

**ETHNOBOTANICAL SURVEY OF MEDICINAL PLANTS
PRACTICED BY THE RAI COMMUNITY OF DHARAN
SUB-METROPOLITAN CITY, SUNSARI, NEPAL**



A PROJECT WORK SUBMITTED TO THE

**DEPARTMENT OF BIOLOGY
CENTRAL CAMPUS OF TECHNOLOGY
INSTITUTE OF SCIENCE AND TECHNOLOGY
TRIBHUWAN UNIVERSITY
NEPAL**

**FOR THE AWARD OF
BACHELOR IN SCIENCE (B.Sc.) IN BOTANY**

BY
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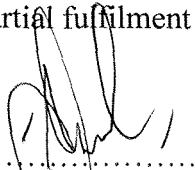
JUNE 2023

RECOMMENDATION

This is to recommend that **SHUSIL CHANDRA RAI** (Symbol No. 500080040, T.U. Registration No 5-2-8-87-2018), has carried out project work entitled “**ETHNOBOTANICAL SURVEY OF MEDICINAL PLANTS PRACTISED BY RAI COMMUNITY OF DHARAN SUB-METROPOLITAN CITY, SUNSARI, NEPAL**” for the requirement to the project work in Bachelor of Science (B.Sc.) degree in Botany under my/our supervision in the Department of Department of Biology, Central campus of technology, Institute of Science and Technology (IoST), Tribhuvan University (T.U.), Nepal.

To my/our knowledge, this work has not been submitted for any other degree.

He has fulfilled all the requirements laid down by the Institute of Science and Technology (IoST), Tribhuvan University (T.U.), Nepal for the submission of the project work for the partial fulfilment of Bachelor of Science (B.Sc.) degree.



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DECLARATION

This project work entitled “ETHNOBOTANICAL SURVEY OF MEDICINAL PLANTS PRACTISED BY RAI COMMUNITY OF DHARAN SUB-METROPOLITAN CITY, SUNSARI, NEPAL” is being submitted to the Department of Biology, Central Campus of Technology, Institute of Science and Technology (IoST), Tribhuvan University (T.U.), Nepal for the partial fulfilment of the requirement to the project work in Bachelor of Science (B.Sc.) degree in Botany. This project work is carried out by me under the supervision of Amrit Maya Lawati and the co-supervision of Sanju Parajuli in the Department of Biology, Central Campus of Technology, Institute of Science and Technology (IoST), Tribhuvan University (T.U.), Nepal.

This work is original and has not been submitted earlier in part or full in this or any other form to any university or institute, here or elsewhere, for the award of any degree.



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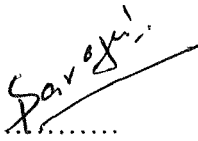
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JUNE 2023

LETTER OF FORWARD

June 2023

On the recommendation of **Mrs. Amrit Maya Lawati** and **Mrs. Sanju Parajuli**, this project work is submitted by Shusil Chandra Rai, Symbol No. 500080040, T.U. Registration No 5-2-8-87-2018, entitled **ETHNOBOTANICAL SURVEY OF MEDICINAL PLANTS PRACTISED BY RAI COMMUNITY OF DHARAN SUB-METROPOLITAN CITY, SUNSARI, NEPAL**” is forwarded by the Department of Biology, Central Campus of Technology, for the approval to the Evaluation Committee, Institute of Science and Technology (IoST), Tribhuvan University (T.U.), Nepal. He has fulfilled all the requirements laid down by the Institute of Science and Technology (IoST), Tribhuvan University (T.U.), Nepal for the project work.



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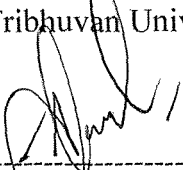
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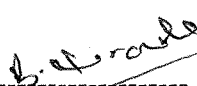
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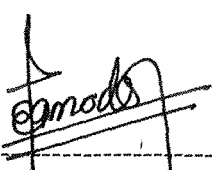
This project work (PRO-406) entitled, "ETHNOBOTANICAL SURVEY OF MEDICINAL PLANTS PRACTICED BY RAI COMMUNITY OF DHARAN SUB-METROPOLITAN CITY, SUNSARI, NEPAL" by Shusil Chandra Rai (Symbol No500080040 and T.U. Registration No5-2-8-87-2018) under the supervision of Amrit Maya Lawati and co-supervision of Sanju Parajuli in the Department of Biology, Central Campus of Technology, Institute of Science and Technology (IoST), Tribhuvan University (T.U.), is hereby submitted for the partial fulfilment of the Bachelor of Science (B.Sc.) degree in Botany. This report has been accepted and forwarded to the Controller of Examination, Institute of Science and Technology, Tribhuvan University, Nepal for the legal procedure.



