

# **ETHNOMEDICINAL PLANTS USED BY THE TAMANG COMMUNITY OF SHANKHARAPUR, KATHMANDU**

A Dissertation

Submitted for the partial fulfillment of the requirements for the Master's

Degree in Science, Biodiversity and Environmental Management

Central Department of Botany

Institute of Science and Technology Tribhuvan University



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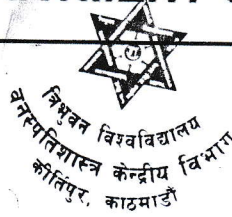
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**RECOMMENDATION**

It is hereby recommended that Srijana Farsawani, M.Sc. final semester student from 'Biodiversity and Environmental Management' at Tribhuvan University, Institute of Science and Technology, Kirtipur Kathmandu carried out the research work entitled "ETHNOMEDICINAL PLANTS USED BY THE TAMANG COMMUNITY OF SHANKHARAPUR, KATHMANDU" under our supervision. The entire work is based on the fieldwork performed by her. As per our knowledge, this work has not been submitted for any other academic degree. We, therefore, recommend this dissertation to be accepted for the partial fulfillment of the requirement of Master's Degree in Biodiversity and Environmental Management at the Institute of Science and Technology, Tribhuvan University.

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**LETTER OF APPROVAL**

The M.Sc. thesis entitled "ETHNOMEDICINAL PLANTS USED BY THE TAMANG COMMUNITY OF SHANKHARAPUR, KATHMANDU" submitted by Miss. Srijana Farsawani has been accepted for the partial fulfillment of her Master's Degree in Biodiversity and Environmental Management.


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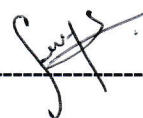
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## DECLARATION

I hereby confirm that I am the author of this work and that this dissertation is completely my own creativity. It has never been submitted, in whole or in part, for a degree at another institution of higher learning. The ideas and opinions stated in this dissertation are purely my own. Any information taken from an external source has been cited in the text, and a thorough list of references is included. Every reasonable attempt has been made to get permission and credit copyright holders for any materials utilized.



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**Srijana Farsawani**

**May, 2024**

## सार

जैविक विविधताले पृथ्वीमा सम्पूर्ण जीवनको सुरक्षा प्रत्याभुत गरी पारिस्थितिकी प्रक्रियाहरू, खाद्य सुरक्षा, मानव स्वास्थ्य र प्रकृति सगँको सम्बन्धलाई सुनिश्चित गर्दछ । एथ्नोबोटनी र एथ्नोमेडिसिनले मानव स्वास्थ्य सामाज र वनस्पतिहरू बीचको सम्बन्ध पत्ता लगाउँछ। एथ्नोमेडिसिन, एथ्नोबोटनीको एक शाखा हो, जसले स्थानीय उपचार प्रथाहरूमा गहिरो अनुसन्धान गर्दछ, जुन पुस्तादेखि पुस्तासम्म मौखिक रूपमा संचारित हुन्छ। नेपालको विभिन्न भौगोलिक क्षेत्रहरूमा बसेका जनजातिहरू स्वास्थ्य सेवाको लागि परम्परागत रूपमा वनस्पतिहरूको उपयोग गर्दछन्। यस अनुसन्धानको मुख्य उद्देश्य शंकरापुरमा रहेका तामाङ् समुदायले औषधीय उद्देश्यको लागि परम्परागत ज्ञानलाई गरिरहेको छ भन्ने अर्घ्य गर्नु हो । विभिन्न वैज्ञानिक बिधिहरूको प्रयोगले २६ पुरुष र १४ महिलाहरू विच गरेको अध्यनले ५३ रोगको उपचार गर्नको लागि ६८ वनस्पतिका प्रजातिहरूको प्रयोग गरिएको पाइयो। यी वनस्पतिका पातहरू सबैभन्दा बढी प्रयोग गरिएको थियो। हड्डी तथा जोर्नी रोगको क्षणीमा उच्चतम ICF थियो, जून ०.३६५ थियो। अर्घ्यले तीन वनस्पति प्रजातिहरू तुलसी, घोडताप्रे र तितेपातीको FL ९००% निर्धारन गरेको छ। गाजा, घ्यु कुमारीको RFC ०.६५ थियो। उच्चतम RFC को मतलब त्यो बिरुवा धेरै मात्रामा प्रयोग गरिन्छ। UVs र RFCs को बिच सहसंबंध गुणांक ०.६६ छ जसले अत्याधिक सकारात्मक महोतोपुर्ण सम्बन्ध देखाएको छ। पारम्परिक चिकित्सकहरू, अनुसन्धानकर्ता, निति निर्माताहरू र समुदायका सदस्यहरूको सहयोगले तामाङ् जातिको एथ्नोमेडिसिनको धरोहलाई सुरक्षित गर्न सकिन्छ ।

मुख्य शब्दहरू: एथ्नोबोटनी, औषधीय बोटहरू, परम्परागत ज्ञान, तामाङ् समुदाय, जैविक विविधता ।

## ABSTRACT

Ethnobotany explores the intricate relationship between human societies and plants, including their traditional uses for food, medicine, and cultural practices. Ethnomedicine, a branch of ethnobotany, delves into local healing practices, often transmitted orally across generations, and investigates how cultural beliefs shape healthcare within different communities. Ethnic communities in Nepal's various phytogeographic regions have different indigenous knowledge of using plant resources for health care. This study primarily aims to document traditional knowledge of medicinal plants used by the Tamang community of Shankharapur, Kathmandu. The Tamang people, an indigenous ethnic group with a rich cultural heritage, have developed a profound knowledge of medicinal plants and healing practices over centuries. Ethnobotanical data were collected through focus group discussions, key informant interviews, personal interviews and transect walks by applying semi-structured questionnaire. Quantitative parameters like Informant Consensus Factor (ICF), Frequency Index (FI), Used Values (UV) and Relative Frequency of Citation (RFC) were used during ethnobotanical analysis to find out the important plant species used in the study area. Of the total informant, males were 26 and females were 14. The study documented 68 medicinal plant species used to treat 53 ailments. Herbs (25 species) were most abundant. Leaves (28) were the plant parts most preferred, and the major mode of herbal formulation was paste (29%). The disease category with the highest ICF value was musculoskeletal ailment with a value of 0.375. The study determined three plant species i.e. *Ocimum sanctum* Linn., *Centella asiatica* (L.) Urb and *Artemisia indica* Willd. with FL of 100%. The RFC value was highest for the *Aloe vera* (L.) Burm. f. and *Cannabis sativa* L. with a value of 0.65. Highest the RFC most frequently the plant is used. There is a positive link between UVs and RFCs ( $r=0.66$ ). Collaborative efforts between traditional healers and other stakeholders are essential for safeguarding the ethnomedicinal heritage of the Tamang people and ensuring its continued relevance in a rapidly changing world.

**Keywords:** Ethnobotany, Tamang community, Medicinal plants, Traditional knowledge, Biodiversity

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## LIST OF ACRONYMS AND ABBREVIATIONS

<b>CAMP</b>	Conservation Assessment and Management Plan
<b>CBS</b>	Central Bureau of Statistics
<b>DPR</b>	Department of Plant Resources
<b>FGDs</b>	Focus group discussions
<b>ICF</b>	Informant Consensus Factor
<b>FL</b>	Fidelity Level
<b>GoN</b>	Government of Nepal
<b>IUCN</b>	International Union for Conservation of Nature
<b>KATH</b>	National Herbarium and Plant Laboratories
<b>KII</b>	Key Informant Interviews
<b>MAPs</b>	Medicinal and Aromatic Plants
<b>MP</b>	Medicinal Plants
<b>OHCHR</b>	Office of the United Nations High Commissioner for Human Rights
<b>RFC</b>	Relative Frequency of Citation
<b>TEK</b>	Traditional Ecological Knowledge
<b>TK</b>	Traditional Knowledge
<b>TU</b>	Tribhuvan University
<b>TUCH</b>	Tribhuvan University Central Herbarium
<b>UNEP</b>	United Nations Environment Programme
<b>UV</b>	Use value
<b>WHO</b>	World Health Organization

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# CHAPTER 1: INTRODUCTION

## 1.1 Background

Ethnobotany, a term coined by John Harshberger in 1896, refers to the study of how Indigenous peoples utilize plants. Previously known as “aboriginal botany,” a term introduced by Power in 1874, it encompassed the investigation of plants used by native populations for various purposes such as food, medicine, and crafting materials. The scope of ethnobotany was broadened by Robbins *et al.* (1916) beyond the identification and cataloging of plants used by Indigenous people. Jones (1941) echoed this sentiment, highlighting ethnobotany’s focus on the dynamic relationship between people and plants. Schultes (1962) further underscored this connection, particularly within indigenous societies. Building upon this, Heiser (1995) expanded the definition to include the study of both wild and cultivated plants and their significance to human societies, thus broadening the concept of ethnobotany to encompass domesticated flora as well.

Plants and people always have had a good relationship since prehistoric times. People have been using different kinds of plants and plant products in different occasions. All such studies of the reciprocal links between people and plants fall under the umbrella of ethnobotany (Cotton, 1996). Nowadays, ethnobotany is acknowledged as a multidisciplinary field of study that includes several facets of botany, ecology, history, anthropology, culture, and plant science (Sheng Ji, 2001). Researchers and environmental experts have taken an interest in the connections between Indigenous communities across the globe, aiming to create a valuable synergy that benefits all of humanity (Smith, 2022). People who identify as belonging to the same ethnic group, such as by ancestral connections, language, social, religious, or cultural experiences, are called ethnic Indigenous communities or ethnicities. There are about 370 million Indigenous people spread across the globe (United Nations Report, 2020). Indigenous knowledge is the main source of all studies using ethnobotany and is termed Traditional Ecological Knowledge (TEK) or Traditional Knowledge (TK) (Kumar *et al.*, 2021).

Indigenous people, who are interacting with the ecosystem over a long run for their livelihood, have the best understanding of resource dynamics and its utilization and management (Folke, 2004). The plants consumed by a group of local people in a particular region are determined through ethnobotanical approaches (Martin, 1995). Documenting indigenous knowledge through ethnobotanical methods is crucial for preserving species and utilizing resources sustainably (Gemedo-Dalle *et al.*, 2005).

Additionally, these studies are valuable as they often uncover plant species of local importance, which can lead to the identification of new medicinal compounds and support economic growth (Uprety *et al.*, 2010).

The conservation and recording of traditional understanding hold significant value for both Indigenous and academic circles. (Huntington, 2000) contended that integrating traditional knowledge into broader scientific inquiry is challenging due to accessibility issues and the necessity for employing social science techniques to collect biological information.

Indigenous and local people's contributions to biodiversity protection and sustainable usage extend much beyond their role in managing natural resources. Their knowledge and practices benefit the worldwide society and serve as an example for biodiversity policies. Furthermore, Indigenous and local groups are most closely involved with conservation and sustainable use because they are on-site communities with significant knowledge of local habitats (Mekonen, 2017).

Over recent years, the global scientific community has shown a growing fascination with the study of medicinal plants and their historical applications (Lev, 2006). The systematic recording of indigenous wisdom in the realm of botany plays a pivotal role in both preserving species and managing biological resources effectively. Historically, various plant-based solutions have been effectively employed to address various medical conditions, including infections of the respiratory system, digestive disturbances, skin conditions, and ailments affecting the liver and heart (Sen, 1993).

Traditional knowledge is under threat due to various modern developments. Research in Nepal by Kunwar *et al.*, (2016) highlights that shifts in lifestyle, economic and cultural changes, alterations in land use, migration trends, the influence of a market-driven economy, changes in plant species, and climate change are all factors that erode traditional knowledge and customs. Atreya *et al.* (2018) further point out that this decline is worsened by a reduction in the variety of plant species, the widespread adoption of modern medical practices and agricultural technologies, including chemical pesticides, genetically modified seeds, and advanced storage methods, coupled with a diminishing awareness and appreciation of traditional knowledge, especially among younger generations.

### **1.1.1 Traditional Knowledge and Practices in the Context of Nepal**

The Indian subcontinent has a long-standing tradition of utilizing plants for a multitude of uses. The Vedas, which are among the earliest compilations of human knowledge, detail the use of plants for medicinal purposes. The four Vedas Rigveda, Yajurveda, Samaveda, and Atharvaveda serve as a treasure trove of ancient medicinal wisdom. Specifically, Atharvaveda, which is synonymous with Ayurveda or the “science of life” integrates herbal remedies with dietary guidelines, psychological insights, and spiritual principles to form a holistic healing system (Joshi & Joshi, 2005). In Nepal, traditional herbal medicine is firmly rooted in religious and cultural customs. Indigenous and local communities have long harnessed the power of plants to address health issues, following time-honored customs and traditions. Despite the rich potential for such practices, Nepal has yet to fully realize the opportunities for ethnobotanical research and application (Rajbhandari, 1994).

Botanical research in Nepal began almost two hundred years ago by foreign scientists (Rajbhandari, 2001). The pioneering work was done by Francis Buchanan, a Scottish physician, who in 1802-1803 gathered 433 plant specimens, marking the first such collection in the country. This effort was succeeded by Nathaniel Wallich’s work during 1820-1821, focusing on the flora of the Kathmandu Valley (Rajbhandari, 1976). Subsequently, Don (1825) and Wallich (1824-1826) published accounts of their plant collections, including ethnobotanical notes. Drawing from the data amassed by Buchanan-Hamilton and Wallich, David Don produced the ‘*Prodromus Florae Nepalensis*’ in 1825, cataloging 650 plant species. This publication set the stage for the ongoing documentation and collection of Nepal’s diverse botanical species. Following these initial explorations, numerous plant species from different regions of Nepal have been systematically cataloged and documented.

The formal investigation into the ethnobotanical applications began with Banerji, (1955) who studied edible and medicinal plants. This was followed by Singh (1960) work on wild edibles, and subsequent studies by Pandey (1964), Jest (1972), and Dobremez (1976), which collectively highlighted the diverse medicinal flora utilized by different communities in Nepal. Manandhar, (2002) cataloged 1,517 species with ethnobotanical uses, and DPR (2007) reported approximately 701 species of medicinal plants found in Nepal. Rokaya et al. (2010) mentioned that there are 1792 to 2331 medicinal plants in Nepal. A comprehensive database indicates that there are 1950 medicinal plant species utilized in Nepal and of these, 1906 belong to the vascular category, which includes 1614 indigenous species, 192 are cultivated or introduced,

and 100 have become adopted (Ghimire, 2008) while Baral and Kurmi (2006) have revealed that 1792 plant species with therapeutic properties are used by traditional healers.

Nepal boasts a rich tapestry of plant diversity, often likened to a natural botanical garden, thanks to its varied geography, ecology, and range of altitudes stretching from 63 to 8,848 meters above sea level. It is a land of cultural and linguistic diversity, home to approximately 142 distinct caste/ethnic groups who speak around 120 different languages (CBS, 2021). A significant portion of the population, about 80%, particularly in remote places, relies on traditional herbal medicines for their basic medical requirements, despite the widespread availability of modern allopathic medicines, (Manandhar, 1980; Ghimire *et al.*, 2000).

