frequently used medicinal plants to treat typhoid and fever A) *Aconitum gammiei* Stapf , B) *Neopicrorhiza scrophulariiflora* (Pennell) D.Y.Hong, C) *Abelmoschus manihot* (L.) Medik, D) *Mussaenda frondosa* L., E) *Asparagus racemosus* Willd., F) *Rubus ellipticus* Sm., G) *Iris domestica* (L.) Goldblatt & Mabb., H) *Begonia picta* Sm. and I) *Achyranthes bidentata* Blume

other parts (Bhattarai et al., 2006). Information on plant parts used might be beneficial for choosing these parts for further research on bioprospecting and phytochemicals determination. But the unsustainable and massive collections of roots, rhizomes and other important plant parts could lead to complete destruction and decline of the plant from its natural habitats (Ghimire et al., 2008).

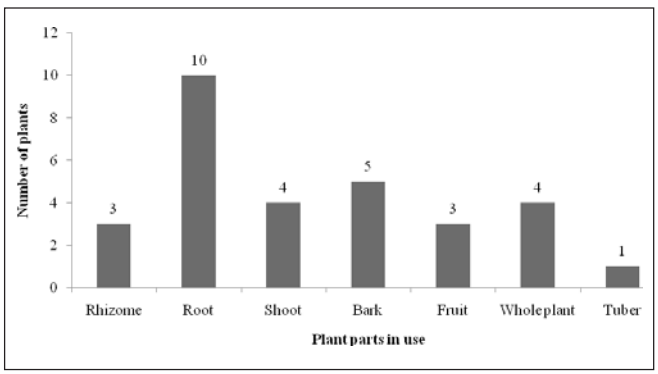

Figure 3: Medicinal plant parts preferred by local people

The total plants cited by local indigenous people were grouped into herb, shrub and tree based on their habit. Herb species were found dominant with 22 (73 %) species followed by tree 5 (17%) and shrub 10 (3%) species as demonstrated in Figure 4.

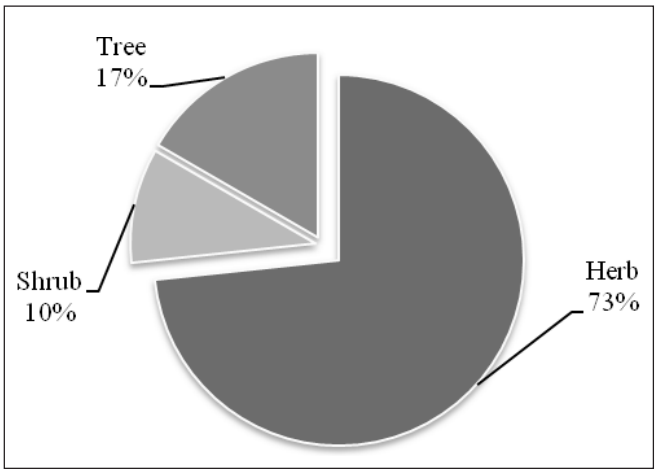

Figure 4: Growth form of medicinal plants used by local people

Herbs like *Aconitum gammiei*, *Berberis aristata*, *Nardostachys jatamansi* and *Neopicrorhiza scrophulariiflora* have habitat far from the human settlements above 2000 m elevation from sea level were collected in harvesting season. Herb diversity is dominant and increases with elevation in Lwangghalel (Khadka, 2019), easy to harvest and use so herbs growth forms were more preferred than others.

Dosage forms and routes of administration

Medicinal plants were used in the decoction, infusion, juice and powder form. Few plants were taken in chewable forms. The most frequently used dosages form was found to be decoction (50%), followed by infusion and juice each (20%), chewable (6.67%) and powder (3.33%). Route of administration for all the dosage forms was oral route. Most of the medication was prepared freshly when needed either from fresh or dried plant parts. The diagrammatic representation of the dosage form is displayed in Figure 5.

Most commonly preferred dosage forms were decoction, infusion and juice. As the routes of administration was oral, dosage forms decoction and infusion with boiling process to extract phytochemicals ensures the absence microbial infection. Similarly, the use of juice is easy for oral administration. The details about the amounts and time period of medication was not disclosed by the traditional healers as it was their main occupation and were not intended to share. Also the use of wild animals body parts along with some secret ingredients were not shared due to their traditional beliefs that the medication becomes ineffective after sharing to unknown persons.