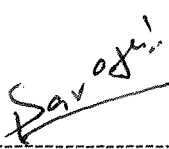
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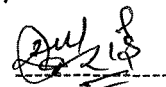
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I would like to express my deep gratitude, appreciation and sincere thanks to my supervisor Assistant Prof. Amrit Maya Lawati for her guidance and constant supervision during my project and I would also like to thank my co-supervisor Assistant Prof. Mrs. Sanju Parajuli, Department of Botany, Central Campus of Technology.

I am very thankful to the entire Rai community in Dharan Sub-Metropolitan city for all their support and cooperation during my field survey, they have helped me to fulfil my project through their ancient tribal knowledge.

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ABSTRACT

Ethnobotany is the study of local plants and their practical application in the treatment of various diseases. The Rai community is one of the oldest, most traditional and unique indigenous groups, living primarily in the mountainous regions of eastern Nepal. This study explores the rich traditions of ethnomedicine practice in Rai communities. Rai communities have long relied on traditional herbal remedies obtained from local plants for the treatment of various ailments. However, with the advancement and emergence of modern medicine, the use of traditional medicinal plants appears to be declining, requiring immediate action to preserve their ethnomedical heritage.

This study was adopted as an interdisciplinary approach, combining ethnomedical research methods, interviews with local community members, village leaders, traditional health practitioners, and botanical surveys. It identified and documented ethnic medicinal plants practised in tribal communities. This study aims to identify promising medicinal plants that may aid in the development of new drugs, health care and new treatments. A total of 73 medicinal plants were identified during this study. Herbs were found to be the most used plant form and out of 73 plants, 17 species could cure respiratory disorders such as cough, asthma, cold, sore throat and pneumonia. Mostly, whole plant was used for treatment followed by leaf and roots of the plant. Plants were primarily utilized for mastication and juice out of all the recorded uses. These findings contribute to a greater understanding and appreciation of traditional treatments in Rai communities. As a result of the documentation and preservation of this knowledge, the Rai community will also benefit from royalties that will allow them continue to market and safeguard their therapeutic plant species. This research aims to raise awareness of traditional knowledge systems and their potential contributions to global health and well-being by emphasizing the importance of interdisciplinary collaboration and cultural considerations.

Keywords: Ethnobotany, Nepal, Rai Community, Medicinal Plants, Survey

शोधसार

Ethnobotany स्थानीय बिरुवाहरूको अध्ययन र विभिन्न रोगहरूको उपचारमा तिनीहरूको व्यावहारिक उपयोग को अध्ययन हो। राई समुदाय मुख्यतया पूर्वी नेपालको पहाडी क्षेत्रमा बसोबास गर्ने सबैभन्दा पुरानो, सबैभन्दा परम्परागत र अद्वितीय आदिवासी समूह हो। यस अध्ययनले राई समुदायहरूमा ethnomedicinal अभ्यासको समृद्ध परम्पराहरूको अन्वेषण गर्दछ। राई समुदायले लामो समयदेखि विभिन्न रोगको उपचारका लागि स्थानीय वनस्पतिबाट प्राप्त परम्परागत जडिबुटीमा भर पर्दै आएका छन्। यद्यपि, आधुनिक औषधिको विकास र उदयसँगै, परम्परागत औषधीय वनस्पतिहरूको प्रयोग घट्दै गएको देखिन्छ, उनीहरूको जातीय सम्पदा जोगाउन तत्काल कदम चाल्न आवश्यक छ।

यस अध्ययनलाई जातीय अनुसन्धान विधिहरू, स्थानीय समुदायका सदस्यहरू, गाउँका प्रमुख, परम्परागत स्वास्थ्य व्यवसायीहरू, र वनस्पति सर्वेक्षणहरूको संयोजन गरी अन्तर-विषय दृष्टिकोणको रूपमा अपनाइएको थियो। यसले जनजाति समुदायहरूमा अभ्यास गरिएका जातीय औषधी वनस्पतिहरूको पहिचान र दस्तावेज गर्दछ। यस अध्ययनको उद्देश्य नयाँ औषधि, स्वास्थ्य हेरचाह र नयाँ उपचारको विकासमा मद्दत गर्न सक्ने आशाजनक औषधीय वनस्पतिहरू पहिचान गर्नु हो। यस अध्ययनको क्रममा कुल ७३ वटा औषधीय वनस्पति पहिचान गरिएको थियो। जडिबुटी सबैभन्दा बढी प्रयोग हुने बिरुवाको रूपमा पाइयो र ७३ बिरुवाहरू मध्ये १७ प्रजातिले खोकी, दम, रुघाखोकी, घाँटी दुख्ने र निमोनिया जस्ता श्वासप्रश्वास सम्बन्धी रोगहरू निको पार्न सक्ने पाइयो। प्रायः सम्पूर्ण बिरुवा उपचारको लागि प्रयोग गरिन्थ्यो र त्यसपछि बिरुवाको पात र जराहरू धेरै प्रयोग गरिन्थ्यो। रेकर्ड गरिएका विभिन्न प्रयोगका मोडहरूमध्ये, बिरुवाहरू प्रायः mastication र रसको रूपमा प्रयोग गरिन्थ्यो। यी निष्कर्षहरूले राई समुदायहरूमा परम्परागत उपचारहरूको ठूलो समझ र प्रशंसामा योगदान पुऱ्याउँछन्। कागजात र संरक्षणले राई समुदायले royalty प्राप्त गर्छ भन्ने कुरा सुनिश्चित गर्न मद्दत गर्दछ, जुन औषधीय बिरुवाहरूको व्यापारीकरण र संरक्षण गर्न प्रयोग गर्न सकिन्छ। यस अनुसन्धानले अन्तरविषय सहयोग र सांस्कृतिक विचारहरूको महत्त्वलाई जोड दिएर पारम्परिक ज्ञान प्रणालीहरू र विश्वव्यापी स्वास्थ्य र कल्याणमा तिनीहरूको सम्भावित योगदानहरूको जागरूकता बढाउने लक्ष्य राखेको छ।