The safeguarding and systematic documentation of ethnobotanical wisdom are essential for future generations. Because of Nepal's rural nature, the majority of the people does not have access to modern health care or structured systems of traditional medicine. For a vast number of Nepalese, especially in remote areas, plant-based remedies are the cornerstone of primary healthcare due to their affordability, accessibility, and ease of use (Manandhar, 2002). The extensive traditional botanical knowledge possessed by Indigenous communities, which encompasses the utilization and stewardship of wild plant resources, is a testament to the deep-rooted relationship between people and plants in Nepal (Cotton, 1997).

### **1.1.2 Trade, Threats and Conservation of Medicinal Plants**

Annually, a substantial quantity of medicinal herbs, amounting to thousands of tons, is harvested from natural landscapes and exported internationally. This commerce in herbal medicine serves as a significant fiscal contributor to the government and provides a vital livelihood for the rural populace. Currently, around 300 varieties of these herbs are commercially utilized for various industrial applications (Pyakurel *et al.*, 2019). Many risks to medicinal plant species are comparable to those that threaten plant variety in general. Key immediate risks include the destruction and deterioration of habitats, as well as excessive harvesting (Hamilton, 1997). A contributing factor to the heightened risk for medicinal plants is the breakdown of customary laws that have historically governed the sustainable use of natural resources. These statutes have frequently proven to be easily overturned by current socioeconomic pressures (Pant, 2002). Most likely the significant 'function' of medicinal plants in the preservation of biology and the environment arises from the bases they are able to offer for people's

participation in the preservation of natural habitats (Schopp-Guth and Fremuth, 2001). The value of medicinal plants extends beyond their direct use, as efforts to conserve and sustainably manage them also support broader environmental conservation and ecosystem services. Thus, the benefits of preserving medicinal plants are not limited to the plants alone but also include the preservation of natural habitats and ecosystems. This is particularly true in remote areas rich in cultural and biological diversity, where medicinal plants are deeply integrated into the cultural fabric and economic survival of the communities. The interaction between humans and medicinal plants is deeply rooted, within a history of collection, usage, and management guided by local traditions and knowledge.

Herbal medicine's globalization combined with uncontrolled exploitation and lack of effective conservation strategy has increased the risk of disappearance of several medicinal plants (Kunwar *et al.*, 2013). Therefore, sustainable utilization and management of medicinal plants is an urgent need. It's crucial to systematically record medicinal plants, their customary applications, and management techniques as a component of broader conservation initiatives aimed at preserving our global heritage (Lambert *et al.*, 1997). Empirical evidence and expertise in ethnoecology should be acknowledged in this endeavor (Ghimire *et al.*, 2006). The conservation and sustainable usage of medicinal plants should be more effective through community-based approaches, in which community members should take increasing responsibility for the management of such resources (Chen *et al.*, 2016).

A significant portion of the global population depends on herbal medicine for their primary healthcare. It is believed that between 70% and 80% of individuals globally depend mainly on such traditional remedies (Shengji, 2001). The absence of effective management has placed highly valuable plants at risk. Fifty-one medicinal plants are now classified under various levels of threat, including endangered, rare, vulnerable, and commercially at risk (Bhattarai *et al.*, 2002). It is commonly understood that medicinal and aromatic plants (MAPs) in mountainous areas face greater risks, with the primary dangers being excessive or unsustainable harvesting practices and the destruction of their natural habitats (Chaudhary, 1998).

The traditional knowledge and use of medicinal plants are steadily eroding due to shifts in local attitudes, the growing impact of worldwide commercialization, and socio-economic changes (Kunwar and Adhikari, 2005). The multitude of factors impacting medicinal plants include deforestation, habitat degradation due to agricultural development, fire, overgrazing, unsustainable harvesting techniques, climate change

(particularly drought), an uncontrolled market, the spread of invasive alien species, unplanned tourism, lack of knowledge, and information gap, lack of conservation incentives, urban and industrial development, poor management, and the erosion of traditional knowledge (Kunwar and Duwadae, 2003; Rai *et al.*, 2011).

The observed decline in Indigenous knowledge has been noted. Herbal remedies are highly valued for their efficacy in treating a number of diseases, including infectious diseases. It is recognized that the methods of using specific plants for healing can vary significantly among indigenous communities, as well as between healers and Jhakris (Manandhar, 1999). Their knowledge, experience, technologies, and recipes have also not been adequately documented. As a result, skills and knowledge deteriorate alongside practitioners.

### **1.1.3 Rationale of the Study**

The Tamang community, one of the Indigenous ethnic groups of Nepal, possesses a rich cultural heritage and deep-rooted knowledge of the medicinal and nutritional uses of local flora. The study of ethnobotany within the Tamang community of Nepal offers a unique opportunity to explore the intricate relationships between Indigenous peoples and their surrounding plant life, particularly in terms of cultural practices, traditional knowledge, and sustainable living. Shankharapur Municipality is an important place with a diverse range of medicinal plant species. However, no detailed ethnobotanical research has yet been undertaken in this region. This research endeavor is based on documenting beneficial plant resources which are living life-supporting sources for people residing in that area. Furthermore, the ethnobotanical documentation itself contributes to safeguarding knowledge and practices of Indigenous and local communities and helps in protection of cultural diversity (Luczaj, 2023).

### **1.1.5 Objectives**

The main objective of the research is to document the traditional knowledge related to medicinal plants used by the Tamang people of Shankharapur Municipality, Kathmandu.

The specific objectives of the research are as follows:

1. To document and identify medicinal plants in the traditional health care system of Tamang people.
2. To calculate the Use Value (UV) of the most frequently used plants and evaluate the Informant Consensus Factor (ICF), Relative Frequency of Citation (RFC) and Fidelity Level (FL) for medicinal plants.
3. To assess the conservation practices of medicinal plants in the study area.

### **1.1.6 Limitation of Study**

The study was focused specifically on documentation of traditional knowledge of the Shankharapur Municipality.

During my study, I confronted a linguistic barrier. Rare and endangered species were not gathered for herbarium preparation. Seasonal variation is an essential aspect in the collection of voucher specimens, as it is difficult to access and dry the specimens during the rainy season, while the collection of blooming stage specimens was not possible during the dry season. Indigenous people, on the other hand, were sometimes hesitant to share their understanding of medicinal plant use with others.

## CHAPTER 2: LITERATURE REVIEW

### 2.1 Ethnobotanical Study and Medicinal Plants

Medicinal plants are a cornerstone of traditional healing systems in developing countries, deeply woven into the fabric of historical and cultural traditions. In nations such as Nepal, they are particularly crucial in rural regions, where approximately 80% of the population relies on them for primary health care (WHO 2011, UNEP 2012, Sathiyaraj *et al.*, 2015). The Anthropological Survey of Nepal under “the Indigenous Peoples of Nepal” reported 125 caste/ethnic groups, 123 languages and 10 religious groups (OHCHR, 2018). There is a discrepancy over the total number of medicinal plants. Manandhar (2002) reported 1002 species. Ghimire (2008) identified a total of 1950 medicinal plant species in Nepal, of which 1906 were represented by vascular plants. This figure could rise if the ancestral knowledge of as many ethnic groups is documented.

Ethnobotany is a field of study that focuses on the complex interactions between humans and plants, exploring the various reasons behind plant selection for diverse applications. Initially, ethnobotanical research primarily involved compiling non-contextual inventories of plants, detailing their uses and preparations in isolated regions (Balick, 1996; Etkin, 1988). This study, and hence the discipline, has been condemned as 'weak' or 'pseudoscience' (Albuquerque and Hanazaki, 2009; Alexiades, 1996). Unlike cognitive ethnobotany, research in ecological ethnobotany has lacked coherent theoretical frameworks. Notable exceptions include biocultural research, which examines the biochemical basis and pharmacologic implications of local people's use of food, psychoactive, and medicinal plants (Etkin, 1988; Johns, 1986). As the subject has evolved, there has been a consistent need for a paradigm shift and more theory-driven research, namely in ecological ethnobotany.

Nepal, like the rest of the globe, has relied on traditional medicine for basic healthcare from the beginning of time. Following the publication of Banerji's paper on medicinal and food plants of eastern Nepal in 1955 (Manandhar 2002), various Nepalese scholars undertook qualitative and quantitative documentation on the use of ethnomedicine-related plants. Some notable studies are: Manandhar 1985, 1986, 1990, 1993, 1995, 1995, 2002; Mahato and Chaudhary, 2003; Shrestha and Pradhan, 1986; Shrestha *et al.*, 1998; Ghimire *et al.*, 2000; Lama *et al.*, 2001; Baral & Kurmi 2006; Shrestha & Dillion 2003; Mahato & Chaudhary 2005; Malla & Chhetri 2009; Uprety *et al.*, 2010, 2012;

Kunwar *et al.*, 2013; Singh *et al.*, 2018. However, many communities across the country remain untouched.

Nepalese ethnobotanical study today covers diverse quantitative ethnobotanical methodologies such as informant consensus factor, use value, and fidelity degree (Kunwar and Bussmann 2009; Rokaya *et al.*, 2010; Uprety *et al.*, 2010; Kunwar *et al.*, 2013) and also constitutes cross-cultural comparisons (Kunwar *et al.*, 2018).

Rokaya *et al.*, (2014) found that 947 species from 158 families and 586 genera are utilized to treat gastrointestinal diseases in Nepal. The most species (348) treated diarrhea, followed by stomachaches (340) and dysentery (307).

Bhattarai *et al.*, (2011) discovered 45 species in the Panchase forest in central Nepal that could be used to treat 34 various types of illnesses. Whole plants and leaves were mostly used. Fever and diarrhea are thought to be the most prevalent illnesses among the various ailments.

Shrestha (1988) recorded 100 species where 53 species were found to be used as food items, while 19 species as medicine, 16 species as firewood, 15 species as fodder, 14 species as timber, 6 species as fiber and 12 species for miscellaneous in Kathmandu Valley (Manichur) by Tamang people.

Manandhar (1992) studied the folklore medicine of Dhading district. He reported 139 species of plants with medicinal value that are used in local therapeutics in the area.

Shrestha & Khadgi (2075) documented 44 species of herbal veterinary practices in Makawanpur, Kathmandu, Lalitpur, Bhaktapur, Sindhupalchowk, Kavrepalanchok, Rasuwa, Nuwakot, Dhading and Lamjung districts of central Nepal along with Tamang people.

Karki *et al.* (2023) identified 111 species of medicinal plants from 103 taxa that were utilized to treat eleven different types of illnesses in the Dolakha district. Families such as Asteraceae, Lamiaceae, and Rosaceae have contributed a higher number of species of the total species recorded in the study. The Jirel people were prone to fever, headaches, cuts and wounds, skeletal and muscular abnormalities, and gastrointestinal ailments. Roots were mostly used for the preparation of remedies, followed by leaves and fruits.

Uprety *et al.* (2010) studied the indigenous use and bio-efficacy of medicinal plants in Rasuwa district and documented 56 medicinal plants with 60 medical formulations. The majority of therapeutic plants (57%) were obtained from herbs, followed by Trees

(23%). Use frequency was high in paste followed by juice. High ICF Value was 1.00 i.e. obtained for ophthalmology problems, toothache and kidney problems.

Dulal *et al.* (2022) identified 96 species of medicinal plants from 56 families and 85 genera to be utilized to treat 40 distinct illnesses. In the study area, herbs (n = 47) were the most common, while leaves (n = 30) were the most commonly used plant parts. Out of all the species, 57% were gathered from the wild. *Curcuma longa* and *Ocimum tenuiflorum* had the greatest frequency indexes of 65%. The ICF value in the study ranged from 0.4 (cardio-vascular) to 0.90 (fever).

Chaudhary & Rajbhandary (2021) documented 105 species used by Tharu out of which the majority of species were herbs i.e. 49. Similarly leaves were the most frequently used plant parts (37%). The most preferred mode of preparation was paste (43 species). There are 126 use reports for 24 plant species in the other condition category, which has the highest ICF value of 0.82. Higher FL level species included respiratory diseases (*Euphorbia royleana*), jaundice (*Cuscuta reflexa*), gastrointestinal disorders (*Bryophyllum pinnatum*), respiratory diseases (*Scindapsus officinalis*), oral and dental problems (*Spilanthes paniculata*), skeletal muscle disorders (*Tamarindus indica*), dermatological disorders (*Rosa alba*), and skeletal muscle disorders (*Achyranthes aspera*).

Singh *et al.* (2012) documented 66 medicinal plants from 37 families and 60 genera. Herbs were the primary source of medicine. Most frequently used parts were leaves i.e. 15%. A large number of species were utilized to treat gastrointestinal disorders, followed by dermatological conditions. The average ICF value is 0.94, and it varies from 0.93 to 0.97.

Gautam & Timilsina (2022) recorded 131 medicinal plants useful for treating various illnesses in the Kaski district. Herbs were employed more frequently, and paste preparation was the most popular method. With a high RFC value of 0.44, *Ocimum Sanctum* is a species that is often cited with a high RFC value 0.44. The Informant Consensus (ICF) was determined to be lowest for ear problems (0.00) and greatest for the digestive ailment category (0.8).

Gautam *et al.* (2023) documented 176 medicinal plant species. Herbs were most common and leaves were widely foraged and most common mode of preparation was paste. The Informant Consensus Factor (ICF) for medicinal plants varied, with digestive ailments at 0.26 and respiratory conditions at 0.97. The Relative Frequency of Citation (RFC) across species spanned from 0.01 to 0.87, with *Curcuma longa* topping

the chart at 0.87. Fidelity Level (FL) percentages ranged widely from 42.86% to 100%, and *Curcuma longa* was the most favored, showing a 51% FL for its use in treating cuts, wounds, and the common cold.

## **2.2 Ethnobotany of Tamang People**

Previous research has delved into the plant usage by the Tamang community, focusing largely on traditional medicinal applications (Shrestha, 1988; Tamang, 2003; Malla & Chhetri, 2009; Uprety *et al.*, 2010; Luitel *et al.*, 2014). While plants serve a multitude of purposes beyond medicine (Bhattarai, 2009), the ethnobotanical aspects of the Tamang community in Shankharapur, Kathmandu district, have not been thoroughly investigated. Uncovering this knowledge is vital for discovering plants with significant bioprospecting potential that could treat serious human diseases.

Medicinal plant lore of Tamang tribe of Kabhrepalanchowk district was studied by Manandhar (1991). It has been discovered that up to 95 plant species, both cultivated and wild, are commonly used to treat a variety of illnesses.

Yadav *et al.*, (2008), reported 53 species of ethno-medicinal plants. Herbs were commonly preferred, and root was widely used. ICF value ranges from 0 to 0.93. The highest ICF Value was for skin tissue cellular disorder. Eleven categories were created from the therapeutic uses of the plants, and the ICF was computed for each category. Consensus revealed a clearly defined medical tradition in the research region. The amount of aromatic and therapeutic plants traded was determined to be relatively high. The species that were traded most frequently were *Nardostachys grandiflora*, *Neopicrorhiza scrophulariiflora*, *Rheum australe*, *Swertia chirayita*, *Valeriana jatamansii* and *Delphinium* sp.