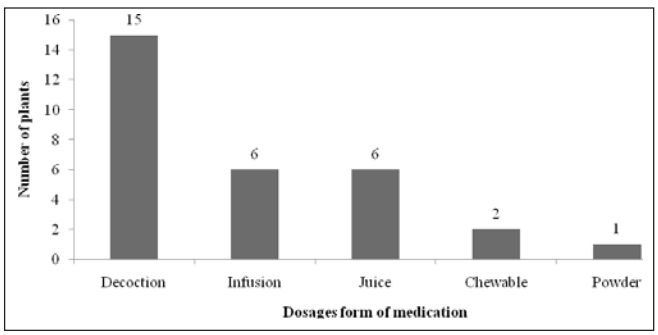

Figure 5: Dosages form of medication in the treatment of typhoid fever by local people

The 30 medicinal plants recorded from this study were found to be popular among the traditional herbalism as plants having antipyretic properties. Voucher specimens of *Nardostachys jatamansi* and *Neopicrorhiza scrophulariiflora* were not collected because they were either rare or restricted for collection or restricted to particular habitat. The indigenous local people of Lwangghalel are rich in ethnomedicinal knowledge and rely on plant based remedies for common health problems including fever, intestinal disorders, cattle diseases and other common health related issues. Typhoid fever was known as Kharo Jaro, Kam Jaro or Kupath among indigenous local peoples. The symptoms of typhoid fever were less appetite, increase in body temperature and fever, headache, abdominal pains and weakness. Typhoid fever and other fever were common during summer and rainy season due to lack of health education, poor hygiene, contaminated food and water. The combination of more than two medicinal plants listed in Table 1 had more effect than single plant. *Begonia picta* and *Oxalis corniculata* were mostly preferred as mixture with other ingredients as these plants improves the bitter taste of medicines. Most of these medicinal plants have multifarious uses to treat other diseases as *Azadirachta indica* was used as an ingredient to prepare medicine for uric acid (Khadka, 2019), whereas *Azadirachta indica* leaf was used in the treatment of typhoid fever in Nigeria (Igberaese and Ogbole, 2018). *Achyranthes bidentata* used to treat typhoid fever contains phytosterols have antibacterial activity (Devi et al., 2007). Root decoction of *Berberis aristata* used for typhoid is supported by its antibacterial activity against *Salmonella typhi* (Sohni et al., 1995, Singh et al., 2008). The reported use of *Centella asiatica*to treat typhoid and fever is justified by the antibacterial activities of its phytochemicals (Roy et al., 2013). According to Khadka (2019) *Neopicrorhiza scrophulariiflora* was used in typhoid, fever, diarrhoea, dysentery and to remove worms from digestive tracts, *Begonia picta* and *Elaeagnus parvifolia* against fever, typhoid and gastrointestinal problems, roots and rhizome of *Aconitum gammiei*, *Iris domestica*, *Mussaenda frondosa* and *Rubus ellipticus* to treat typhoid and

fever in Lwangghalel, Kaski district. Among 45 medicinal plants reported by Bhattarai et al., (2013) from Panchase region, *Achyranthes aspera* and *Rubus ellipticus* were used in typhoid and *Swertia chirayita* in fever, which were similar to present findings.

Herbal healers, elderly people, traditional practitioners were rich in traditional knowledge about plant resources and its use. They still believe and are depended in herbalism. Mostly the forest dwellers, herders, lamas, jhakris and aged community leaders were knowledgeable about such resources. They were also interested to document such type of their ancestral knowledge but they want their rights and some returns too without misusing such knowledge.

Conclusion

Ethno-medicinal study focusing on typhoid fever has not been carried out in this area. Traditional medicinal plants could be alternative drug source as drug-resistance typhoid fever is common in developing world. The information and findings presented here are primarily based on interviews, group discussions, transect walk and field observation with indigenous local traditional healers, elderly peoples, lamas and social workers. Although being rich in medicinal plants only traditional practitioners and elder people had knowledge about multifarious uses of those resources. The reason behind this is that there were no health services in rural areas as nowadays, so they were totally dependent on traditional treatment for various diseases.

This study provides authentic data related to the ethnomedicinal uses of local flora to treat typhoid and fever and will lure the attention of pharmacologist, phytochemists, researchers working on antipyretic and antimicrobial drugs and traditional healers to find out the potential natural products in those plants. Further detail documentation with involvement of local stakeholder is important as some traditional medicine practitioners kept secrecy about medicinal uses of plants, so that it can be accessible to a large number of populace.