LIST OF ACRONYMS AND ABBREVIATIONS

df: Degree of Freedom

FGD: Focal Group Discussion

IPR: Intellectual Property Right

PRA: Participatory Rural Appraisal

Km: Kilometre

MP: Medicinal Plants

LIST OF TABLES

Table 1: Checklist of recorded MP during study	10
Table 2: Ailments categorical division with respect to the number of plants used to treat ailments.....	16

LIST OF FIGURES

Figure 1: Study area.....	7
Figure 2: Percentage of life forms of plant used for treatment of different ailments	16
Figure 3: Percentage of plants parts used for treatment of different ailments.....	17
Figure 4: Different modes of plant's preparation with respect to number of plant species used for medicinal purposes	18

LIST OF PHOTOGRAPHS

Photographs 1: Ethnobotanical Survey in Dharan 4	i
Photographs 2: Ethnobotanical Survey in Dharan 51	i
Photographs 3: A file photo with local resident during in-depth individual interview ..	ii
Photographs 4: A file photo during indepth individual interview in Dharan 13	ii
Photographs 5: A file photo during in-depth interview with local resident.....	iii
Photographs 6: A file photo during group discussion.....	iii
Photographs 7: A file photo during in-depth individual interview	iv
Photographs 8: A file photo during in-depth individual study	iv
Photographs 9: A file photo during in-depth individual interview	v
Photographs 10: A file photo during an in-depth individual interview	v
Photographs 11: A file photo with traditional medicinal practitioner	vi
Photographs 12: A file photo of group discussion with a traditional medicine practitioner	vi

LIST OF APPENDIX

Appendix i: Photo Plates	i
Appendix ii: Questionnaire.....	vii

Table of Contents

Cover Page	
RECOMMENDATION	ii
DECLARATION	iii
LETTER OF FORWARD	iv
BOARD OF EXAMINATION AND CERTIFICATE OF APPROVAL	v
ACKNOWLEDGEMENTS	vi
ABSTRACT	vii
शोधसार	viii
LIST OF ACRONYMS AND ABBREVIATIONS	ix
LIST OF TABLES	x
LIST OF FIGURES	xi
CHAPTER 1	1
1. INTRODUCTION	1
1.1 General Introduction	1
1.2 Rationale	2
1.3 Objectives	3
1.3.1 General Objective	3
1.3.2 Specific Objectives	3
CHAPTER 2	4
2. Literature Review	4
2.1 General background of ethnobotany	4
2.2 Rai as an indigenous community	5
2.3 Ethnobotanical approaches for study of ethnomedicine	5
2.4 Urgency of the study	6
CHAPTER 3	7
3. MATERIALS AND METHODS	7
3.1 Materials	7

3.1.1 Study Area	7
3.2 Methodology	8
3.2.1 Field work and ethnobotanical data collection	8
3.2.1.1 Focal group discussion (FGD).....	8
3.2.1.2 In-depth individual interviews.....	8
3.2.2 Plant sample collection.....	8
3.2.3 Identification and nomenclature of collected plants.....	9
Chapter 4	10
4. Results	10
4.1 Diversity of medicinal plants and their indigenous uses.....	10
4.2 Plants part used	17
4.3 Mode of plant's preparation	18
4.4 Analysis of different categorial data	18
4.4.1 Age group and level of ethno botanical knowledge	18
4.4.2 Gender type and level of ethnomedicinal knowledge	19
Chapter 5	20
5. Discussion, conclusion and recommendation	20
5.1 Discussion and Conclusion	20
5.2 Novelty and national prosperity aspect of the project.....	21
5.4 Recommendation.....	22
REFERENCE	23
Appendix i:Photo Plates	i
Appendix ii: Questionnaire	vii

