



Medicinal plants of curative values used in the treatment of diarrhea and dysentery disorder in far western Nepal: A review

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Abstract: Children residing in far western region of Nepal are prone to food and water borne diseases; diarrhea and dysentery are the prominent one. Although the region is rich in plants with medicinal properties; but still only a handful of people are conscious about their uses. Far western region has received the least amount of attention from researchers, so limited numbers of research exploring the floral potent of the region are available. This paper aims to review the availability of medicinal plants traditionally used by the local people of this region as mentioned in earlier research carried out in this region. A total of 55 literatures accessible from 1970-2021 were collected through ResearchGate and Google Scholar and thoroughly reviewed for the purpose. A total of 60 plant species of pharmacological significance belonging to 38 families representing 57 genera were found to be medically valuable in lessening the complications of diarrhea and dysentery. Fabaceae family was reported with the highest uses. Lack of conservation of ancient knowledge has led to use of medicinal plants in appropriate manner leading to vibrant side effects rather than cure. Proper marketing strategies and conservation practices can provide an alternative source of income to rural people of this region.

Keywords: Medicinal plants; Far-western Nepal; Diarrhea; Dysentery, Ethnomedicinal, Indigenous

INTRODUCTION

For food, spices, medicinal and cultural purposes, people use a wide range of non-cultivated as well as cultivated plants (Shanmugam et al., 2011; Aryal et al., 2018). Medicinal plants have a far larger financial contribution than timber items in Nepalese society (Kalauni & Joshi, 2018). The fundamental methods of healthcare in far west Nepal were herbal medicines (Kunwar et al., 2010). From ancient times the plant resources are widely being used to cure diseases (Patil & Patil, 2005; Biosci et al., 2012) and also served widely as primary means of health care (Adhikari et al., 2019; Khajuria et al., 2021). The inhibiting indigenous populations and tribal communities use a variety of locally available ethnomedicinal plants for a range of medical purposes (Thapa et al., 2020). People in remote areas have learned the knowledge for the proper application of different medicinal plants from their experience and also from their ancestors (Bhattarai et al., 2006; Yadav & Rajbhandary, 2016; Singh et al., 2018). As the young generation is ignorant about the traditional use of ethnomedicinal uses, the valuable ethnomedicinal practices are disappearing rapidly (Singh, 2020).

Research on ethnomedicinal plant has been emphasized to help in the development of newer pharmaceuticals that will benefit humanity (Ghimire & Bastakoti, 2009). The demand for the ethnomedicinal plant is increasing as most people rely on the ethnomedicinal plants because they are cost-effective, acceptable, have biological benefits, and have ease of access (Yineger et al., 2008). The natural populations of wild medicinal plants are declining day by day due to overexploitation, lack of appropriate skill for conservation, and inappropriate harvesting techniques (Pant et al., 2005). Several important medicinal plant species are in danger of existence due to over-exploitation resulting from the increasing global demand (Bhattarai, 2009). If the multiple therapeutic plants in our surroundings are regulated and conserved systematically, they can be utilized as a replacement to pharmaceutical drugs (Joshi et al., 2019). Thapa et al., (2020) in the Baitadi district has found that fever, diarrhea, and the common cold were the most common ailments for which medicinal herbs were utilized.