Luitel *et al.* (2014) documented 161 plant species from 144 genera and 86 families have been shown to treat 89 human diseases. Studies on pharmacology and phytochemistry supported the traditional usage of 60 plant species. The most common sources of medicinal materials were herbs (45%), trees (33%), and shrubs (23%). The majority of plant species were used to treat gastrointestinal disorders, and powder was the most widely used form.

Yadav and Rajbhandary (2016) reported 21 species of medicinal plants as useful for the treatment of gastrointestinal disorders by Tamang people. The mode of usage was high in paste, and the most commonly utilized plant part is the root. The diseases that appear to occur most commonly include stomachache, gastritis, diarrhea/dysentery, and worm infection.

Nepali *et al.* (2020) recorded 45 plant species of medicinal value that are used by the Tamang people in the Kispang rural municipality of the Nuwakot region. These plants belong to 36 genera and 24 families. The majority of plants (32 species) were utilized for food and medicinal. Among the 26 species of plants, leaves were the most often used plant part. This study demonstrated the extensive traditional knowledge of the Tamang population at the study location regarding the use of plants for a variety of purposes.

Ambu *et al.* (2020) documented 101 medicinal plants from Kavrepalanchok where the majority of species used were herbs. The highest Fidelity level (FL%) was found for *Calotropis gigantea* used for dermatological diseases and *Drymaria cordata* for fever. The Informant Consensus Factor (ICF) indicated that the fever (0.49) had the highest consent.

### **2.3 Conservation of Medicinal Plants**

Conservation of medicinal plants is increasingly recognized as crucial for maintaining biodiversity, ensuring sustainable use of resources, and preserving traditional knowledge systems. With a significant portion of the world's population relying on herbal medicines for primary healthcare and the pharmaceutical industry sourcing many drug compounds from plants, the need to conserve these natural resources is more pressing than ever. Effective conservation strategies involve a multi-faceted approach, integrating scientific research, community involvement, policy development, and education.

The initial evaluation of the threat to Nepalese flora was conducted by Shrestha and Joshi (1996). Subsequently, a workshop for the Conservation Assessment Management Plan (CAMP) in January 2001 appraised the threat levels of selected medicinal plants in Nepal, utilizing IUCN threat categories (Tandon *et al.*, 2001). These assessments suggest that around 138 native vascular plant species are at risk in Nepal, with medicinal plants constituting over 50 of these species. Notably, 73 of the endangered species, representing 52.9%, are plants that thrive at high altitudes, typically above 2500 meters.

Cunningham (1996) developed the Rapid Vulnerability Assessments method, which has been modified and applied to high altitude medicinal plants at Shey Phoksundo National Park by Tripathi and Schmitt (2001), Rokaya (2002), and Ghimire and Aumeeruddy-Thomas (2005). Cunningham (1996) developed this method for the assessment of useful plants at Bwindi National Park in Uganda. When evaluating the

susceptibility of a species to varying patterns of harvesting, the method proves to be a valuable way to integrate ecological and social parameters, such as the kind of user groups, the amount and methods of harvesting, the degree of social control over harvesting, and so on, locally.

In Shey Phoksundo National Park, Ghimire and Aumeeruddy-Thomas (2005) evaluated the vulnerability of 35 species of heavily traded medicinal plants. Twenty MAP species were found to be possibly susceptible. Six of these species (*Nardostachys grandiflora*, *Dactylorhiza hatagirea*, *Neopicrorhiza scrophulariiflora*, *Delphinium* sp. and *Valeriana jatamansii*) fall under the high vulnerability group, with threat ratings of 12 or more than 25. Five species had a vulnerability score of 20, and nine species had a score between 21 and 24.

Shrestha & Shrestha (2012) assessed the vulnerability of 20 species of high valued medicinal plants in Langtang National Park. The most susceptible species were found to be *Aconitum spicatum*, *Nardostachys grandiflora* and *Neopicrorhiza scrophulariiflora*. *Dactylorhiza hatagirea*, *Swertia chirayita*, *Delphinium himalayai*, *Rheum nobile* and *Asparagus racemosus* were the next most vulnerable species.

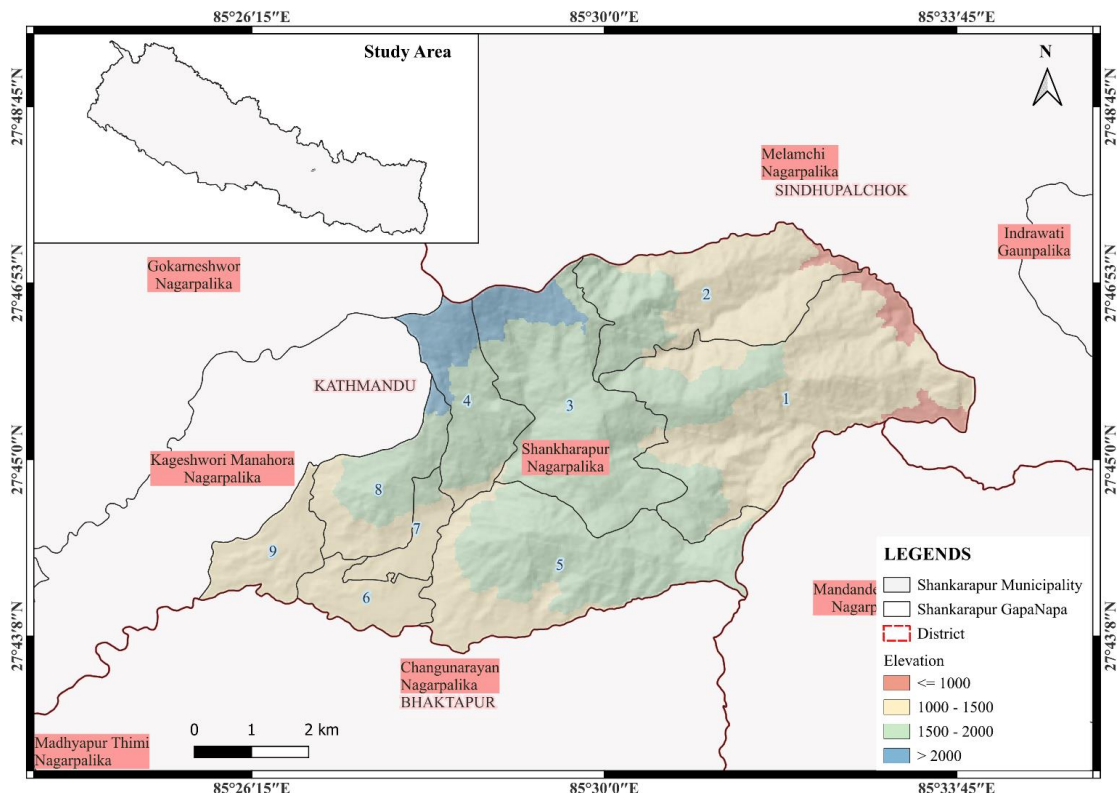
Khakurel *et al.* (2024) evaluated the susceptibility of 19 species of high value medicinal plants in Annapurna conservation area. *Dactylorhiza hatagirea* and *Neopicrorhiza scrophulariiflora* were on highest threat category.

# CHAPTER 3: MATERIALS AND METHODS

## 3.1 STUDY AREA

### 3.1.1 Physiographic Location

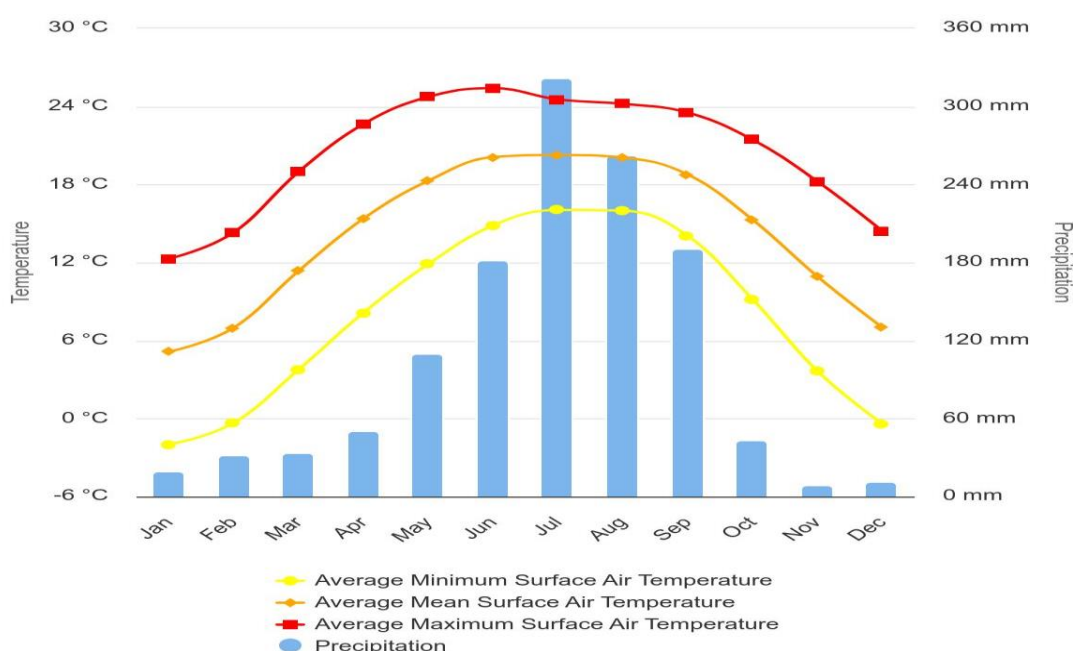
The study was conducted in the Bagmati Province's Shankharapur Municipality in the Kathmandu district, which is located at the center of the country (Figure 1). The district has a total size of 413.69 km<sup>2</sup>. The district is situated between 1,262 meters (4,140 feet) and 2,732 meters (8,963 feet) above sea level. The districts border the study area are as follows: south: Lalitpur and Makwanpur District; west: Dhading District and Nuwakot District; north: Nuwakot District and Sindhupalchok District; and east: Bhaktapur District and Kavrepalanchok District. The main river in the river system of the Kathmandu Valley is the Bagmati River. With its six main tributaries, the Bishnumati, Manohara, Dhobikhola, Nakhhu, Balkhu, and Tukucha, it drains the entire valley.



**Figure 1:** Map showing Shankharapur Municipality, Kathmandu, Central Nepal

### 3.1.2 Climate

Geographically, the area is a transition zone between subtropical and temperate climates. The temperature is hot in summer and dry in winter. The landform and elevation of the region have a significant impact on the climate. There are 199.6 days of precipitation and 1855 mm of total precipitation in a year (Figure 2).



Source: (<https://climateknowledgeportal.worldbank.org/country/nepal/climate-data-historical>)

**Figure 2:** Climatographic from 1991 to 2020

### 3.1.3 Biodiversity

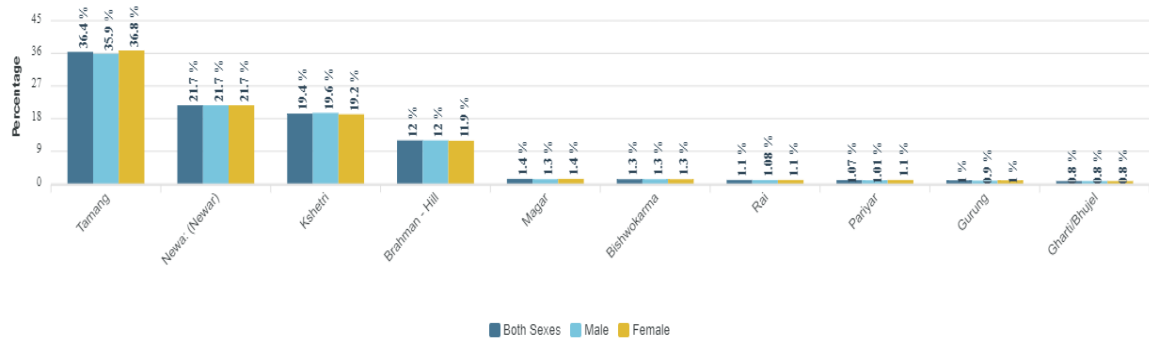
Altitudinal and climatic variation creates a high diversity of plants in Shankarapur Municipality. This study area lies on the border of Shivapuri National Park. The physiographic pattern plays a significant role in precipitation in Nepal. According to altitudinal zone and climatic variation lower mixed hardwood forests (*Quercus semicarpifolia* Sm.), Chirpine Forests (*Pinus roxburghii*), Oak Forest (*Quercus lanuginose* D. Don) and upper mixed hardwood forest are seen in the area. *Schima wallichii* (DC.) Korth., *Quercus semicarpifolia* Sm., *Quercus lanuginose* D. Don, *Rhododendron arboretum* Sm. are dominant vegetation.

### 3.1.4 Culture and Ethnicity

The total number of households was 7140 and the total population was 29,318 in Shankharapur. Out of them 14,424 were male and 14,894 were female. The high

number of populations were 20–24-year age group whereas less no were 90-94 age group (CBS 2021).

According to ethnic group wise comparison Tamang were dominant inhabitants with more than 35% of total population followed by Newar, Chettri, Brahmin, Magar, Bishwokarma, Rai, Pariyar, Gurung and Bhujel.



(Source: Central Bureau of Statistics 2021)

**Figure 3:** Population of different ethnic group in Study Area.

The Tamang, an indigenous community of Nepal, have their origins in the historical region of Ganesh Himal. Initially migrating from Tibet, they established their first settlements in the Thancher area of Rasuwa, Nepal (Hagen, 1980). This ethnic group is known for its rich cultural heritage and historical significance in the region. The Tamang community acquires their various needs from plants (Manandhar, 2002). The Tamang community possesses a wealth of traditional knowledge in the utilization of wild flora, particularly in identifying and using wild edible fruits and plants with medicinal properties (Nepali *et al.*, 2020).

### 3.1.6 People’s Socioeconomic Status and Dependency

The primary livelihood strategy used in the area is agriculture, specifically the production of crops and the care of animals. Majority of the households are engaged in traditional agriculture and animal husbandry, both directly and indirectly. People grow maize, paddy, wheat, millet, potato etc. People rear goat, sheep and buffalo as animal husbandry. Besides this migration is the major problem in the study area. Many people of the young generation were in the foreign country.

## **3.2 METHODS**

### **3.2.1 Ethical issues**

The study's goals were reviewed with local healers and government officials in the area before any fieldwork was conducted, including the Ward President of Sankharapur Municipality. Permission was taken before documenting traditional knowledge of people and also before accessing the natural resources (plant species) around them. Throughout the research, cultural sensitivities were respected, and their rights to traditional knowledge and natural resources were acknowledged.

### **3.2.2 Ethnobotanical Study**

Ethnobotanical study was conducted in three wards that is Bajrayogini (Ward no.8), Lapsehedi (Ward no.4), Naglebhare (Ward no.1). The research work was done in these three wards because majority of the Tamang population reside in these wards. Two methods were used for the fieldwork: the inventory technique and the survey technique (Cunningham, 2001; Martin, 1995). Participatory observations, key informant interviews (KII), focus group discussions (FGDs), community resource mapping, and transect walks are the main techniques used to collect data (Kunwar *et al.*, 2010).