CHAPTER 1

1. INTRODUCTION

1.1 General Introduction

To sustain life in a harsh and difficult environment, humans have a close and deep connection with animals and plants. Every civilization in the world demonstrates these connections through various forms of interaction with native flora and fauna (Alves & Souto, 2011). Ethnobotany is the study of local plants and their practical uses, based on traditional knowledge of local cultures and peoples (Kunwar & Bussmann, 2008). It is an interdisciplinary science of applied botany that deals with various aspects of plants in their relationship to humans. In recent years, interest in ethnobotanical research has increased. This is mainly due to the search for potential new economic plants and the need to conserve and utilize plant resources in tribal areas for socioeconomic development (Chaudhary & Rai, 2017).

Nepal is a geographically and climatically varied country, rich in biodiversity, which has supported a diverse ethnic group with its rich customs, traditions, culture, festivals and festivals. The country is considered a bastion of traditional medical knowledge (Sitaula, 2009). There is a long history of the traditional use of plants and plant resources for medicinal purposes in Nepal, as they are free of side effects, affordable and easily available, and sometimes the only source of medical care available to the poor. Its use is spreading rapidly. Ethnic communities have extensive traditional knowledge of the uses of plants and plant parts and have a long tradition of passing this indigenous knowledge from generation to generation. Indigenous Knowledge of Medicinal Plants Is Being Recognized Worldwide (MoFSC, 2002).

Nepal is a multiethnic and multilingual country with 125 caste/ethnic groups speaking 123 different languages as their primary languages (National Statistical Office, 2014). The Rai population is dispersed throughout the country mainly along the Hill Plain (Hill 419,913; Terai 155,249; Mountain 44,842) and dominating towards the east as 517,278 in Eastern Development Region; 92,066 in Central DR; 8,018 in Western DR; 1,531 in Mid-western DR and 1,111 in Far-western DR (National Statistical Office, 2014). The documentation of indigenous use of plants by the Rai community seems to begin with the work of (Toba, 1975) who documented the names of plants in Khaling (Rai language) in

Solukhumbu district. (Milan, 2000) have documented the plants used by Aathpahariya Rai of Dhankuta district, Nepal. Little work has been undertaken in the Rai community regarding the medicinal uses of plant and animal species (Rai & Singh, 2015).

1.2 Rationale

Ethnobotany studies the direct relationship between plants and humans in his culture (Rahman *et al.*, 2019). Ethnobotanical research has the potential to gather and integrate local and scientific knowledge to advance the goal of biocultural conservation (Gaoue *et al.*, 2017). Ethnobotany provides insight into how societies interact with local environmental resources (Pei *et al.*, 2020b). The Rai community in Dharan, a sub-Metropolitan city of Sunsari, Nepal, is known for its extensive knowledge of the use of plants for medicinal, cultural, research and conservation purposes. However, this knowledge is rapidly being lost due to various factors such as modernization, globalization and urbanization. The constant encroachment and deflection of culture within the traditional medical community have significantly lost potentially rich knowledge (Bhattarai, 2020). The new generation's modernized lifestyle and their distaste for native medicinal plants are other reasons for the alarming decline of long-standing practices (Bhattarai, 2020; Pangeni *et al.*, 2020; Rai & Singh, 2015). Rai & Singh (2015) studied Medicine and Ethnobiology at Rai Community, Baikunte Village Development Committee, Bhojpur, Eastern Nepal. Similarly, Magar *et al.* (2022) studied ethnomedicine in the Sub-Metropolitan city of Dharan. This study showed that the Rai community has a very rich knowledge of medicinal plants and ethnobotanical knowledge.

This study is important because it can provide insight into the potential utilization of plant resources for medicine, food and other purposes. The findings of this research may also contribute to the development of new herbal products and industries, benefiting both the Rai community and society at large. The aim of this study is therefore to contribute to the preservation of traditional knowledge on plant utilization and conservation practices and to promote the sustainable use of plant resources in the region.

1.3 Objectives

1.3.1 General Objective

Ethnobotanical documentation of medicinal plants practised by the Rai community of Dharan Sub-Metropolitan City, Sunsari, Nepal.

1.3.2 Specific Objectives

- i) To survey Dharan Sub-Metropolitan City and gather information on their ethnomedicinal knowledge.
- ii) To collect the specimen of the traditionally used plants by the community and preserve, dry and prepare the herbarium.
- iii) To find the current status of the ethnomedicinal knowledge of the Rai Community and analyze possible threats.