Diarrhea is described as the condition of increment of many stools (more than 3 per day) (Kalakheti et al., 2016), increased stool fluidity, and/or the presence of blood and mucus in the stool (Joad, 1960) whereas dysentery is a condition of bloody diarrhea caused by the infection from the bacteria of *shigella* genus (Rosenberg et al., 2013). Diarrhea is the prime cause of illness and death in children around many countries (Acharya et al., 2018). Approximately around two billion people from less developed nations have meager hygienic supplies (Paterson et al., 2007) and poor sanitation (Williams & Berkley, 2018) making them miserable to suffer from food and waterborne diseases. Due to the lack of availability of safe drinking water, poor sanitation practices, and unhygienic living conditions, diarrheal ailments remain a serious problem in Nepal (Pokhrel & Viraraghavan, 2004). Diarrhea and dysentery have distressed around 90% of our country's population (Paudel et al., 2005) and also affected the visitors (Taylor et al., 2015) due to lack of sanitation and use of unsafe drinking water. In the case of developing countries like Nepal, diarrhea has been the major cause of child mortality rate where it accounts for a rate of 16/1000 (for children below 5) (Stapleton, 1989). Approximately half of the children below five suffering from diarrhea were not fortunate enough to get a visit to health care centers, as per the reports of National Demographic and Health Survey (MOHP, 2007). A toll of hundreds was reported dead in far-western Nepal due to an outbreak of diarrhea (Ansari et al., 2009). The topography of the far western Region varies from plains of Terai in the south, hills in mid-section and mountains in the north, with gradual increase of altitude towards the north in the Himalayas; with the highest altitude of 7132m (Mt. Api) (UNFCO, 2012). This variation of topography has made the region rich in a large number of plant diversity among which medicinal plants are one of them (Bhatt & Kunwar, 2020). However, this region has received the least amount of

attention from researchers, so limited number of researches exploring the floral potent of the region are available. Hence, this paper aims to focus on the collection of available information from the researches and present them in a productive way.

METHODOLOGY

The paperwork is entirely concentrated on the investigation of information collected from secondary sources. Different online portals were surfed in the process to collect relevant information from literatures published in various renowned journals from 1970-2021. All the literatures analyzed in this study are collected from the Google Scholar and Research Gate with the key words 'Medicinal plants', 'Far-western Nepal', 'Diarrhea and dysentery', 'Ethno medicinal', 'Indigenous'. A total of 55 selected literatures were methodically reviewed numerous times, and information regarding medicinal plants use in far western Nepal for the treatment of diarrhea and dysentery was collected, summarized, and structured in a rational way. The complete process is explained in figure 1 which is based on the PRISMA flow chart.

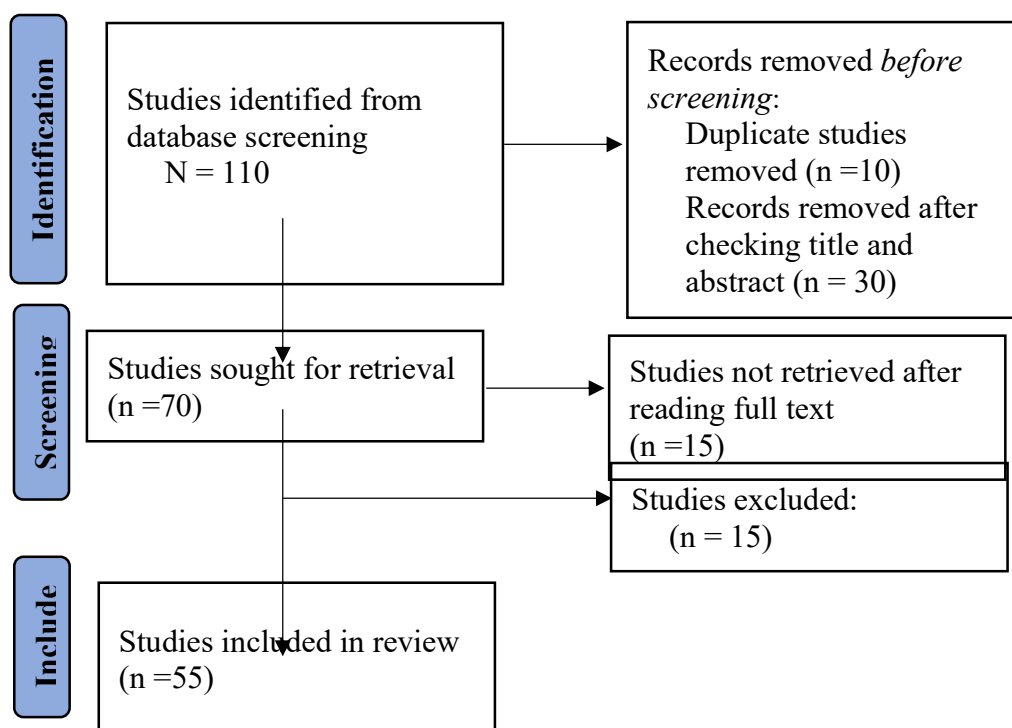


Figure 1: PRISMA flow chart for the studies related to Medicinal plants of curative values used in the treatment of diarrhea and dysentery disorder in far western Nepal.