Through key informant interviews and individual informant interviews, comprehensive information regarding the use of plants in several categories was acquired. Forty local people (26 male and 14 female), including seven key informants (5 male and 2 female) were interviewed. The key informants include one woman with hotel business, one housewife with good knowledge of medicinal plants, one male was social worker, and four were males who were involved in the medicinal plant collection and utilization including traditional healers. A snowball sampling technique was used to identify the other informants through key informants (Scherrer *et al.*, 2005). Local informants include housewives, elderly people, mother group leaders, medicinal plant collectors in the past. Interviewed people had different level of education but some had no education. The interview with local people was done where they feel comfortable with applying semi-structured questionnaires. As key informants had good understanding of medicinal plants, specific information on those plants, processing, illness cures, and parts used were acquired from them.

### 3.2.3 Plant Collection and Identification

The locals assisted in the collection of the plant specimens. In addition, pictures and a field note were taken. In the field, the gathered specimens were tagged. Ultimately, in accordance with Rajbhandari and Rajbhandary (2015) and Bridson and Forman (1998), the specimens were dried, mounted, and pressed. Additionally, locals validated the gathered specimens.

By comparing the specimens with those that had been placed in the Tribhuvan University Central Herbarium (TUCH), the specimens were recognized. Finally, consultation with experts was done for unidentified species. The specimens were deposited at Tribhuvan University's Central Herbarium (TUCH). Various online resources were checked for the accepted scientific names of plant species (<http://www.efloras.org/>, <http://www.theplantlist.org>, <http://www.flowersofindia.net/>, <https://www.catalogueoflife.org/col/search/>).

### 3.2.4 Data Analysis

Microsoft Excel was used to assess the number of various species in useful categories, life forms, and ethnobotanical data.

The following methods were applied for the data analysis:

#### 1) Informant Consensus Factor (ICF)

A technique for identifying potentially useful medicinal plants that demonstrate which plant groupings deserve more in-depth research was created by Trotter and Logan (1986) and was then readapted by Heinrich (2000). ICF is thus calculated using the following formula:

$$\text{ICF} = \frac{N_{ur} - N_t}{(N_{ur} - 1)}$$

Where, 'N<sub>ur</sub>' is the number of individual plant use reports for a particular illness category,

'N<sub>t</sub>' is total number of species used by all informants for this illness category.

#### 2) Use value (UV)

This is calculated to ascertain the utility species relative significance (Arulappan et al., 2015). When a species is cited for multiple categories, its use value is considerable; when it is noted for just one or a small number of categories, it approaches zero. It

indicates if a species of plant is employed for one or more uses. The following formula, provided by Philips and Gentry (1993), will be used to determine UV:

$$UV = \frac{Uc}{n}$$

Where, 'Uc' is the uses mentioned by each informant for a given species and

'N' is the total number of informants

### **3) Relative Frequency of Citation (RFC)**

The relative frequency of citation is calculated to find out the frequency of useful species. It shows about how frequently used a particular plant species in the local level. RFC is high when many informants cite the provided plant species, and low when few informants cite the given plant species. Relative frequency of citation (RFC) will be calculated with the formula used by Tardio and Santayana (2008):

$$RFC = \frac{U}{N}$$

Where, 'U' is number of informants who mentioned the use of a given plant species and

'N' is the total number of informants interviewed during the survey.

### **4) Fidelity level (FL)**

The fidelity level (FL) is calculated to ascertain which plant species are most commonly employed by the locals in the study area to cure a specific disease category (Friedman et al., 1986). The following formula is used to determine the FL value:

$$FL = \frac{Np}{Ni} * 100$$

Where, 'Np' is the number of use-reports mentioned for a certain plant species for a specific disease category.

'Ni' is the total number of usage reports cited for a certain species.

### **5) Pearson coefficient correlation**

Pearson's correlation coefficient is the ratio of the covariance between two variables and their standard deviations and is calculated by using the formula used by Bano *et al.* (2014).

$$r = \frac{COV(X, Y)}{SD(X) * SD(Y)}$$

Where, 'r' is the Pearson correlation coefficient for the given sample,

'COV' is the covariance,

'X' and 'Y' are the variables for which we are interested to explore the relationships and

'SD' is the standard deviation for the same variables is computed as:

$$SD(X) = \sqrt{\frac{1}{n-1} \sum_{i=1}^n (X_i - \bar{X})^2}$$

$$\bar{X} = \frac{\sum_{i=1}^n X_i}{n}$$

Where, X bar represents the mean value of X and n denotes the sample size. Likewise, SD(Y) can be calculated.

## CHAPTER 4: RESULTS

### 4.1 Socio-demographic Profile of the Informants

Altogether 40 people were selected as participants of the study, and information on traditional knowledge was gathered through their interviews. Out of the total number of informants, 5 were key informants and rest of 35 were knowledgeable individuals who served solely as informants. A tabular list of informants has been provided, comprising their name, address, age, and level of education (Appendix 1). The percentage of males was 65% (26) and only fourteen informants were females (35%). Among individuals who provided the information, 20 people belonged to the age group of 40-60 years, 7 informants were above 60 years of age, 1 informant was above 80 years of age and 12 informants belonged to age group of 20-39 years were noticed knowledgeable about medicinal herbs (Table 1). In respect to their literacy rate, out of 40 informants 17 informants were illiterate and rest of 23 were literate. The highest qualification of the informants was 12<sup>th</sup> grade. The informants engaged primarily in agriculture and animal husbandry. Of the 40 respondents, 19 were farmers followed by housewife (10), dhami/jhakris (7), shopkeeper (2), social worker (1), and village head (1).

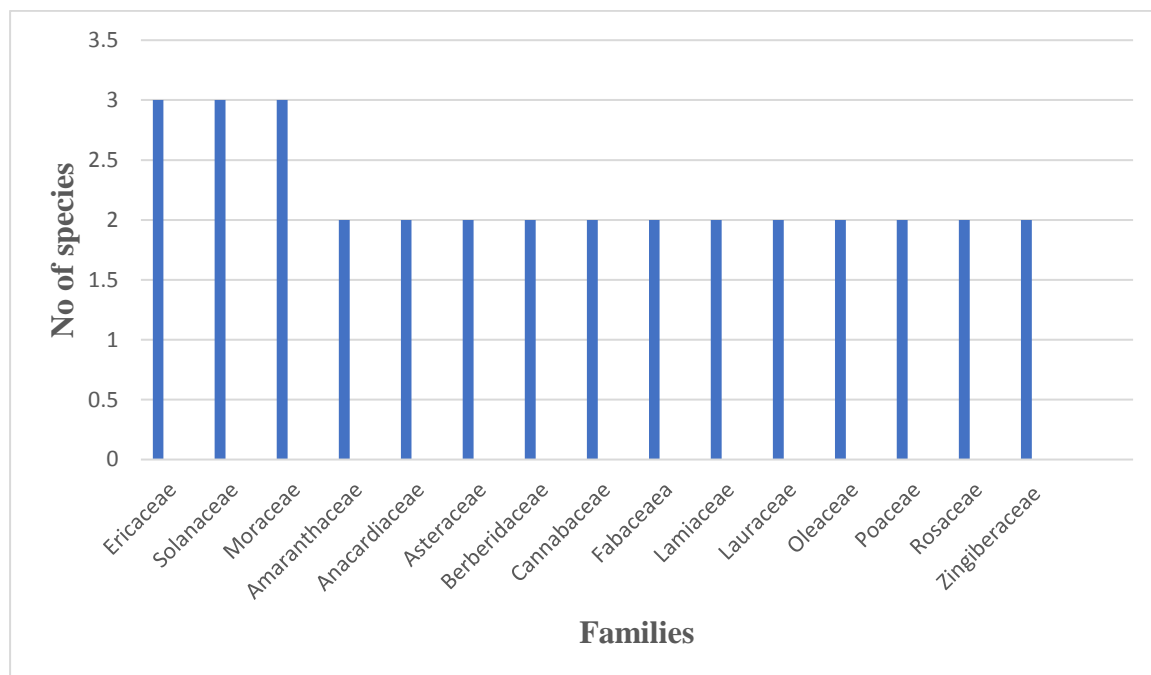
**Table 1.** Distribution of informant's gender and age

Gender	No. of informants by Gender and Age			
	20-40	40-60	60-80	80-100
Male	6	12	7	1
Female	6	8	0	0
<b>Total</b>	12	20	7	1

### 4.2 ETHNOMEDICINAL PLANTS

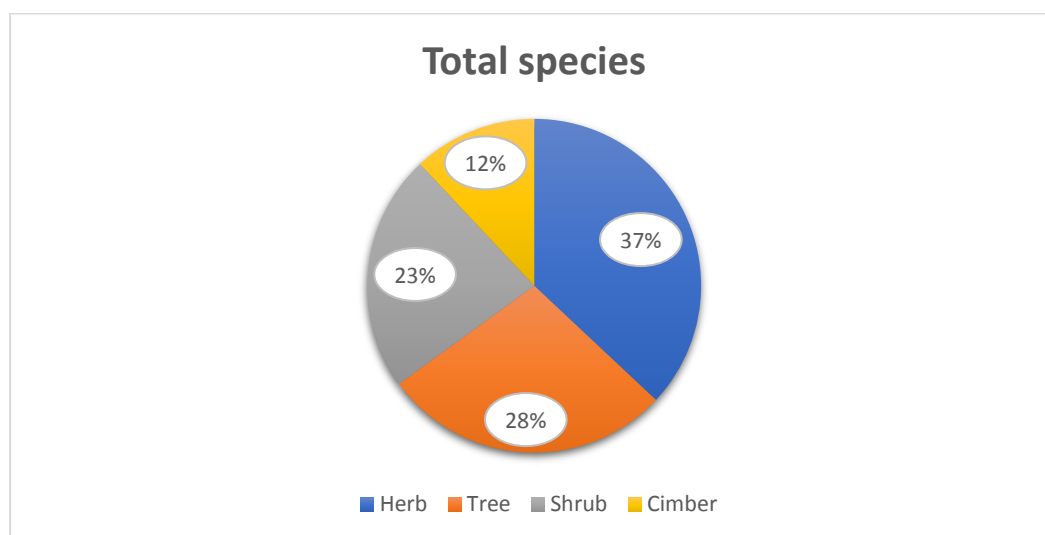
A total of 68 species of plants, belonging to 48 families were recorded as medicinally important plants (Appendix 2). Ericaceae, Solanaceae and Moraceae were the predominant families with 3 species followed by Amaranthaceae, Anacardiaceae, Asteraceae, Berberidaceae, Cannabaceae, Fabaceae, Lamiaceae, Lauraceae,

Oleaceae, Poaceae, Rosaceae, Solanaceae and Zingiberaceae with 2 species. The other 35 families had only one species (Figure 4).



**Figure 4:** Most dominant families in the study area with no of species

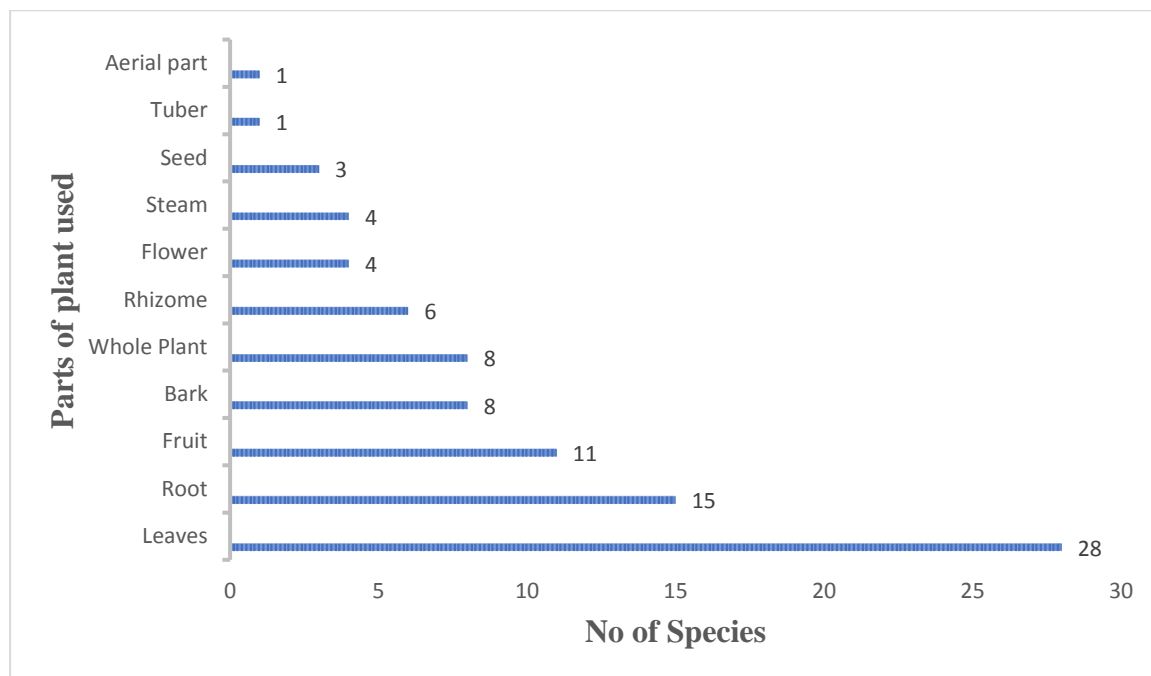
Among the total species, according to plant life forms, 25 were herbaceous species, 19 trees, 16 shrubs and 8 climbers (Figure 5). Out of 68 therapeutic plants, 55 species were harvested from the wild and 13 species were cultivated.



**Figure 5:** Total species with life forms

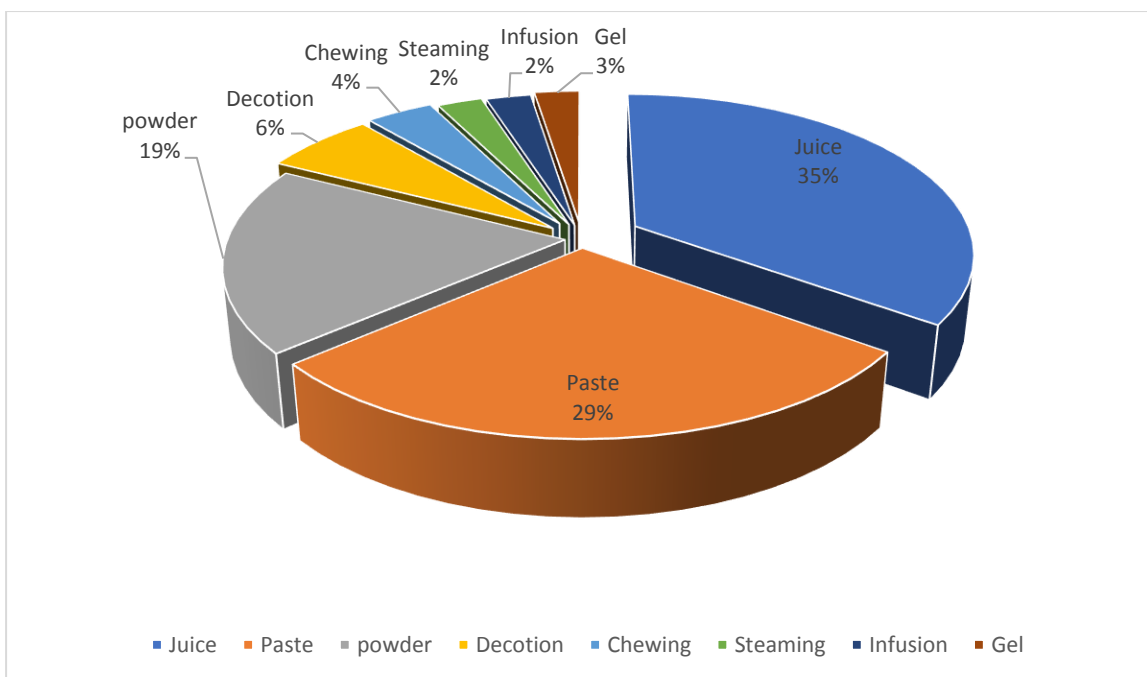
The several components of the medicinal plant that were used included the bark, bud, flower, fruit, latex, gum, leaves, rhizome, root, seed, and complete plant. 28 species

of plant leaves were found to be most frequently used followed by all part root (15 species), fruit (11 species), bark (8 species), whole plant (8 species), rhizome (6 species), flower (4 species), steam (4 species), seed (3 species), tuber (1 species), and aerial part (1 species) of plants (Figure 6).