CHAPTER 2

2. Literature Review

2.1 General background of ethnobotany

Ethnobotany is defined as the discipline concerned with interactions between humans and plants (Jones, 1994). One of the early pioneers of ethnobotany was Richard Evans Schultes, who examined the utilization of plants by innate societies within the Amazon rainforest. Schultes's work laid the establishment for cutting-edge thinking about ethnobotany, and his commitments proceed to rouse unused eras of ethnobotanists (Bailey, 1995).

Ethnobotany as a separate field emerged in the mid-20th century when scientists began to realize the importance of traditional knowledge in understanding usage by different cultures (Balick & Cox, 2020). Ethnobotany has numerous commonsense applications, counting the disclosure of unused drugs and the improvement of maintainable farming hones. Conventional information on plants has too contributed to the advancement of unused innovations and materials (Balick & Cox, 2020).

Dobremez (1976) described 35 species of medicinal plants of Nepal Himalaya. Sacherer (1979) reported on the ethnobotany of the Rolwaling Sherpa and some of the medicinal plants they used. Manandhar (1980, 1980, 1982, 1985, 1986) conducted ethnobotanical studies in several districts of Nepal. Similarly, Bhandary & Shrestha (1982) reported a total of 67 poisonous plant species from the Kathmandu Valley and 15 poisonous plant species from the Annapurna and Langtang Himal regions There are few ethnobotanical studies on medicinal plants in Nepal (Dangol & Gurung, 1991).

Milan (2000) have also studied the ethnobotany of Aathpaharia Rai in and around Dhankuta Bazar area. The study of ethnobotany has a long history, dating back to ancient civilizations such as the Greeks and Romans who used plants for medicinal purposes. (Cunningham, 2001).

MoFSC (2002) have listed 393 medicinal plants. Ethnobotany has many facets, including the way people name and classify plants, the value added to plants, their uses, and how they are managed. Straddling the natural and social sciences (Balick, 2005).

Rai & Singh (2015) surveyed the Rai community at Baikunte Village Development Committee, Bhojpur, East Nepal, and listed 87 plant species.

Similarly, Magar *et al.* (2022) documented 33 species of medicinal plants in 20 families in the Dharan region

2.2 Rai as an indigenous community

Rai is one of the major ethnic groups, they speak their specific language. They are mainly found in the hilly regions of the country including Bhojpur, Khotang, Dhankuta, and Sankhuwasabha districts. Most of the Rai people live in traditional houses i.e., houses made up of stone and mud with a thatched roof. Rai is one of the indigenous groups in Nepal. Rai communities use medicinal plants and animal species to cure sicknesses in life Nepalese indigenous people groups dwelling on distinctive geographic belts with conventional lifestyles that are closely joined with biological diversity, normal assets, and environment from centuries (Sherpa, 2005). Nepal, in terms of indigenous conventional information, is considered as one of the wealthiest, due to its topographical diversities and numerous ethnic communities. All of these communities have a few kind of conventional information related with their life from time immemorial (Sharma *et al.*, 2009). Rai, too allude themselves as Khambu or Khambas follows their relocation from Tibet in a few farther past. They recognize themselves with the Kirati gather or the Kirat confederation that incorporates the communities Limbu, Sunuwar, Yakkha Dhimal, Koche, Meche, and Hayu (Bain, 2018).

2.3 Ethnobotanical approaches for study of ethnomedicine

Ethnobotanical field work are majorly conducted by two approaches for collecting data (Jain, 2010) i) meeting the learned individual to accumulate data on different employments of plant and at the same time collecting voucher examples and ii) interfacing all restorative plants found around the community at that point appearing the plants to witnesses and gathering the procured data. Among the specified two approaches the primary one is broadly taken after strategy for ethnobotanical considers (Jain, 2010). Relating to other literary works of ethnobotanical ponders, lion's share of the ponders have drawn nearer Participatory rural appraisal (PRA) alongside Focal group discussion (FGD) and in-depth individual interviews utilizing semi-structured survey study (Bain,

2018; Bhattarai, 2018, 2020; Chaudhary & Rai, 2017; Dahal, 2016; Magar *et al.*, 2022; Pangei *et al.*, 2020; Rai & Singh, 2015; Toba, 1975). These ponders have said that village head and medicinal practitioners are met to gather essential information.

Amid the field overview, documentation of the plants, plants part per utilized, their processing, preparation and dosage, etc. for specific aliment, local (or tribal) name are the key components that are to be cautiously recorded (Bhattarai & Khadka, 2016; Das *et al.*, 2021; Jain, 2010; Rajbanshi & Thapa, 2019). Further, talk with respect to collected plants among other tribal individuals and disposing of the negating uses of plants are the key methods for approving the ethnomedicinal hones of the examined community (Jain, 2010).