RESULTS & DISCUSSION

The study was focused on the availability of plants with medicinal properties useful in the treatment of diarrhea and dysentery in the far western region. An account of 60 plants species belonging to 38 families representing 57 genera has been documented. Table 1 summarizes the list of plant species reported including their local name, family, parts used, and forms of use. Among the observed species, plants belonging to the family Fabaceae (17%) were reported with the highest use, followed by Amaranthaceae (5%), Anacardiaceae (5%), Euphorbiaceae (5%), and the plant species belonging to the family Urticaceae, Taxaceae, Rosaceae, Moraceae, Liliaceae, etc. were reported to be used less frequently. Figure 1 demonstrates the occurrence of plant species based on family. In the context of plant habit, trees (38%) were the dominant life form used to cure diarrhea and dysentery followed by shrubs (30%), herbs (28%), and climbers (3%). Figure 2 illustrate the use of plant species based on their life form. Among all the plants reported, roots and bark (both 21%) were the ones used most frequently followed by fruits (18%), leaf (13%), flower (8%), seed (4%), stem (3%), rhizome (3%), gall (1%) and resin (1%). Figure 3 illustrates the uses of plant parts as a curative measure of diarrhea and dysentery. Most of the medicines were found to be taken in form of juices, powder, paste, and decoction or as mixtures mixed with some other ailments.