**Figure 6:** Parts of the plants used

Plant parts were utilized in various manners to treat various illnesses. The most common technique of taking medication in the research region was juice (35%), which was followed by paste (29%), powder (19%), decoction (6%), chewing (4%), steaming (2%), infusion (2%) and gel (2%) (Figure 7).



**Figure 7:** Mode of preparation of medicine

**Table 2:** Mode of preparation of herbal remedies

S.N.	Preparation Method	Description	No of Species
1.	Paste	Fresh plant or plant parts are grinded in stone grind (okhal).	23
2.	Juice	Plant parts is pressed filtered and juice is consumed.	28
3.	Powder	Dried parts are crushed and make powder.	15
4.	Chewing	Fresh or dried plant parts are chewed.	
5.	Decoction	Plant parts are boiled in water and extracted form is used.	5
6.	Infusion	Water is used to immerse plant parts for some time.	3
7.	Cooked	Plant parts are eaten after being steam-cooked.	5
8.	Gel	Fresh plant is taken with the knife or spoon and gel is extracted.	2

### 4.3 Informant Consensus Factor (ICF)

The informant consensus factor has a mean value of 0.16 and a range of values from 0.2 to 0.37. Musculo-skeletal ailments had a high ICF value (0.375) with 9 use reports for 6 species followed by dermatology having an ICF value of 0.36 with 20 use reports for 13 species. Similarly, the circulatory disorder had an ICF value of 0.33 with 7 use reports for 5 species, the general and specified ailment category had an ICF value of 0.31 with 20 use reports for 14 species, respiratory disorders had an ICF value of 0.23 with 14 use reports for 11 species, endocrine and metabolic ICF value was 0.2 with 11 use reports for 9 species and others like neurology, dental and urology had less ICF value i.e. 0.00 (Table 3).

**Table 3:** List of disease and ailment categories with respective ICF Value

<b>Disease and ailment category</b>	<b>Biomedical terms</b>	<b>No of plants</b>	<b>Number of plants used in the report for a specific illness category (N<sub>ur</sub>)</b>	<b>Total no of used species by informants for this illness category (N<sub>t</sub>)</b>	<b>Informant consensus factor (ICF)</b>
General and unspecified	Body cooling	2	20	14	0.31
	Cancer	1			
	Dehydration	1			
	Fever	13			
	Swelling	1			
	Snake bite	1			
	Disinfectant	1			
Digestive	Dysentery	8	32	25	0.22
	Gastric	7			

	Jaundice	5			
	Indigestion	4			
	Parasitic worm	1			
	Stomach problem	6			
	Constipation	1			
Circulatory	Blood purification	2	7	5	0.33
	Blood pressure Regulation and control	5			
Musculo-skeletal	Body ache	3	9	6	0.375
	Joint Fractures	4			
	Joint problem	1			
	Back pain	1			
Neurological	Head ache	5	7	7	0.00
	Memory power	1			
	Anxiety	1			
Dental Problem	Toothache	6	7	7	0.00
	Tooth plague	1			
Ophthalmology	Eye infection	2	2	2	0.00
Respiratory	Asthma	2	14	11	0.23
	Common cold	4			
	Cough	4			
	Sore throat	3			
	Tonsil	1			

Dermatology	Skin problem	5	20	13	0.36
	Burns	2			
	Rashes/ Disease	6 1			
	Chicken pox	3			
	Cut/Wounds	1			
	Dandruff				
Endocrine and Metabolic	Diabetes	8	11	9	0.2
	Cholesterol	3			
Urology	Urinary problem	2 1	4	4	0.00
	Kidney stone	1			
	Urine purifier				
Gynecology and Sexual	Urogenital disorder	1 1	5	5	0.00
	Menstrual problem	2 1			
	Maternity problem				
	Increase fertility				

#### 4.4 Use Value and RFC

The UV value ranged between 0.62 to 1. Based on the UV data, the most useful medicinal plant species were *Acorus calamus* L., *Aloe vera* (L.) Burm. f., *Ageratina adenphora* (Spreng.), *Artemisia indica* Willd., *Rhododendron arboreum* Sm., *Gaultheria trichophylla* Royle, *Ocimum sanctum* Linn., *Mentha spicata* L., *Lablab purpureus* (L.) Sweet, *Ficus religiosa* L., *Myrica esculenta* Buch.-Ham. ex D. Don, *Artemisia indica* Willd., *Cynodon dactylon* (L.) Pers., *Phyllanthus emblica* L., *Rumex nepalensis* Sprengel, *Citrus aurantifolia* Swingle. *Sapindus mukorossi* Gaertn.,

*Solanum virginianum* L., *Astilbe rivularis* Buch. Ham. ex D.Don, *Taxus species*, *Urtica dioica* L. and *Cissus quadrangularis* L. (Table 4). The least used species was *Semecarpus anacardium* L.f. (0.62).

RFC is a measure commonly used in ethnobotanical investigations to determine the relative relevance or prominence of a plant species within a specific community. It is a valuable metric for understanding how often a plant is cited by community members for its uses. The highest RFC is for *Aloe vera* (L.) Burm. f. and *Cannabis sativa* with a value of 0.65.

**Table 4:** List of plant species with respective Use Value and RFC

S. N	Name of Medicinal Plants	No. of citation by informants	Total no. of informants	UV index	RFC
1.	<i>Justicia adhatoda</i> L.	39	40	0.97	0.37
2.	<i>Acorus calamus</i> L.	40	40	1	0.5
3.	<i>Saurauia nepaulensis</i> DC.	32	40	0.8	0.3
4.	<i>Achyranthes bidentata</i> Blume	39	40	0.97	0.62
5.	<i>Amaranthus leucocarpus</i> S.Watson	35	40	0.87	0.52
6.	<i>Rhus chinensis</i> Mill.	30	40	0.75	0.4
7.	<i>Semecarpus anacardium</i> L.f.	25	40	0.62	0.12
8.	<i>Centella asiatica</i> (L.) Urb.	28	40	0.7	0.47
9.	<i>Periploca calophylla</i> (Wight) Falc.	30	40	0.75	0.35
10.	<i>Asparagus racemosus</i> Willd.	35	40	0.87	0.22
11.	<i>Agave</i> sp.	28	40	0.7	0.32
12.	<i>Aloe vera</i> (L.) Burm. f.	40	40	1	0.65

13.	<i>Ageratina adenphora</i> (Spreng.)	40	40	1	0.6
14.	<i>Smallanthus sonchifolius</i> (Poepp.) H. Rob.	30	40	0.75	0.15
15.	<i>Berberis asiatica</i> DC.	36	40	0.9	0.4
16.	<i>Mahonia napaulensis</i> DC.	31	40	0.77	0.27
17.	<i>Trichodesma indicum</i> L.	28	40	0.7	0.25
18.	<i>Nasturtium officinale</i> W.T.Aiton	30	40	0.75	0.17
19.	<i>Cannabis sativa</i> L.	30	40	0.75	0.65
20.	<i>Hibiscus-rosa sinensis</i> L.	35	40	0.87	0.57
21.	<i>Lobelia pyramidalis</i> Wall.	32	40	0.8	0.17
22.	<i>Drymeria cordata</i> (L.) Willd. ex Schult.	39	40	0.97	0.12
23.	<i>Artemisia indica</i> Willd.	40	40	1	0.6
24.	<i>Cuscuta reflexa</i> Roxb.	34	40	0.85	0.3
25.	<i>Gaultheria fragrantissima</i> Wall.	31	40	0.77	0.15
26.	<i>Rhododendron arboreum</i> Sm.	40	40	1	0.4
27.	<i>Lyonia ovalifolia</i> (Wall.) Drude	35	40	0.87	0.22
28.	<i>Solanum nigrum</i> L.	40	40	1	0.35
29.	<i>Euphorbia rayleana</i> Boiss.	38	40	0.95	0.42
30.	<i>Bahunia variegata</i> L.	40	40	1	0.37
31.	<i>Macrotyloma uniflorum</i> (Lam.) Verdc.	34	40	0.85	0.2
32.	<i>Swertia chirayita</i> (Roxb. ex- Fleming) Karsten	39	40	0.975	0.55
33.	<i>Juglans regia</i> L.	32	40	0.8	0.3

34.	<i>Ocimum sanctum</i> Linn.	40	40	1	0.62
35.	<i>Mentha spicata</i> L.	40	40	1	0.47
36.	<i>Camphora officinarum</i> Nees.	32	40	0.8	0.4
37.	<i>Lindera neesiana</i> (Nees) Kurz.	28	40	0.7	0.35
38.	<i>Lablab purpureus</i> (L.) Sweet	40	40	1	0.47
39.	<i>Lycopodium clavatum</i> L.	34	40	0.85	0.2
40.	<i>Melia azedarach</i> L.	38	40	0.95	0.15
41.	<i>Tinospora cordifolia</i> (Thunb.) Miers	35	40	0.87	0.12
42.	<i>Ficus Semicordata</i> Buch. - Ham. ex Sm.	31	40	0.77	0.1
43.	<i>Ficus religiosa</i> L.	40	40	1	0.25
44.	<i>Myrica esculenta</i> Buch.- Ham. ex D.Don	40	40	1	0.22
45.	<i>Myrsine semiserrata</i> Wall.	29	40	0.72	0.17
46.	<i>Psidium guajava</i> L.	40	40	1	0.57
47.	<i>Nephrolepis cordifolia</i> (L.) K. Presl	40	40	1	0.35
48.	<i>Jasminum officinale</i>	34	40	0.85	0.3
49.	<i>Nyctanthes arbor-tristis</i> L.	39	40	0.97	0.37
50.	<i>Phyllanthus emblica</i> L.	40	40	1	0.42
51.	<i>Cynodon dactylon</i> (L.) Pers.	40	40	1	0.15
52.	<i>Imperata cylindrica</i> (L.) P.Beauv.	38	40	0.95	0.15
53.	<i>Rumex nepalensis</i> Sprengel	40	40	1	0.35

54.	<i>Adiantum capillus- veneris</i> L.	28	40	0.7	0.3
55.	<i>Barleria prionitis</i> L.	35	40	0.87	0.05
56.	<i>Rubus ellipticis</i> Sm.	38	40	0.87	0.12
57.	<i>Rubia cordifolia</i> L.	31	40	0.77	0.17
58.	<i>Citrus aurantifolia</i> Swingle.	40	40	1	0.22
59.	<i>Osyris lanceolata</i> Hochst. & Steud.	30	40	0.75	0.1
60.	<i>Sapindus mukorossi</i> Gaertn.	40	40	1	0.25
61.	<i>Datura metel</i> L.	35	40	0.87	0.15
62.	<i>Solanum virginianum</i> L.	40	40	1	0.45
63.	<i>Astilbe rivularis</i> Buch. Ham. ex D.Don	40	40	1	0.32
64.	<i>Taxus</i> sp. L.	40	40	1	0.1
65.	<i>Urtica dioica</i> L.	40	40	1	0.22
66.	<i>Cissus quadrangularis</i> L.	40	40	1	0.32
67.	<i>Amomum subulatum</i> Roxb.	35	40	0.87	0.45
68.	<i>Curcuma caesia</i> Roxb.	35	40	0.87	0.35

#### 4.5 Fidelity Level (FL %)

The fidelity level (FL) of 68 different species ranged from 28.57-100%. *Ocimum sanctum* Linn., *Centellaasiatica* (L.) Urb, *Artemisia indica* Willd. had 100% FL against (fever, common cold, sore throat), (urine infection, memory power, blood purifier, controls Blood pressure), and (Cut, Stop Bleeding, ringworm) respectively which is the highest FL. Lowest value against stomach problem, gastric *Adiantum capillus- veneris* L. had 28.57% (Table 5).

**Table 5:** List of disease and ailment category with respective FL value.

<b>10</b>	<b>Name of Medicinal Plants</b>	<b>Major Ailments</b>	<b>Fidelity Level FL (%)</b>
1.	<i>Justicia adhatoda</i> L.	Jaundice, headache, fever, skin disease	83.33
2.	<i>Acorus calamus</i> L.	Sore throat, cold, cough	90
3.	<i>Saurauia nepaulensis</i> DC.	Jaundice, fever, anxiety	92.30
4.	<i>Achyranthes bidentata</i> Blume	toothache, urinary problem, fever	87.5
5.	<i>Amaranthus leucocarpus</i> S.Watson	Ulcers, Diarrhea, Cholesterol	78.57
6.	<i>Rhus chinensis</i> Mill.	Diarrhea/Aau preko, stomache	50
7.	<i>Semecarpus anacardium</i> L.f.	fever, digestive problems, abortion	80
8.	<i>Centella asiatica</i> (L.) Urb.	urine infection, memory power, blood purifier, controls Blood pressure	100
9.	<i>Periploca calophylla</i> (Wight) Falc.	Fracture, joint pain	62.5
10.	<i>Asparagus racemosus</i> Willd.	Gastric, Ulcer	66.66
11.	<i>Agare</i> Sp.	Diabetes, Fever	83.33
12.	<i>Aloe vera</i> (L.) Burm. f.	Skin burnt, dental plague, skin problems, control sugar	86.66
13.	<i>Ageratina adenphora</i> (Spreng.)	Cut, Stop Bleeding, skin disease	53.33
14.	<i>Smallanthus sonchifolius</i> (Poepp.) H. Rob.	Control Diabetes	90