2.4 Urgency of the study

A study conducted by Rai & Singh (2015) has recorded the medico-ethnobiology in Rai community in Baikunthe Town Development Committee. The study distinguished the use of 87 plant species to treat 65 sorts of illnesses. This offer assistance within the noteworthy breakthrough in pharmaceutical businesses. There is an extraordinary criticalness for further research and investigation before indigenous cultures and natural habitats gets adulterated (Budha-Magar *et al.*, 2020; Chaudhary & Rai, 2017; Jain & Borthakur, 1980). Simultaneously, the use of allopathic drugs has also caused significant decrease in use of traditional medicinal plants by Rai community (Magar *et al.*, 2022). The other reasons for the decrease of traditional medication practitioner are urbanization and modernization, so detailed study on the tribal information is recommended (Budha-Magar *et al.*, 2020; Das *et al.*, 2021; Magar *et al.*, 2022; Rai & Singh, 2015). Essentially it was found that the older populace to be preservationist around sharing their information about a few medicinal plants amid the study (Jain, 2010). Therefore, prior documentation is necessary both to gain the trust of the tribe and to educate the next generation about traditionally useful medicinal plants. These factors and circumstances most favored the study of traditional indigenous knowledge.

CHAPTER 3

3. MATERIALS AND METHODS

3.1 Materials

3.1.1 Study Area

Dharan is a sub-metropolitan city in Sunsari District of Nepal which lies at 26° 49' 0" North, 87° 17' 0" East (Fig. 1). It is situated on the foothills of the Mahabharata Range in the North with its southern tip touching the edge of the Terai region at an altitude of 1148 ft (349 m) and occupies an area of 193.8 Sq km (National Statistical Office, 2014). The average temperature of Dharan is 23.2°C and precipitation averages 1799 mm. According to the 2011 census, the population of Dharan is 116,181 out of which 54,599 were males and 61,582 were females (Planning & Secretariat, 2012). Rai, Limbu, Magar and Tamang are major ethnic groups inhabiting this area consisting of about 20 percent, 11 percent, 11 percent and 10 percent respectively (National Statistical Office, 2014).

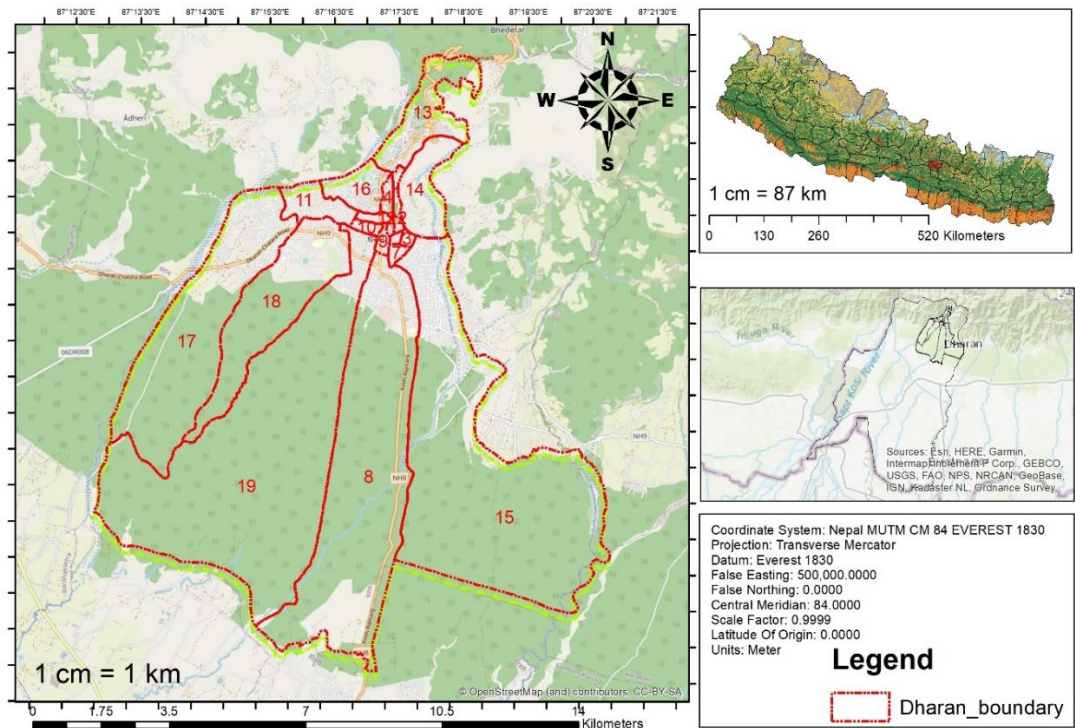


Figure 1: Study area

3.2 Methodology

3.2.1 Field work and ethnobotanical data collection

Ethnobotanical survey was conducted from Udhauli Chaad (December 8, 2022) to Ubhauli Chaad (May 5, 2023). The field data was collected using two methods i.e. FGD and in-depth individual interviews (Bhattarai, 2020; Magar *et al.*, 2022; Pangeni *et al.*, 2020; Planning & Secretariat, 2012; Rai & Singh, 2015; Rijal, 2011). Village leaders and local naturopathic doctors were invited to the FDG. General informants were randomly selected for the study based on age (16+ only), irrespective of occupation, gender, religion, education level, and caste. Ethical issues were clarified to local residents and traditional healers in the community. Ethnomedical data were then collected based on FGD and interactions with indigenous peoples through in-depth individual interviews.