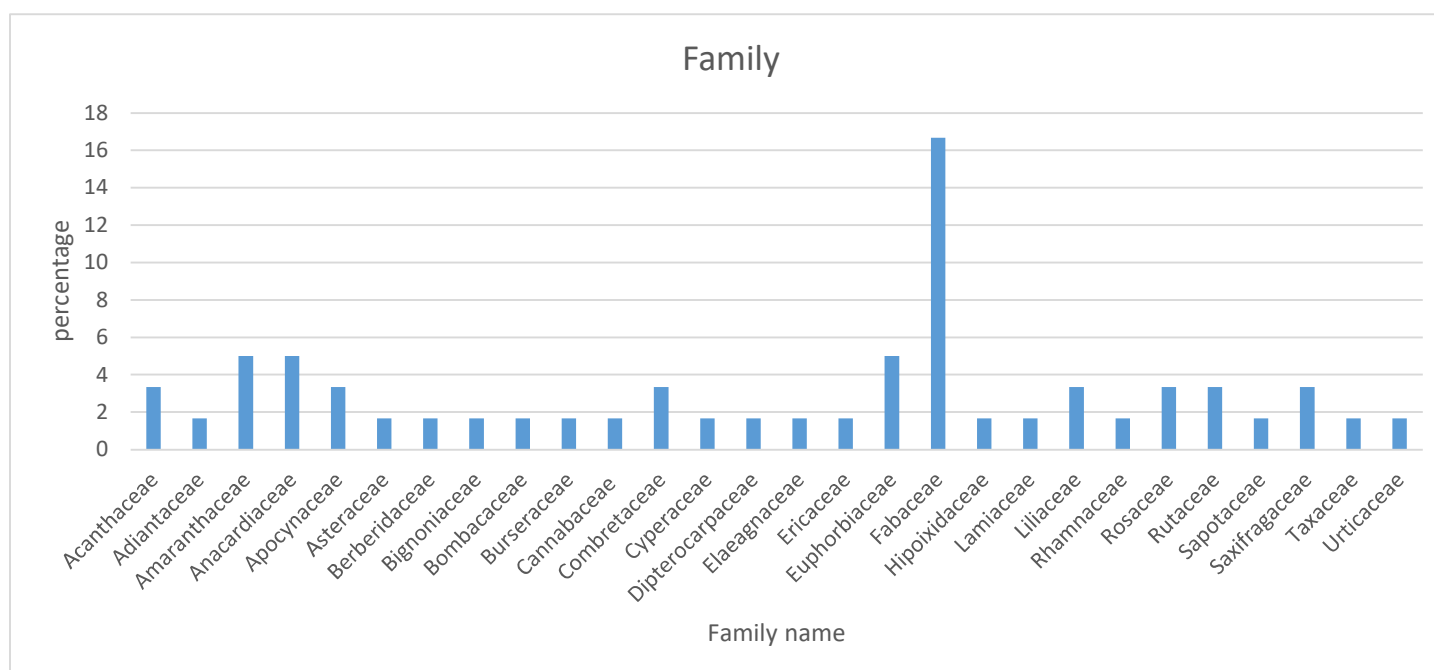
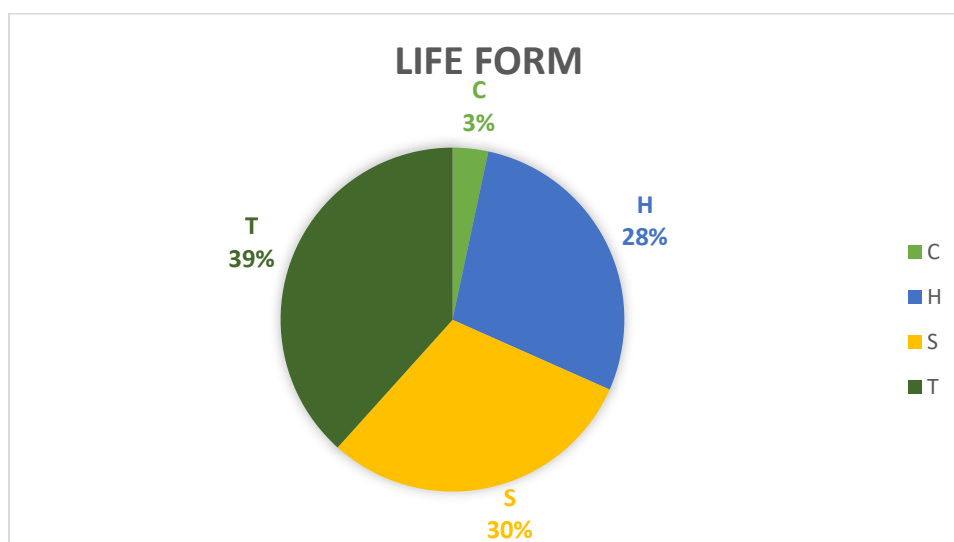


Figure-1: Bar diagram illustrating the occurrence of plant species based on their family