15.	<i>Berberis asiatica</i> DC.	Jaundice, eye infection, skin problem, toothache	89.28
16.	<i>Mahonia napaulensis</i> DC.	Eye problem, dysentery	58.33
17.	<i>Trichodesma indicum</i> L.	Diarrhea	75
18.	<i>Nasturtium officinale</i> Le W.T.Aiton	Control Sugar and Pressure, asthma	92.30
19.	<i>Cannabis sativa</i> L.	Asthma, pain	70.58
20.	<i>Hibiscus-rosa sinensis</i> L.	Urine Purifier, control cholesterol and pressure	93.75
21.	<i>Lobelia pyramidalis</i> Wall.	fever, increase fertility	50
22.	<i>Drymeria cordata</i> (L.) Willd. ex Schult.	Indigestion, cold, headache	90
23.	<i>Artemisia indica</i> Willd.	Cut, Stop Bleeding, ringworm	100
24.	<i>Cuscuta reflexa</i> Roxb.	Jaundice	62.5
25.	<i>Gaultheria fragrantissima</i> Wall.	fracture, back pain	86.66
26.	<i>Rhododendron arboreum</i> Sm.	Tonsil, diabetes, headache	95
27.	<i>Lyonia ovalifolia</i> (Wall.) Drude	Skin Diseases	62.5
28.	<i>Solanum nigrum</i> L.	fever, Gastric, headache	66.66
29.	<i>Euphorbia rayleana</i> Boiss.	Fever, Stop Bleeding	53.33
30.	<i>Bahunia variegata</i> L.	Body Ache, Toothache, indigestion	80
31.	<i>Macrotyloma uniflorum</i> (Lam.) Verdc.	Chicken pox, stone problem	66.66

32.	<i>Swertia chirayita</i> (Roxb. ex-Fleming) Karsten	Fever, Gastric, Indigestion, control sugar	93.75
33.	<i>Juglans regia</i> L.	Toothache	53.33
34.	<i>Ocimum sanctum</i> Linn.	fever, common cold, sore throat	100
35.	<i>Mentha spicata</i> L.	Cold, Cough	53.33
36.	<i>Camphora officinarum</i> Nees.	stomach problem, Snake Bite	33.33
37.	<i>Lindera neesiana</i> (Nees) Kurz.	Skin Burn and skin Disease, stomach problem	62.5
38.	<i>Lablab purpureus</i> (L.) Sweet	Skin allergy	66.66
39.	<i>Lycopodium clavatum</i> L.	Fever, gastric	81.81
40.	<i>Melia azedarach</i> L.	Antidandruff	76.92
41.	<i>Tinospora cordifolia</i> (Thunb.) Miers	Gano, stomachache	77.77
42.	<i>Ficus semicordata</i> Buch. - Ham. ex Sm.	kidney stone	80
43.	<i>Ficus religiosa</i> L.	Skin Problem, menstrual bleeding	75
44.	<i>Myrica esculenta</i> Buch.- Ham. ex D.Don	Diarrhea, toothache	60
45.	<i>Myrsine semiserrata</i> Wall.	Diarrhea	58.33
46.	<i>Psidium guajava</i> L.	fresh leaf control sugar level, indigestion	92.30
47.	<i>Nephrolepis cordifolia</i> (L.) K. Presl	fever, headache, cough	83.33
48.	<i>Jasminum officinale</i>	Tonsils, Fever, High blood pressure	90.90

49.	<i>Nyctanthes arbor-tristis</i> L.	Control sugar, Fever	71.42
50.	<i>Phyllanthus emblica</i> L.	Cooling	78.57
51.	<i>Cynodon dactylon</i> (L.) Pers.	skin disease (vitiligo)	58.33
52.	<i>Imperata cylindrica</i> (L.) P.Beauv.	Treat worm, diarrhea, urinary problem	62.5
53.	<i>Rumex nepalensis</i> Sprengel	paste of rhizome applied to cure swelling, jaundice	70
54.	<i>Adiantum capillus-veneris</i> L.	stomach problem, Gastric	28.57
55.	<i>Barleria prionitis</i> L.	Skin burns	44.44
56.	<i>Rubus ellipticus</i> Sm.	Gastric	77.77
57.	<i>Rubia cordifolia</i> L.	Dysentery, urogenital disorder	79
58.	<i>Citrus aurantifolia</i> Swingle.	Cholesterol, disinfectant, cooling	63.63
59.	<i>Osyris lanceolata</i> Hochst. & Steud.	Paste on fracture	60
60.	<i>Sapindus mukorossi</i> Gaertn.	Hair growth	87.5
61.	<i>Datura metel</i> L.	Cough, body ache	90
62.	<i>Solanum virginianum</i> L.	Toothache	88.88
63.	<i>Astilbe rivularis</i> Buch. Ham. ex D.Don	Stop bleeding pregnant woman	80
64.	<i>Taxus</i> sp. L.	Cancer, Stomach pain	66.66
65.	<i>Urtica dioica</i> L.	High blood pressure	91.66
66.	<i>Cissus quadrangularis</i> L.	Fracture	76.92

67.	<i>Amomum subulatum</i> Roxb.	fruit used in stomach pain, throat pain	71.42
68.	<i>Curcuma caesia</i> Roxb.	Gastric, blood purifier	44.44

#### 4.6 Pearson correlation coefficient

A Pearson correlation coefficient was calculated to determine the linear connection between RFCs and UVs. There was a positive correlation between the two variables,  $r = 0.66$ .

#### 4.7 Conservation of Medicinal Plants

Medicinal plants play a crucial role in providing herbal products and traditional medicines worldwide. However, they are disappearing at an alarming rate due to factors such as overharvesting, habitat destruction, and increasing demand for herbal drugs. Several informants claim that the complete plant of *Swertia chirayita* (Roxb. ex-Fleming) Karsten, roots of *Acorus calamus* L. and roots of *Asparagus racemosus* Willd. were in high demand. The increasing demand for these plants in the trade market is a double-edged sword. While it highlights the importance and efficacy of traditional medicines, it also underscores the urgent need for sustainable harvesting practices and conservation measures to ensure these plants do not become extinct.

## CHAPTER 5: DISCUSSION

### 5.1 Knowledge distribution among genders and age groups and

#### Traditional Knowledge

A community's understanding of the usage of plants may differ depending on a number of factors, including age, gender, and socioeconomic status (Toledo *et al.*, 2009). The majority of informants were older than 40 years (Table 2). The research results indicate that traditional knowledge is still widely held within the community, but that its future transmission to the next generation is potentially endangered. The declining rate of transfer of indigenous knowledge might be attributed to a lack of interest among the younger generation in learning and practicing it as a result of the quickly growing digital age, in which information is at our fingertips and modernity is relentless.

The most knowledgeable healers were determined to be traditional practitioners because they have integrated information about medicinal plants into their traditional health care system and apply it in their daily lives (Bisht *et al.*, 2006) as their occupation. Ethnomedicinal information is often kept confidential (Giday *et al.*, 2009), and traditional healers rarely divulge their expertise to others out of concern that knowledge disclosure might reduce their practice's efficacy (Shrestha *et al.*, 2014). There have also been reports of this concealment from the eastern Nepalese district of Ilam (Bhattarai, 2017), the western Nepalese district of Humla (Rokaya *et al.*, 2010), and the center Nepalese district of Makwanpur (Luitel *et al.*, 2014). Non-sharing mentality and modernization patterns such as education, commercialization, and cultural adjustment. etc. may aid in the decline of traditional knowledge.

#### 5.2 Plant Diversity and Uses

This study identified 68 species of medicinal plants utilized by the Tamang people in Shankarapur Municipality. The herb occupied the major percentage of the habitat (n=25) followed by trees (n=19), shrubs (n=16) and climbers (n=8) which is comparable to other studies (Ambu *et al.*, 2020; Dulal *et al.*, 2022; Gautam & Timilsina, 2022). Herbs were abundant, which could be related to the fact that most therapeutic plants are naturally found as herbs with small height (Uprety *et al.*, 2010)

The dominant family was Ericaceae with 4 species followed by Moraceae with 3 species (Fig.3).

The most frequently used part was leaves (n=28) followed by root (n=15), fruit (n=11), bark (n=8), whole plant (n=8), rhizome (n=6), flower (n=4), stem (n=4), seed (n=3), tuber (n=1), and aerial part (n=1) of plants. The local inhabitants have traditionally relied on leaves for medical purposes. Leaves play a crucial role in nutrition synthesis and have significant biochemical activity, which may explain their widespread usage in medicine (Poudyal *et al.*, 2012). Similar results were also obtained in other studies (Chaudhary *et al.*, 2020; Dulal *et al.*, 2022; Nepali *et al.*, 2020; Singh *et al.*, 2012) where the majority of plant parts were used as leaves. The major modes of ethnomedicine preparation in the studied region were extracting juice (35%) followed by paste (29%), powdering (19%), decoction (6%), chewing (4%), steaming (2%), infusion (2%) and Gel (2%) (Figure 6). Out of total ethnomedicine, 92% of species were prepared by using fresh plant materials, whereas 8% were prepared using dried parts. The rationale for the recurring usage of fresh plant material might be because the drying process incorporates the loss of volatile oil, or that high temperatures cause protein to denature additionally, increased utilization of fresh plant material is not a sustainable technique since it may endanger the plants owing to frequent harvesting (Khan *et al.*, 2014). One medicinal plant from the study area i.e. *Swertia chirayita* (Roxb. ex-Fleming) Karsten is listed vulnerable in both CAMP and IUCN respectively.

### **5.3 Use value, Informant consensus Factor, Fidelity Level and RFC**

Altogether 53 ailments were listed which were treated with various plant species. Five plants were not identified to be used medicinally in Nepal's ethnomedical literature search (Dulal *et al.*, 2022, Dhital *et al.*, 2021, Singh *et al.*, 2012, Karki *et al.*, 2023) it might represent the new application of ethnomedical procedures in Nepal. The plants were *Amaranthus leucocarpus* S.Watson to treat ulcers, diarrhea, cholesterol, *Myrsine semiserrata* Wall. to treat diarrhea, *Barleria prionitis* L. to treat skin burns, *Cissus quadrangularis* L. to treat fracture and *Amomum subulatum* Roxb. fruit used to stomach pain and throat pain.

Quantitative techniques such as Informant Consensus Factor (ICF) and Use Value (UV), Fidelity Level (FL %) and RFC have been used to analyze the usefulness of the

ethnobotanical species (Trotter and Logan, 1986; Arulappan *et al.*, 2015; Friedman *et al.*, 1986).

In ethnobotanical research, consensus analysis provides a dependable score ranging from 0 to 1 for each claim with strong supporting data (Singh *et al.*, 2012). In order to examine the informant consensus factor, 53 different diseases that have been reported were split into 12 categories as suggested by Singh *et al.* (2012) (Table 3). In this study, the value of the informant consensus factor ranged from 0.2 to 0.37. A low ICF value suggests the diversity of knowledge or lack of consensus among informants regarding the effectiveness of certain plants for specific health conditions (Gebreyes & Melesse, 2016). Musculo-skeletal ailments have a high ICF value (0.375) with 9 use reports for 6 species followed by dermatology having ICF value (0.36) with 20 use reports for 13 species. Musculoskeletal conditions received the most plant use citations, followed by dermatological conditions. The high ICF score indicates that certain diseases are more common in Shankarapur. This could be because of the poor socioeconomic status and unhygienic conditions of the local population, as well as the fact that residents must travel to the city for facilities.

When there is agreement among informants on taxon selection, the ICF value is high; when there is disagreement, the number is low (Raghupathy *et al.* 2008). Many researchers (Singh *et al.*, 2012, Shrestha *et al.*, 2014, Malla *et al.*, 2015, Shrestha *et al.*, 2016, Poudel *et al.* 2021, Dulal *et al.*, 2022, Dhital *et al.*, 2021) from Nepal have employed this technique to assess respondents' agreement with specific medicinal plants, for the treatment of various illnesses.

Higher FL values are found in the medicinal plants that the locals utilize more often than in the less common ones. In this study, the FL values varied from 1.0% to 100%. A high-fidelity level indicates that a plant is preferred by a large proportion of informants for treating a particular condition, suggesting its potential therapeutic significance and cultural importance. Conversely, a low fidelity level might indicate that the plant is used by a smaller group of people or for various purposes (Tugume *et al.*, 2016). The study determined 3 plant species *Ocimum sanctum* Linn., *Centella asiatica* (L.) Urb and *Artemisia indica* Willd. (Table 5) with a FL of 100% which might indicate that the plants have high curative potential. These plants have many compounds that give them their medicinal properties. *Ocimum sanctum* Linn. is used

to treat fever and cough. Its aerial parts include many therapeutic components (Chaudhuri, 2018). Furthermore, it has been discovered that the phenolic compounds isothymusin, isothymonin, apigenin, rosmarinic acid, and cirsimaritin have anti-inflammatory and antioxidant qualities (Rao *et al.*, 2023). *Centella asiatica* includes brahmicacid, isobrahmic acid, brahminoside, and brahmoside, which function as psychotropic and anticonvulsant agents. This helps increase memory, focus, and concentration similarly alcoholic extract of the whole plant showed strong cardioprotective activity (Singh *et al.*, 2010). Asiaticoside and madecassoside can reduce the risk of cardiovascular disease and lower urine protein/creatinine levels (Bandopadhyay *et al.*, 2023). The paste from the *Artemisia indica* Willd plant is administered topically on wounds (Manadhar, 2002) similar report was found in (Chaudhary & Rajbhandary, 2021).

The most beneficial species of medicinal plants while taking into account all informants in terms of Use value (UV) were *Acorus calamus* L., *Aloe vera* (L.) Burm. f., *Ageratina adenphora* (Spreng.), *Artemisia indica* Willd., *Rhododendron arboreum* Sm., *Gaultheria trichophylla* Royle, *Ocimum sanctum* Linn., *Mentha spicata* L., *Lablab purpureus* (L.) Sweet, *Ficus religosa* L., *Myrica esculenta* Buch.-Ham. ex D.Don, *Artemisia indica* Willd., *Cynodon dactylon* (L.) Pers., *Phyllanthus emblica* L., *Rumex nepalensis* Sprengel, *Citrus aurantifolia* Swingle. *Sapindus mukorossi* Gaertn., *Solanum virginianum* L., *Astilbe rivularis* Buch. Ham. ex D.Don, *Taxus* species, *Urtica dioica* L. and *Cissus quadrangularis* L. with the value 1 (Table 4). The ethnobotanical research implies that the more often a plant is believed to be helpful, the more frequently it will be utilized ((Bekalo *et al.*, 2009, Khakurel *et al.*, 2022). Low UV medicinal plants are not necessarily less significant, although their availability is limited (Mahmood *et al.*, 2013). Neglecting low-UV plant species can prevent future generations from inheriting knowledge (Chaachouay *et al.*, 2019).

The RFC value ranges from 0.1 to 0.65. The highest rank of RFC is for *Aloe vera* (L.) Burm. f. and *Cannabis sativa* L. with a value of 0.65. RFC reflects how frequently a species is mentioned in ethnobotanical studies (Amjad *et al.*, 2017).

## **5.4 Relationship between RFCs and UVs: Pearson correlation**

### **coefficient**

Between RFCs and UVs, the Pearson correlation value was 0.66 ( $\rho$ -value  $>0.05$ ) revealing a strong positive correlation exists between the usefulness of a plant species and how frequently it is cited in ethnobotanical contexts which suggests that the number of useful medicinal plants tends to rise with increased use of the informants (Bano *et al.*, 2014) (Appendix 2 and 3). Similar strong positive relation was found by Khakurel *et al.*, 2022). The UV and RFC values may differ in the same vicinity, as well as from area to area and community to community, because use value and RFC values are dynamic and rely on the customary wisdom of the community (Siddique *et al.*, 2021). Species with elevated UV and RFC exhibit great recovery capability for a certain ailment (Cordero *et al.*, 2022; Khakurel *et al.*, 2022).