3.2.1.1 Focal group discussion (FGD)

Six FDGs were performed. Each discussion was attended by five people, including a traditional medicine practitioner, a village chief, and other local residents. As part of the FDG, basic ethnomedical information on medicinal plants was listed regarding their status and uses.

3.2.1.2 In-depth individual interviews

Detailed information was collected through individual interviews using a series of structured questionnaires. A total of 117 people (64 male, 53 female), including 7 traditional medicine practitioners (7 male, 0 female), were randomly selected and interviewed. A survey's structured data set contains the background of the respondents. That is: Personal name, age, gender, occupation, educational background, annual income, taxonomic groups of medicinal plants, habitat and distribution, main use categories, parts used, and type of collection.

3.2.2 Plant sample collection

A transect walk was made along the town outskirts for collection of plants utilized for therapeutic purposes. This comprised of strolling along the height gradient of around 349 meter to 1400 meter from an ocean level. 2 local medicinal practitioner was

contracted and were included within the transect walk for collecting locally specified valuable plant specimen.

3.2.3 Identification and nomenclature of collected plants

Collected specimens were pressed, dried, mounted and stored according to standard methods specified by (Alexiades, 1996). Specimens were identified using standard literature (Alexiades, 1996; Aththorick & Berutu, 2018; Bailey, 1995; Bain, 2018; Balick & Cox, 2020; Bhattarai, 2018, 2020; Bhattarai *et al.*, 2013; Bhattarai & Khadka, 2016; Budha-Magar *et al.*, 2020; Chaudhary & Rai, 2017; Cunningham, 2001; Dahal, 2016; Das *et al.*, 2021; District, 2009; Focho *et al.*, 2009; Jain & Borthakur, 1980; Kunwar & Bussmann, 2008; Magar *et al.*, 2022; Milan, 2000; Pangeni *et al.*, 2020; Pei *et al.*, 2020a; Rai & Singh, 2015; Rajbanshi & Thapa, 2019; Sharma *et al.*, 2009; Sheikh *et al.*, 2013; Sitaula, 2009; Srithi *et al.*, 2009; Thapa, 2013; Toba, 1975). Additionally, the species was confirmed by comparing specimen specimens deposited at the Herbarium Department, Central Campus of Technology, Hattisar, Dharan.

Chapter 4

4. Results

4.1 Diversity of medicinal plants and their indigenous uses

Table 1: Checklist of recorded MP during study

S. N.	Family	Scientific Name	Local Name	Life forms	Parts Uses	Form of medication	Disease
1	Asteraceae	<i>Cirsium verutum</i> D. Don Spreng	Sungure Khada	Herb	Late x, Root	Mastication	Eye pain, Measles
2	Acanthaceae	<i>Justicia adhatoda</i> L.	Asuro	Herb	Leaf	Decoction	Fever
3	Acoraceae	<i>Acorus calamus</i> L.	Bojho	Herb	Root	Mastication Consumed and applying latex	Tonsillitis, Asphyxia, Antilice
4	Aloaceae	<i>Aloe vera</i> L.	Ghiu Kumari	Herb	Leaf	Whole Plant	Burned Skin , Gastritis
5	Amaranthaceae	<i>Amaranthus cruentus</i> L.	Rato Latte	Herb	Whole Plant	Consumed by frying	Anemia
6	Amaranthaceae	<i>Achyranthes aspera</i>	Ulti Jhar	Herb	Root	Mastication	Pneumonia, Tonsillitis
7	Amaryllidacea	<i>Allium sativum</i> L.	Lasun	Herb	Bulb	Mastication	Ring (Fungus infection)
8	Anacardiaceae	<i>Mangifera Indica</i> L.	Aap	Tree	Bark	Consumed by juice	Dysentery
9	Anacardiaceae	<i>Semecarpus anacardium</i> L. F.	Bhalayo	Tree	Fruit	Mastication	Dysentery, asthma, and acute rheumatism