Abbreviations: C: Climbers, H: Herbs, S: Shrubs, T: Trees

Figure-2: Plants used based on their life form

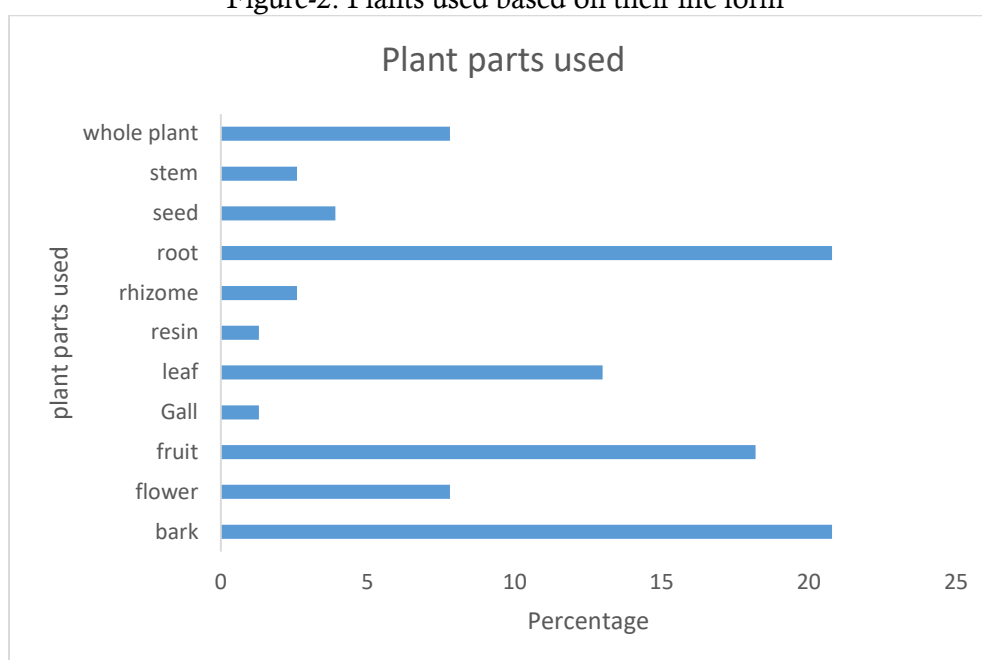


Figure-3: Illustration of plant parts used to treat diarrhea and dysentery

Table-1: Showing Scientific name, Family name, Local name, Life form, Parts used and Medicinal uses of the plants.

Scientific name	Family	Name	Life form	Plant parts used	Medicinal uses
<i>Acacia catechu</i>	Fabaceae	Khair(N)	T	Shoot	Shoot juice is consumed as a curative measure against diarrhea (Kunwar et al., 2010).
<i>Achyranthes aspera</i>	Amaranthaceae	Dattiwan(N)	S	Root	Root juice is taken orally to cure diarrhea and dysentery (Bhattarai et al., 2009; Burlakoti & Kunwar, 2008; Kunwar et al., 2009;)
<i>Adiantum capilliluis</i>	Adiantaceae	Gophale(N)	H	whole plant	The whole fern plant is useful against diarrhea (Kunwar et al., 1970).
<i>Aegle marmelos</i>	Rutaceae	Bel(N)	T	Fruit/leaves	Extract of plant leaves and fruit (taken orally) is used in the treatment of diarrhea and dysentery (Burlakoti & Kunwar, 2008; Kunwar & Bussmann, 2009; Bhattarai et al., 2013)
<i>Alstonia scholaris</i>	Apocynaceae	Chhatiwan(N)	T	Bark	Oral consumption of bark juice is useful to cure both diarrhea and dysentery (Kunwar et al., 2009).
<i>Amaranthus viridis</i>	Amaranthaceae	Lunde(N)	H	Leaf	Clean and fresh leaves are eaten up to cure diarrhea (Kunwar et al., 2012)
<i>Andrographis paniculata</i>	Acanthaceae	Kalmegh (N)	H	Root	Root extract is useful to cure dysentery (Kunwar et al., 2010)
<i>Asparagus racemosus</i>	Liliaceae	kurilo(N)	H	Root/shoot	Root juice helps to cure diarrhea. Tender shoots when consumed is useful in diarrhea (Bhattarai et al., 2009; Burlakoti & Kunwar, 2008; Kunwar et al., 2009).
<i>Astilbe rivularis</i>	Saxifragaceae	Budhookhato(N)	H	Whole plant	Cures diarrhea and dysentery (Kunwar et al., 1970; Kunwar et al., 2009; Kunwar & Bussmann, 2009; Kunwar et al., 2013).
<i>Azadiracta indica</i>	Meliaceae	Neem(N)	T	Leaves/Bark	Bark and leaves of neem are useful against diarrhea (Thapa et al., 2020).
<i>Bahunia purpurea</i>	Fabaceae	Tanki(N)	T	Flower	Fresh flowers are beneficial to treat diarrhea and dysentery (Kunwar et al., 2012)
<i>Bahunia variegata</i>	Fabaceae	koilaro(Th), Koiralo(N)	T	Bark/flower	Flower extract is useful in diarrhea and dysentery (Kunwar et al., 2010), bark juice is consumed orally to cure dysentery (Acharya & Acharya, 2009; Negi & Sharma, 2012)