## **5.5 Conservation of medicinal plants**

Since the tradition of gathering medicinal plants for traditional uses emerged gradually and in balance with the environment, it is usually not an issue (Ghimire *et al.*, 2005). Medicinal plants were mostly collected from the wild to treat common diseases in the research region. Nonetheless, this investigation showed that there was a reasonable level of experience in the garden and its environs for growing decorative and beneficial medicinal plants. The respondents' information indicated that the quantity of therapeutic plants in the field of study was steadily declining. Most of the participants stated that inappropriate harvesting, overexploitation, grazing, habitat deterioration, and industrialization posed a threat to medicinal plants. Increased industry and urbanization, accompanied by unmanaged population increase and human intervention, lead to resource exploitation and habitat degradation.

## **5.6 Comparison of current uses with other studies**

In a study conducted in Kavrepalanchok researchers documented the use of 101 medicinal plants by Tamang communities. The most commonly used plant families were Asteraceae, Fabaceae, Lamiaceae and Zingiberaceae with and most frequently used species herbs. The most used parts of the plant were the roots. The fidelity level (FL) indicated that *Calotropis gigantea* (100%) was the most commonly used species

for treating Skin diseases, *Drymaria cordata* (100%) for fever, and *Wrightia arborea* and *Mangifera indica* (100%) for gastrointestinal disorders. The IFC indicated that the fever (0.49) group had the highest Consent. Highest RFCs was for *Achyranthes bidentata* with a value of 0.28.

Comparatively, another study in Sikles, Kaski district researchers documented 115 wild medicinal plant species that the native Gurung people utilize (Khakurel *et al.*, 2023). The Asteraceae family was the best represented, followed by Rosaceae. Herb was the most dominant life form. The most often utilized plant section was the root, and the most preferred preparation method was paste. The highest number of medicinal plants were used to treat stomach disorders. The use of plants to cure ear issues, dandruff, intestinal worms, and to boost breastfeeding had the highest ICF values, followed by diarrhea and dysentery, cough and cold has the highest informant consensus factor. *S. chirayita* had the highest RFC (0.84), followed by *N. scrophulariiflora* (0.80) and *P. polyphylla* (0.77). *P. polyphylla* (3.70) had the highest use value, followed by *L. neesiana* (3.05), *R. australe* (2.84), *B. ciliata* (2.54), *Astilbe rivularis* Buch.-Ham. ex D. Don (2.22), *A. calamus* (2.21), *N. scrophulariiflora* (2.18), and *D. hatagirea* (2.13). The Pearson correlation coefficient between RFCs and UVs was 0.63 (p-value <0.05), demonstrating a strong positive relationship between the local importance of each species and the utilization of plants.

Both studies highlight the importance of traditional knowledge in the use of local plant species for treating various ailments. The studies collectively underscore the rich ethnobotanical knowledge possessed by these communities and the critical role of certain plant species in their healthcare practices. The high FLs indicate specific plants are trusted for treating certain conditions, while the ICF values reflect community consensus on treatment efficacy. The RFC and UV values provide a measure of the frequency and importance of plant use, respectively.

The comparison of these data also showed that the 63 plant species had already been mentioned and five species had been indicated to have new uses. *Amaranthus leucocarpus* S.Watson to treat Ulcers, Diarrhea, Cholesterol, *Myrsine semiserrata* Wall. to treat Diarrhea, *Barleria prionitis* L. to treat Skin burns, *Cissus quadrangularis* L. to treat Fracture and *Amomum subulatum* Roxb. fruit used to stomach pain; throat pain was found to have new uses.

## **CHAPTER 6: CONCLUSION AND RECOMMENDATIONS**

### **6.1 CONCLUSION**

Based on the results of this study, it can be said that Shankarapur people's use of ethno-medicinal plants in their healthcare system is significant. A total of 68 medicinal plants were reported from the study area and it shows indigenous group of this area still practices traditional knowledge. The locals are still quite knowledgeable about herbal medicine, but as they get more modernized, they may eventually lose their understanding of the plant's traditional use. Therefore, it is crucial to research and document how various tribes have used plants for scientific purposes. Additionally, traditional knowledge must be passed down from generation to generation in order to ensure its preservation in the future. Since there is no systematic method for passing on indigenous knowledge about the uses of medicinal plants, younger generations in the communities are not interested in traditional healing methods because they see little financial benefit from them and instead pursue other careers. Additionally, it demonstrates that the study area's traditional wisdom was mainly intended to the elderly, it shows the possibility that such information will soon vanish. Therefore, it becomes essential to document and identify the species in order to maintain this ancient medical practice. The plant parts used in phytotherapy showed that a large no of leaves is used followed by roots, fruits, barks, seeds, whole plants, latex, stems, rhizomes, flowers and latex. Exploration of medicinal plants is essential for the documentation of indigenous and traditional knowledge. Such documentation of comprehensive ethnomedicinal plants is very valuable and additionally, it is crucial to encourage the cultivation of these medical plants, as this will greatly encourage agricultural diversity, boost farmer incomes, and preserve the wild populations of these native medicinal plants. The main reason for the extension of medicinal plants is the globalization of herbal medicine, uncontrolled exploitation uprooted of whole plants and lack of effective conservation strategies.

## **6.2 RECOMMENDATIONS**

- a. Conduct scientific research to validate the efficacy of these plants in treating various ailments.
- b. Engage local communities in conservation efforts. Collaborate with traditional healers, herbalists, and indigenous people to understand their practices and beliefs.
- c. Promote sustainable collection methods to prevent overharvesting. Encourage selective harvesting and leave enough plants for natural regeneration.
- d. Encourage home gardens where people can grow these plants for personal use.

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## APPENDICES

### Appendix 1. List of informants and their socio-demographic information

S. N.	Name	Gender	Age	Educational Qualification	Category of informant
1	Dig Bahadur Tamang (Lapsephedi)	Male	58	Illiterate	Key informant
2	Sita Tamang (Lapsephedi)	Female	44	10 <sup>th</sup> standard	Key informant
3	Aaide Moktan (Naglebhare)	Male	60	Illiterate	Key informant
4	Indra Lal Tamang (Bajrayogini)	Male	66	2 <sup>nd</sup> standard	Key informant
5	Ram Bahadur Moktan (Bajrayogini)	Male	61	Illiterate	Key informant
6	Bishnu Tamang (Bajrayogini)	Male	40	5 <sup>th</sup> standard	Key informant
7	Rupa Tamang (Naglebhare)	Female	40	8 <sup>th</sup> standard	Key informant
8	Chandra Bahadur Tamang (Lapsephedi)	Male	60	Illiterate	Knowledgeable person
9	Pasang Tamang (Lapsephedi)	Male	32	12 <sup>th</sup> standard	Knowledgeable person
10	Man Bahadur Moktan (Bajrayogini)	Male	56	2 <sup>nd</sup> standard	Knowledgeable person
11	Man singh Tamang (Naglebhare)	Male	82	Illiterate	Knowledgeable person
12	Kali Tamang (Lapsephedi)	Female	30	3 <sup>rd</sup> standard	Knowledgeable person
13	Buddha Bdr Waiba (Lapsephedi)	Male	74	Illiterate	Knowledgeable person
14	Prem Bahadur Syangbo (Lapsephedi)	Male	69	Illiterate	Knowledgeable person
15	Prem Bahadur Bomjan (Naglebhare)	Male	59	Illiterate	Knowledgeable person
16	Padam Tamang (Bajrayogini)	Male	45	Illiterate	Knowledgeable person

17	Hira Tamang (Lapsephedi)	Female	43	5 <sup>th</sup> standard	Knowledgeable person
18	Aakash Tamang (Lapsephedi)	Male	30	10 <sup>th</sup> standard	Knowledgeable person
19	Bikash Tamang (Bajrayogini)	Male	41	10 <sup>th</sup> standard	Knowledgeable person
20	Gori Tamang (Lapsephedi)	Female	34	8 <sup>th</sup> standard	Knowledgeable person
21	Santa Kumar Tamang (Lapsephedi)	Male	35	5 <sup>th</sup> standard	Knowledgeable person
22	Annem Tamang (Bajrayogini)	Male	35	12 <sup>th</sup> standard	Knowledgeable person
23	Dilip Tamang (Naglebhare)	Male	32	8 <sup>th</sup> standard	Knowledgeable person
24	Sunita Tamang (Bajrayogini)	Male	45	Illiterate	Knowledgeable person
25	Buddha Tamang (Bajrayogini)	Male	38	2 <sup>nd</sup> standard	Knowledgeable person
26	Kanxi Tamang (Naglebhare)	Female	52	Illiterate	Knowledgeable person
27	Buddhi Tamang (Lapsephedi)	Male	40	5 <sup>th</sup> standard	Knowledgeable person
28	Maya Tamang (Lapsephedi)	Female	29	12 <sup>th</sup> standard	Knowledgeable person
29	Sarmila Tamang (Naglebhare)	Female	38	Illiterate	Knowledgeable person
30	Kaila Tamang (Bajrayogini)	Male	44	2 <sup>nd</sup> standard	Knowledgeable person
31	Ram Tamang (Naglebhare)	Male	50	Illiterate	Knowledgeable person
32	Shankar Tamang (Naglebhare)	Male	45	8 <sup>th</sup> standard	Knowledgeable person
33	Maila Tamang (Bajrayogini)	Male	55	Illiterate	Knowledgeable person
34	Dipa Tamang (Bajrayogini)	Female	31	12 <sup>th</sup> standard	Knowledgeable person
35	Man Maya Tamang (Naglebhare)	Female	39	8 <sup>th</sup> standard	Knowledgeable person
36	Gita Tamang (Lapsephedi)	Female	42	3 <sup>rd</sup> standard	Knowledgeable person
37	Mina Waiba Tamang (Lapsephedi)	Female	44	Illiterate	Knowledgeable person
38	Ram Lal Tamang (Lapsephedi)	Male	50	Illiterate	Knowledgeable person
39	Anish Tamang (Naglebhare)	Male	39	9 <sup>th</sup> standard	Knowledgeable person
40	Sundar Tamang (Bajrayogini)	Male	61	Illiterate	Knowledgeable person

**Appendix 2: List of Medicinal Plants recorded from Shankarapur Municipality**

S.N.	Scientific Name	Plant Name	Local Name (T)	English Name	Col. No.	Family	Habitat	Habit	Used Part	Used Form	Used For	Similar citation
1	<i>Justicia adhatoda</i> L.	Aasuro	Auro	Malabar Nut	SHN23	Acanthaceae	W	H	leaf	Paste	Jaundice, headache, fever, skin disease	(Gubhaju & Gaha 2019; Dulal <i>et al.</i> , 2022)
2	<i>Acorus calamus</i> L.	Bojho	Sete	Sweet Flag	SHN30	Acoraceae	C	H	Rhizome	Powder	Sore throat, cold, cough	(Shrestha & Joshi, 1993; Shrestha & Dhillion, 2003; Manandhar, 2002; Gubhaju & Gaha 2019; Dulal <i>et al.</i> , 2022)
3	<i>Saurauia nepaulensis</i> DC.	Gogan	Gogan		N/A	Actinidiaceae	W	T	Root, steam	Juice	Jaundice, fever, anxiety	(Joshi and Joshi, 2003)

4	<i>Achyranthes bidentata</i> Blume	Datiwan	Ghyunrpu ch	ox Knee	SHN36	Amaranthaceae	W	H	Root, twigs, leaf	Paste, Juice	toothache, urinary problem, fever	(Nepal <i>et al.</i> ,2020; Gautam & Timilsina, 2022)
5	<i>Amaranthus leucocarpus</i> S.Watson	Ludey	Ludey	Amara nth	SHN37	Amaranthaceae	C	H	leaf	Steaming	Ulcers, Diarrhoea, Cholestrol	Not Found
6	<i>Rhus chinensis</i> Mill.	Bhakimlo	Tipfru	Nutgall Tree	N/A	Anacardiaceae	W	T	leaf, root	Juice, Decotion	Diarrhoea/ Aau preko, Stomache	(Shrestha & Dhillion, 2003; Ojha <i>et al.</i> ,2021)
7	<i>Semecarpus anacardium</i> L.f.	Bhalayo	Gursing	Nut Tree	N/A	Anacardiaceae	W	T	Fruit	Powder	fever, digestive problems, abortion	(Dulal <i>et al.</i> , 2022)
8	<i>Centella asiatica</i> (L.) Urb.	Ghodtapre	Tajyoimra	Indian penny wort	SHN25	Apiaceae	W	H	Leaf, Whole Plant	Juice	urine infection, memory power, blood purifier, controls Blood pressure	(Shrestha & Dhillion, 2003; Dulal <i>et al.</i> , 2022)
9	<i>Periploca calophylla</i> (Wight) Falc.	Sikhari lahara	Sikhari lahara	pretty- Leaved Silkflo wer Vine	N/A	Apocynaceae	W	S	steam	Paste	Fracture, joint pain	(Oli <i>et al.</i> , 2005)

10	<i>Asparagus racemosus</i> Willd.	Kurilo	Yabuju	Satavari	SHN26	Asparagaceae	W	H	Root	powder	Gastric, Ulcer	(Kuwar & Bussmann, 2009)
11	<i>Agave</i> Sp.	Ketaki	Ketaki	Screw pine	SHN46	Asparagaceae	W	S	root	Juice	Diabetes, Fever	(Ojha <i>et al.</i> , 2021; Dulal <i>et al.</i> , 2022)
12	<i>Aloe vera</i> (L.) Burm. f.	Guikumari	Guikumari	Aloe vera	SHN45	Asphodelaceae	C	S	leaf	Gel	Skin burnt, dental plague, skin problems, control sugar	(Shrestha & Dhillon, 2003; Dhital <i>et al.</i> , 2021; Gubhaju & Gaha 2019)
13	<i>Ageratina adenphora</i> (Spreng.)	Kalo Banmara	Thanagmra	Crofton weed	SHN51	Asteraceae	W	S	leaf	Juice	Cut, Stop bleeding, skin disease	(Shrestha & Dhillon, 2003; Dhital <i>et al.</i> , 2021; karki <i>et al.</i> , 2023)

14	<i>Smallanthus sonchifolius</i> (Poepp.) H. Rob.	Bhuisyau	Bhuisyau	Ground apple	SHN56	Asteraceae	C	H	Tuber	Juice	Control diabetes	(Dulal <i>et al.</i> , 2022; Ojha <i>et al.</i> , 2021)
15	<i>Berberis asiatica</i> DC.	Chutro	Pichyar	Indian Barberr y	SHN10	Berberidaceae	W	S	Root, steam	Paste, Infusion	Jaundice, eye infection, skin problem, toothache	Shrestha & Dhillion, 2003; Tamang, 1970; Dulal <i>et al.</i> , 2022; Gautam & Timilsina, 2022)
16	<i>Mahonia napaulensis</i> DC.	Jamaino mandro	Jamaino mandro	Mahonia	N/A	Berberidaceae	W	S	Bark	Decoction	Eye problem, dysentry	(Manandhar, 2002; Baral & Kurmi, 2006; Dulal <i>et al.</i> , 2022)
17	<i>Trichodesma indicum</i> L.	Kanike kuro	Kanike kuro	Ceylon hound's tongue	SHN07	Boraginaceae	W	H	Root	Paste	Diarrhea	(Dulal <i>et al.</i> , 2022)