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Table 1: Enumeration of medicinal plant species of oral dosage used to treat typhoid and fever

S. N.	Botanical name	Voucher number	Family	Local name (Nepali)	Habitat	Uses	Parts used	Preparation
1	*Abelmoschus manihot* (L.) Medik.	L11	Malvaceae	Kapase	H	T	Root	Decoction
2	*Achyranthes bidentata* Blume	KL429	Amaranthaceae	Datiwan	H	T	Root	Juice
3	*Aconitum gammiei* Stapf	KL321	Ranunculaceae	Nirmasi	H	F & T	Rhizome	Decoction
4	*Asparagus racemosus* Willd.	L49	Asparagaceae	Kurilo	H	F & T	Root	Decoction
5	*Azadirachta indica* A.Juss.	KL444	Meliaceae	Nim	T	F & T	Bark	Decoction
6	*Begonia picta* Sm.	KL141	Begoniaceae	Magar kachi	H	F & T	Whole plant	Chewable
7	*Berberis aristata* DC.	KL349	Berberidaceae	Chutro	S	T	Bark	Infusion
8	*Castanopsis tribuloides* (Sm.) A.DC.	KL219	Fagaceae	Katus	T	F	Bark	Decoction
9	*Centella asiatica* (L.) Urb.	B131	Apiaceae	Ghodtapre	H	F & T	Shoot	Juice
10	*Cirsium verutum* (D. Don) Spreng.	KL449	Compositae	Thakailo	H	F	Root and shoot	Juice
11	*Curcuma angustifolia* Roxb.	KL452	Zingiberaceae	Besar/Haledo	H	F	Rhizome	Powder
12	*Elaeagnus parvifolia* Wall. ex Royle	KL401	Elaeagnaceae	Guyeli	S	F	Fruit	Chewable
13	*Erythrina stricta* Roxb.	KL466	Leguminosae	Fadelo	T	T	Bark	Decoction
14	*Eurya acuminata* DC.	L16	Pentaphyllaceae	Jhyanu	T	T	Young shoot	Juice
15	*Galium aparine* L.	KL411	Rubiaceae	Tite jhar	H	F & T	Shoot	Infusion
16	*Imperata cylindrica* (L.) Raeusch.	KL459	Poaceae	Siru ghans	H	T	Root	Infusion
17	*Iris domestica* (L.) Goldblatt & Mabb.	KL423	Iridaceae	Khadgaa dhari	H	F & T	Rhizome	Decoction
18	*Mussaenda frondosa* L.	KL247	Rubiaceae	Dhobino	H	F & T	Root	Decoction
19	*Nardostachys jatamansi* (D.Don) DC.		Caprifoliaceae	Jatamasi	H	F & T	Root	Decoction
20	*Neopicrorhiza scrophulariiflora* (Pennell) D.Y.Hong		Plantaginaceae	Kutki	H	F & T	Root	Decoction
21	*Nephrolepis cordifolia* (L.) C. Presl	KL460	Nephrolepidaceae	Paniamala	H	F	Tuber	Juice
22	*Ocimum tenuiflorum*L.	B163	Lamiaceae	Tulasi	H	F	Shoot	Infusion
23	*Oxalis corniculata* L.	KL462	Oxalidaceae	Chariamilo	H	T	Whole plant	Decoction
24	*Physalis peruviana* L.	B164	Solanaceae	Isamgol	H	F	Fruit	Decoction
25	*Prunus persica* (L.) Batsch	KL467	Rosaceae	Aaru	T	T	Bark	Decoction
26	*Rubus ellipticus* Sm.	S133	Rosaceae	Ainselu	S	F & T	Root	Decoction
27	*Solena amplexicaulis* (Lam.) Gandhi	KL402	Cucurbitaceae	Gol kakri	H	F	Fruit	Juice
28	*Swertia chirayita* H. Karst.	B167	Gentianaceae	Chiraito	H	F & T	Whole plant	Infusion
29	*Swertia paniculata*Wall.	B118	Gentianaceae	Chiraito	H	F	Whole plant	Infusion
30	*Thysanolaena latifolia* (Roxb. ex Hornem.) Honda	KL465	Poaceae	Amriso	H	F	Root	Decoction

Note: T-Typhoid, F-Fever, H-Herb, S-Shrub, T-Tree