<i>Bauhinia vahlii</i>	Fabaceae	Malu(N)	C	Bark/seed	Bark juice is given orally consumed(Burlakoti & Kunwar, 2008; Thapa et al., 2014).
<i>Berberis asiatica</i>	Berberidaceae	Chutro(N)	S	Root	Root extract is orally taken to cure diarrhea (Bhattarai et al., 1970; Burlakoti & Kunwar, 2008; Kunwar et al., 2009; Kunwar et al., 2013)
<i>Bergenia ciliate</i>	Saxifragaceae	Dhungefool(N)	H	Root/rhizome	Decoction of rhizome and root is used to cure diarrhea (Kunwar, 2003; Burlakoti & Kunwar, 2008; Kunwar & Bussmann, 2009; Kunwar et al.; 2009; Kunwar et al., 2013; kunwar, 2014; Ghimire et.al., 2021)
<i>Boehmeria platylylla</i>	Urticaceae	Gargallo(N)	T	Root	Root juice is orally taken to cure dysentery (Kunwar et al., 2010)
<i>Bombax ceiba</i>	Bombacaceae	Simal(N)	T	Flower/seed/root/bark	Both flower and seed are used to cure diarrhea (Burlakoti & Kunwar, 2008; Kunwar et al., 2009). Root and bark are emetic and stimulant (Kunwar et al., 2013).
<i>Butea monosperma</i>	Fabaceae	Palans(N)	T	Bark	The use of bark gum is beneficial to cure diarrhea and dysentery (Kunwar et al., 2012)
<i>Cannabis sativa</i>	Cannabaceae	Ganja(N), Bhang(R)	H	Leaf	About 15 ml of Leaf juice is taken orally four times a day to cure diarrhea and dysentery (Manandhar, 1998).
<i>Curculigo orchioides</i>	Hipoixidaceae	Musal eri(N)	H	Root	The root also has anti-diarrhea properties (Kunwar et al., 1970; Kunwar et al., 2013). Mixture of 2gm of plant root mixed with black pepper and barley seeds in equal amounts controls dysentery when consumed thrice a day (Manandhar, 1985) ,
<i>Cyperus rotundus</i>	Cyperaceae	Siru(N)	H	Rhizome/root/bark	Rhizome decoction is used to treat diarrhea and dysentery (Kunwar et al., 2009; kunwar, 2014; Ghimire et.al., 2021), root and bark extract is useful in treatment of diarrhea (Burlakoti & Kunwar, 2008; Acharya et al., 2009)
<i>Desmodium trifolium</i>	Leguminosae	Chaupate(N)	S	Whole plant	Whole plant extract is used often as cure for diarrhea and dysentery(Bhatt et al., 2021).
<i>Diploknema butyracea</i>	Sapotaceae	Chiuri(N)	T	Bark	Bark juice is orally consumed to treat diarrhea (Thapa et al., 2014)
<i>Elaeagnus parvifolia</i>	Elaeagnaceae	Guyeli	S	Fruits	Fruits are eaten in cases of bloody dysentery (Pyakurel, 2020)
<i>Euphorbia hirta</i>	Euphorbiaceae	Dudhi jhar(N)	H	whole plant	Plant juice is consumed for treating diarrhea (Kunwar, 2003; Kunwar et al., 2010)
<i>Evolvulus alsinoides</i>	Fabaceae	Aankuri phul(N)	H	whole plant	Plant exhibit anti-dysenteric properties (Kunwar et al., 2010).
<i>Ficus auriculata</i>	Moraceae	Timlo(N)	T	Fruit	Fruits are consumed during diarrhea and dysentery. (Burlakoti & Kunwar, 2008; kunwar, 2014)
<i>Garuga pinnata</i>	Burseraceae	Dabdabe(N)	T	Bark	Bark juice is taken orally (Thapa et al., 2014).
<i>Indigofera atropurpurea</i>	Fabaceae	Hakunya(N)	S	Flower	Boiled 5gm of flowers in 2 water cups for around 5min, when consumed 4 times a day helps to treat diarrhea and dysentery (Manandhar, 1998)
<i>Jurinia dolomiaea</i>	Asteraceae	Bhutkes(N)	H	Root	Root juice is orally taken to cure diarrhea (Kunwar et al., 2010)
<i>Justicia adathoda</i>	Acanthaceae	Asuro(N)	S	Leaf	Leaf juice is taken orally to treat diarrhea and dysentery (Kunwar et al., 2009)
<i>Mallotus philippensis</i>	Euphorbiaceae	Sindhure(N)	T	Bark	Bark juice is extracted and given orally (Thapa et al., 2014).
<i>Mangifera indica</i>	Amaranthaceae	Anp(N)	T	Bark	Bark juice is taken orally to cure diarrhea and dysentery (Bhattarai et al., 2009; Thapa et al., 2014).
<i>Mimosa pudica</i>	Fabaceae	Lajjawati(N)	S	Leaves/Roots	Juice of the plant is used in jaundice, fever and diarrhea (Bhatt & Kunwar, 2020).
<i>Musa paradisiaca</i>	Musaceae	Kera(N)	S	Leaves/Fruits	Leaves and fruits are consumed to cure diarrhea (Thapa et al., 2020).
<i>Myrica esculenta</i>	Myricaceae	Kaphal(N)	T	Bark/fruit	Bark juice is consumed and fruits are taken orally to treat dysentery & diarrhea. (Kunwar et al., 2010; Thapa et al., 2020).
<i>Ocimum tenuiflorum</i>	Lamiaceae	Tulsi(N)	H	Bark	Bark juice is consumed in order to treat both diarrhea and dysentery (Thapa et al., 2020).
<i>Oroxylum indicum</i>	Bignoniaceae	Tatelo(N)	T	Leaf,root and sed	leaf decoction, root decoction is useful to treat diarrhea and dysentery (Burlakoti & Kunwar, 2008; Kunwar et.al., 2009). Seeds help in ingestion (kunwar,2014)
<i>Oxalis corniculata</i>	Oxalidaceae	Chari amilo(N)	H	Leaf	Juice is taken orally to cure diarrhea and dysentery (Pyakurel, 2020).