18	<i>Nasturtium officinale</i> W.T.Aiton	Khole sag	Syongdap	Watercress	SHN32	Brassicaceae	W	H	leaf	Steaming	Control Sugar and Pressure, asthma	(Dulal <i>et al.</i> , 2022; Ojha <i>et al.</i> , 2021)
19	<i>Cannabis sativa</i> L.	Ganja	Ganja	Hemp	SHN17	Cannabaceae	W	S	leaf	powder	Asthma, pain	(Tamang, 1970; Ojha <i>et al.</i> , 2021)
20	<i>Hibiscus-rosa sinensis</i> L.	Ghanti phool	Mendo	Chinese Hibiscus	SHN19	Cannabaceae	C	S	Flower	Juice	Urine Purifier, control cholesterol and pressure	(Dulal <i>et al.</i> , 2022)
21	<i>Lobelia pyramidalis</i> Wall.	Eklebir	Eklebir	Pyramidal lobelia	SHN14	Campanulaceae	W	S	leaf, Bark	Juice	fever, increase fertility	(Dulal <i>et al.</i> , 2022)
22	<i>Drymeria cordata</i> (L.) Willd. ex Schult.	Abijalo	Abijalo	Chickweed	N/A	Chryophyllaceae	W	H	leaf	Juice	Indigestion, cold, headache	(Gautam & Timilsina, 2022)
23	<i>Artemisia indica</i> Willd.	Titepate	Chyanchin	mugwort	SHN16	Compositae	W	H	leaf	Paste	Cut, Stop Bleeding, ringworm	(Shrestha & Dhillon, 2003; Ojha <i>et al.</i> , 2021; Dulal <i>et al.</i> , 2022)

24	<i>Cuscuta reflexa</i> Roxb.	Aakash Beli	Nurbusi	Giant Dodder	SHN05	Convolvulaceae	W	S	Whole Plant	Juice	Jaundice	(Shrestha & Dhillon, 2003; Tamang, 1970; Shrestha, 1988; Dhital <i>et al.</i> , 2021)
25	<i>Gaultheria fragrantissima</i> Wall.	Dhasingre	Chyanchal	Checker berry	SHN06	Ericaceae	W	S	Leaf/Young Shoot	Paste, Juice	fracture, back pain	(Dulal <i>et al.</i> , 2022)
26	<i>Rhododendron arboreum</i> Sm.	Laligurans	Padamendro	Rhododendron	SHN50	Ericaceae	W	T	leaf	Juice, Powder	Tonsil, diabetes, headache	(Dhital <i>et al.</i> , 2021)
27	<i>Lyonia ovalifolia</i> (Wall.) Drude	Aangeri	Damsing	fetterbush	SHN15	Ericaceae	W	S	Bud	Paste	Skin Diseases	(Dulal <i>et al.</i> , 2022; Gautam & Timilsina, 2022)
28	<i>Solanum nigrum</i> L.	Kaligedi	Kaligedi	Blueberry	SHN35	Solanaceae	W	H	Fruit	Decoction	fever, Gastric, headache	(Dulal <i>et al.</i> , 2022; Ojha <i>et al.</i> , 2021)
29	<i>Euphorbia rayleana</i> Boiss.	Siudi	Ghesya	Sullu Spurge	SHN42	Euphorbiaceae	W	S	leaf	Latex	Fever, Stop Bleeding	(Dulal <i>et al.</i> , 2022)

30	<i>Bahunia variegata</i> L.	Koiralo	Ampu	mounta in ebony	SHN47	Fabaceae	W	T	Bark	Juice	Body ache, Toothache, indigestion	(Gautam & Timilsina, 2022)
31	<i>Macrotyloma uniflorum</i> (Lam.) Verdc.	Gahat	Gahat	Horsegram	N/A	Fabaceae	C	S	Aerial part	Decoction	Chicken pox, stone problem	(Dulal et al., 2022)
32	<i>Swertia chirayita</i> (Roxb. ex-Fleming) Karsten	Chiraito	Timda	Chireta	N/A	Gentianaceae	W	H	Whole Plant	Infusion	Fever, Gastric, Indigestion, control sugar	(Shrestha & Dhillion, 2003; Dhital et al., 2021)
33	<i>Juglans regia</i> L.	Okhar	Okhar	Persian walnut	SHN21	Juglandaceae	C	T	Leaf	paste	Toothache	(Ojha et al., 2021)
34	<i>Ocimum sanctum</i> Linn.	Tulsi	Tulsi	Holy Basil	SHN41	Lamiaceae	C	H	leaf and whole plant	Juice	fever, common cold, sore throat	(Dulal et al., 2022; Gautam & Timilsina, 2022; Ojha et al., 2021)
35	<i>Mentha spicata</i> L.	Pudina	Nasur	Mint	SHN40	Lamiaceae	W	H	Whole Plant	Juice	Cold, Cough	(Gautam & Timilsina, 2022)
36	Camphora ofiFinarum Nees	kapur	kapur	Camphor T	SHN55	Lauraceae	W	T	Root, fruit	Juice, paste	stomach problem, Snake Bite	(Gautam & Timilsina, 2022)

37	<i>Lindera neesiana</i> (Nees) Kurz.	Sil Timur	Kutum	Lindera Seed	SHN54	Lauraceae	W	T	Bark/Fruit	Paste, Powder	Skin Burn and skin Disease, stomach problem	(Gautam & Timilsina, 2022)
38	<i>Lablab purpureus</i> (L.) Sweet	Tate simi	Tate simi	Hyacinth bean	SHN22	Leguminosae	C	S	Leaf, flower	Paste	Skin allergy	(Dulal <i>et al.</i> , 2022; Ojha <i>et al.</i> , 2021)
39	<i>Lycopodium clavatum</i> L.	Nagbeli	Pra	Common Club moss	N/A	Lycopodiaceae	W	S	whole plant	Powder	Fever, gastric	Not found
40	<i>Melia azedarach</i> L.	Bakaino	Bakaino	chinaberry	SHN34	Meliaceae	W	T	Seed	Paste	Antidandruff	(Dulal <i>et al.</i> , 2022)
41	<i>Tinospora cordifolia</i> (Thunb.) Miers	Gurjo	Gundri Gatho	Heart-leaved moonseed	SHN24	Menispermaceae	W	S	Fruit	Juice	Gano, stomachache	(Shrestha, 1988; Gautam & Timilsina, 2022)
42	<i>Ficus semicordata</i> Buch. Ham. ex Sm.	Khanayer	Khanayer	Drooping fig	SHN28	Moraceae	W	T	Leaf	decoction (milky latex)	kidney stone	(Dulal <i>et al.</i> , 2022)
43	<i>Ficus religiosa</i> L.	Peepal	Peepal	Sacred Fig	SHN31	Moraceae	W	T	Root/Bark	Paste, juice	Skin Problem, menstrual bleeding	(Gautam & Timilsina, 2022)

44	<i>Myrica esculenta</i> Buch.-Ham. ex D.Don	Kafal	karbasi/Namun	Bayberry	SHN20	Myricaceae	W	T	Bark	Juice, paste	Diarrhea, toothache	(Shrestha & Dhillion, 2003; Gautam & Timilsina, 2022)
45	<i>Myrsine semiserrata</i> Wall.	Kalikath	Bebangkal o	Bluberry myrtle	N/A	Myrtaceae	W	T	Bark	Boil	Diarrhoea	Not found
46	<i>Psidium guajava</i> L.	Amba	Ambaru	Guava	SHN44	Myrtaceae	C	T	leaf, fruit	Juice, Chewing	fresh leaf control sugar level, indigestion	(Gautam & Timilsina, 2022; Ojha <i>et al.</i> , 2021)
47	<i>Nephrolepis cordifolia</i> (L.) K. Presl	Pani amala	Kyuiamala	Bayabang	SHN12	Nephrolepidaceae	W	H	Rhizome	Juice	fever, headache, cough	(Gautam & Timilsina, 2022; Ojha <i>et al.</i> , 2021)
48	<i>Jasminum officinale</i>	jhai ko ful Chameli	Chameli	Jasmine	SHN18	Oleaceae	C	S	Leaf	Paste	Tonsils, Fever, High Blood pressure	(Shrestha & Dhillion, 2003; Dulal <i>et al.</i> , 2022)
49	<i>Nyctanthes arbor-tristis</i> L.	parijat	parijat	Night Blooming Jasmine	SHN29	Oleaceae	C	T	Leaf	powder	Control sugar, Fever	(Dulal <i>et al.</i> , 2022)

50	<i>Phyllanthus emblica</i> L.	Amala	Amala	Gooseberry	SHN39	Phyllanthaceae	W	T	Fruit	Powder, Chewing	cooling	(Kuwar & Bussmann, 2009)
51	<i>Cynodon dactylon</i> (L.) Pers.	Dubo	Narkapan g	Bermuda grass	SHN38	Poaceae	W	H	Whole Plant	Paste	skin disease (vitiligo)	(Shrestha & Dhillion, 2003)
52	<i>Imperata cylindrica</i> (L.) P.Beauv.	Siru	Gragsu	Cogan grass	SHN27	Poaceae	W	H	leaf, Root	Juice	Treat worm, diarrhea, urinary problem	(Gubhaju & Gaha 2019; Dulal <i>et al.</i> , 2022; Gautam & Timilsina, 2022)
53	<i>Rumex nepalensis</i> Sprengel	Halhale	Alpipi	Nepal dock	SHN04	Polygonaceae	W	H	rhizome	Paste	paste of rhizome applied to cure swelling, jaundice	(Singh <i>et al.</i> , 2012; Dulal <i>et al.</i> , 2022; Khatri <i>et al.</i> , 2021)
54	<i>Adiantum capillus veneris</i> L.	Rani sinka	Rani sinka	Maiden hair	SHN09	Pteridaceae	W	H	Leaf	Powder	stomach problem, Gastric	Ojha Khatri <i>et al.</i> , 2021)
55	<i>Barleria prionitis</i> L.	Vajra danti	Vajra danti	Nepal cinquefoil	SHN11	Rosaceae	W	S	Root	Powder	Skin burns	Not found
56	<i>Rubus ellipticus</i> Sm.	Ainselu	polong	Golden evergreen raspberry	SHN33	Rosaceae	W	S	Root	Juice	gastric	(Shrestha & Dhillion, 2003)

57	<i>Rubia cordifolia</i> L.	Majitho	Yagre		SHN08	Rubiaceae	W	S	Root and whole plant	Powder	Dysentery, urogenital disorder	(Ojha <i>et al.</i> , 2021)
58	<i>Citrus aurantifolia</i> Swingle.	Kagati	Kagati	Lemon	SHN48	Rutaceae	C	T	fruit	Juice	Cholesterol, disinfectant, cooling	(Ojha Khatri <i>et al.</i> , 2021)
59	<i>Osyris lanceolata</i> Hochst. & Steud.	Nundhiki	Dalkanda ba	W tea	SHN01	Santalaceae	W	S	Bark	Paste	Paste on fracture	(Dulal <i>et al.</i> , 2022; Ojha <i>et al.</i> , 2021)
60	<i>Sapindus mukorossi</i> Gaertn.	Reetha	Lyumdang	Soapnut	SHN16	Sapindaceae	W	T	Seed	Paste	Hair Growth	(Dulal <i>et al.</i> , 2022)
61	<i>Datura metel</i> L.	Dhaturo	Dhaturo	Devil's trumpet	SHN49	Solanaceae	W	H	Leaf	Powder	Cough, body-ache	(Ojha Khatri <i>et al.</i> , 2021)
62	<i>Solanum virginianum</i> L.	Kantakari	Gramjyul	Yellow-fruit nightshade	SHN53	Solanaceae	W	S	Seed	Paste	Toothache	(Shrestha & Dhillon, 2003; Shrestha, 1988; Dulal <i>et al.</i> , 2022)

63	<i>Astilbe rivularis</i> Buch.- Ham. ex D.Don	Budo Okhati	Budo Okhati		N/A	Saxifragaceae	W	H	Rhizome	Powder	Stop Bleeding pregnant woman	(Shrestha & Dhillion, 2003; Dhital <i>et al.</i> , 2021; Dulal <i>et al.</i> , 2022)
64	<i>Taxus baccata</i> L.	Loath Salla	Sinki	Europe an Yew	SHN13	Taxaceae	W	T	Leaf	Powder/Re sin	Cancer, Stomach Pain	(Dhital <i>et al.</i> , 2021; Ojha Khatri <i>et al.</i> , 2021)
65	<i>Urtica dioica</i> L.	Sisno	Polo	stingin g nettle	SHN43	Urticaceae	W	H	Leaf	Infusion	High Blood pressure	(Dhital <i>et al.</i> , 2021; Karki <i>et al.</i> , 2023)
66	<i>Cissus quadrangularis</i> L.	Haddijhor	Haddijhor	Veldt Grape	N/A	Vitaceae	W	S	Root	Paste	fracture	Not found
67	<i>Amomum subulatum</i> Roxb.	Banaduwa	Banaduwa		SHN02	Zingiberaceae	W	H	fruit	Juice	fruit used in stomach pain, throat pain	Not found
68	<i>Curcuma caesia</i> Roxb.	Kalo haledo	Kalo haledo	Black turmeri c	SHN52	Zingiberaceae	W	H	rhizome	Paste	Gastric, blood purifier	(Dulal <i>et al.</i> , 2022; Karki <i>et al.</i> , 2023; Ojha <i>et al.</i> , 2021)
<b>Legends: Life form;</b> H=Herb, S=Shrub, T=Tree, C=Climber; <b>Habitat;</b> W=Wild, C=Cultivated												

### Appendix 3: RFCs and UVs and their correlation

	<b>Mean</b>	<b>Standard deviation</b>	<b>Minimum</b>	<b>Maximum</b>
RFC	0.32	0.062	0.1	0.65
UV	0.90	0.23	0.7	1

<b>Covariance</b>	<b>0.009</b>
<b>P value</b>	<b>0.66</b>

#### **Appendix 4: Questionnaire for Collecting Field Data on Medicinal Plant**

1. Name

Gender:

Occupation:

Knowledge gained from:

Knowledge transferred to:

3. Description of drug

Method of preparation of drug:

a) Natural

b) Crushed

c) Juice

d) Decoction

e) Paste

f) Powder

Plant part used as medicine:

a) Root

b) stem

c) leaf

d) flower

e) fruit

f) Seed

g) Root bark

h) Stem bark

i) Latex

j) Gum

4. Reason for considering plant as medicine

a) Religious belief

b) Tradition

c) Personal experience of healer

d) Strong belief on herbal drug



## PHOTO PLATES



**Photo plate 1:** **A.** Dried *Swertia chirayita* (Roxb. ex-Fleming) Karsten **B.** *Solanum virginianum* L. **C.** *Berberis asiatica* DC **D.** *Cynoglossum zeylanicum* (Vahl)



**Photo plate 2: E. *Curcuma caesia* Roxb. F. *Rubus ellipticus* Sm. G. Interviewing the local H. Collecting herbarium specimen**