<i>Pfumbago zeylanica</i>	Plumbaginaceae	Kalamnath(N)	S	Root	Mixture of single seed of barley and black pepper mixed with 1gm of plant root consumed twice a day cures dysentery (Manandhar, 1985).
<i>Pistacia chinensis</i>	Anacardiaceae	Kakarsingee(N)	T	Gall	Useful in treatment of dysentery and also treatment of hepatitis and liver disorders (Kunwar et al., 2009).
<i>Pyhyllanthus emblica</i>	Euphorbiaceae	Amala(N)	T	Fruit	consumption of fresh fruits helps to control diarrhea and dysentery (Kunwar et al., 1970; Kunwar et al., 2013)
<i>Pyracantha crenulata</i>	Phytolaccaceae	Ghangharu(N)	S	Fruit	Fruits are taken orally to cure dysentery (Kunwar et al., 2010; Pyakurel, 2020)
<i>Quercus lanata</i>	Fagaceae	Baanjh(N)	T	Resin	consumption of dry resin help to cure dysentery (Kunwar et al., 2010)
<i>Rauvolfia serpentina</i>	Apocynaceae	Dhaldhaliya (Th)	S	Root/fruit	root extraction treats cattle diarrhea (Manandhar, 1985), fruits consumed help in cure of diarrhea and dysentery (Acharya et al., 2009)
<i>Rhododendron arboreum</i>	Ericaceae	Laligurans(N)	S	Flower	Flower extraction is consumed to treat dysentery (Kunwar et al., 2009; Coburn, 1974; Pyakurel, 2020)
<i>Rhus parviflora</i>	Anacardiaceae	Satibayer(N)	H	Fruit	Decoction is taken for dysentery (Burlakoti & Kunwar, 2008; Kunwar, 2014).
<i>Rosa macrophylla</i>	Rosaceae	Jangali gulaf	S	Fruits	Diarrhea is treated with fruit extract (Pyakurel, 2020).
<i>Rubus ellipticus</i>	Rosaceae	Ainselu(N)	S	Root	Root juice is taken orally to cure diarrhea and dysentery (Pyakurel, 2020)
<i>Rus javanica</i>	Anacardiaceae	Bhakiamilo(N)	T	Fruit	Fruits are consumed to treat dysentery (Kunwar, 2003.)
<i>Shorea robusta</i>	Dipterocarpaceae	Sal(N)	T	Bark	Bark juice is extracted and given orally (Thapa et al., 2014).
<i>Smilax ovalifolia</i>	Liliaceae	Bhityaul(R)	C	Stem	Stem juice is taken to cure diarrhea (Manandhar, 1998).
<i>Syzigium cumini</i>	Myrtaceae	Jamun(N)	S	Bark/seed	Bark and seed powder is consumed to treat diarrhea and dysentery (Kunwar et al., 2009; Burlakoti & Kunwar, 2008).
<i>Taxus wallichiana</i>	Taxaceae	Lothsalla(N)	T	Leaf	Dry leaves are used to cure diarrhea (Kunwar et al., 2010).
<i>Terminalia bellirica</i>	Combretaceae	Barro(N)	H	Fruit	fruit juice is given orally to cure cattle diarrhea (Kunwar et al., 2012; Bhattarai et al., 2013)
<i>Terminalia chebula</i>	Combretaceae	Harro(N)	T	Bark, fruit	Juice of bark is consumed whereas fruit is eaten with <i>Phyllanthus emblica</i> (Thapa et al., 2014; Bhattarai et al., 2013).
<i>Thalictrum cultarum</i>	Ranunculaceae	Pel jad(N)	H	whole plant	Plant extraction is consumed to treat dysentery(Kunwar et al., 2009; Kunwar & Bussmann, 2009; Kunwar et al., 2013;)
<i>Woodfordia fruticosa</i>	Lythraceae	Dhainyaro(N)	S	Flower	flower decoction is consumed to treat bloody dysentery (Bhattarai et.al., 2009; Burlakoti & Kunwar, 2008; Kunwar et al., 2009; Pyakurel, 2020)
<i>Zanthoxylum armatum</i>	Rutaceae	Timur(N)	S	Fruit	fruits consumed help to treat diarrhea (Kunwar, 2003; Bista & Webb, 2006; Kunwar et al., 2013)
<i>Zizyphus mauritiana</i>	Rhamnaceae	Bayar(N)	S	Root	Plant powder is used to treat dysentery (Manandhar, 1985), root paste is useful in treatment of diarrhea and dysentery (Kunwar et al., 2009; Kunwar, 2014)

Abbreviations for names: N: Nepali Name R: Raute Name Th: Tharu name

CONCLUSION

The richness of medicinal plants in the far western region is abundant. This study illustrates the use of 60 plant species belonging to 38 families reported to be conveniently beneficial for the treatment of diarrhea and dysentery. Plant species belonging to the Fabaceae family were reported with the highest uses. Trees were the most used variety in terms of plant habit while we encountered climbers to be least used. Root and bark were the most used plant parts used in the form of paste and powder. In the context of far western region, it has received the least amount of attention from the researchers. The potency of medicinal plants of this region is yet to be realized as not more than a few enough pieces of research have been carried out in this region. In rural parts of this region, where cases of diarrhea and dysentery is more common, use of the medicinal plants as described in table 1. have been means of primary health care; but dependency on allopathic medications is rapidly increasing as traditional ethnobotanical knowledge of local communities is vanishing due to ignorance of young generation, lack of conservation strategies and lack of proper documentation. Also, the lack of conservation of ancient knowledge has led to use of medicinal plants in appropriate manner leading to vibrant side effects rather than cure. Proper marketing strategies and conservation practices can provide an alternative source of income to rural people of this region. Therefore, it is suggested that this region requires more research to explore the diversified glorious distribution of dynamic plant species rich in medicinal values and more experimentations to ensure the promising prospects of medicinal plants.

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DECLARATION OF CONFLICT OF INTEREST

No conflict of interest to declare.

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