10	Apiaceae	<i>Centella asiatica</i> L.	Ghodt pre	Herb	Leaf	Applying the paste	Wound Healing, Skin Disease
11	Apocynaceae	<i>Calotropis gigantea</i> L.	Aank	Shru b	Late x	Applying the latex	Sprain
12	Asparagaceae	<i>Asparagus racemosus</i> Willd.	Kurilo	Herb	Who le Plant	Decoction	Diabetes, Stomach Problem, Headach e
13	Asteraceae	<i>Artemisiz dubia</i> Wall. Ex Bess,	Teti Pati	Shru b	Leaf, Root	Consumed as juice	Nose bleeding, Back Pain, Joint pain
14	Asteraceae	<i>Ageratina adenophora</i> Spreng. King & H.Rob.	Kalo Banmar a	Shru b	Twig	Masticatio n	Cuts and wounds
15	Bignoniaceae	<i>Oroxylum indicum</i> L.	Totola	Cree per	Bark	Consumed by juice	Fever, Jaundice
16	Bombacaceae	<i>Bombax ceiba</i> L.	Simal	Tree	Root, Flow er	Consumed by juice and decoction	Measles, Common cold
17	Brassicaceae	<i>Brassica campestris</i> L.	Tori	Shru b	Seed	Applying oil	Common cold, Facture
18	Bromielliaease	<i>Ananas comosus</i> L. Merr.	Bhui Katahar	Shru b	Root	Consumed by juice	Jaundice
19	Cannabaceae	<i>Cannabis sativa</i> L.	Ganja	Herb	Seed	Consumed by frying	Diarrhea, Stomach ache
20	Caryophyllaceae	<i>Drymaria diandra</i> Blume	Abijal	Herb	Leaf	Consumed by juice	Fever
21	Combretaceae	<i>Terminalia chebula</i> Retz.	Harro	Tree	Fruit	Decoction	Cough, Sore throat , fever and cough

22	Combretaceae	<i>Terminalia bellerica</i> Gaertn. Roxb.	Barro	Tree	Fruit	Mastication	Cough, Vomitting
23	Convolvulaceae	<i>Cuscuta reflexa</i> Roxb.	Pahelel ahara	Climber	Whole Plant	Consumed by juice	Jaundice
24	Cucurbitaceae	<i>Cucurbita maxima</i> D.	Pharsi	Climber	Fruit	Decoction	Dysentery
25	Cucurbitaceae	<i>Luffa echinata</i> Roxb. M. Roem.	Ban Ghiraula	Climber	Leaf	Consumed by frying	Fever and Jaundice
26	Ericaceae	<i>Rhododendron arboreum</i> Sm.	Gurans	Tree	Bark, Flower	Consumed as Fermentation, Mastication, Juice	Heart Pain, Diarrhoea
27	Ericaceae	<i>Lyonia ovalifolia</i> Wall.	Angeri	Tree	Twig	Mastication	Skin Disease
28	Euphorbiaceae	<i>Euphorbia hirta</i> linn.	Itin Jhar	Herb	Whole Plant	Mastication	Cuts
29	Euphorbiaceae	<i>Euphorbia hirta</i> L.	Dudhe Jhar	Herb	Late x	Applying the latex	Cuts and wound
30	Fabaceae	<i>Mimosa pudica</i> L.	Lajawati Jhar	Herb	Root	Consumed as juice	Wound Healing, Digestive Disorder
31	Fabaceae	<i>Senegalia catechu</i> L.f. P.J.H. Hurter& Mabb.	Khair	Tree	Bark	Decoction	Cough, Ulcers
32	Lamiaceae	<i>Mentha spicata</i> L.	Pudina	Herb	Whole Plant	Consumed with hot water	Jaundice, Indigestion
33	Lamiaceae	<i>Ocimum Lenuiflorum</i> L.	Tulsi	Herb	Leaf	Mastication, Decoction	Headache, sinusitis, allergies, cold migraines and tonsillitis cough and tonsillitis
34	Lauraceae	<i>Persea odoratissima</i> Ness Kosterm	Kaulo	Tree	Root	Consumed as juice	Piles

35	Lauraceae	<i>Cinnamomum zeylanicum</i> BL.	Dal Chini	Tree	Bark	Mastication	Digestive Disorder
36	Lauraceae	<i>Cinnamomum tamala</i> Buch-Ham T.	Tej Patta	Tree	Leaf Young Shoot	Decoction	Cholesterol, weight loss
37	Melastomataceae	<i>Osbeckia stellata</i> Buch.- Ham. ex Ker Gawl.	Asare	Herb		Decoction	Toothache
38	Meliaceae	<i>Azadirachta india</i> A. Juss	Neem	Tree	Leaf	Consumed as paste and juice	Toothache, Fever
39	Menispermaceae	<i>Tinospora sinensis</i> Lour. Merr.	Gujurgano	Climber	Root	Applying by paste	Fracture
40	Moraceae	<i>Ficus religiosa</i> L.	Peepal	Tree	Root	Decoction	Spleen swelling
41	Moraceae	<i>Ficus semicordata</i> Buch.-Ham. ex Sm.	Khanyu	Tree	Late x	Mastication	Mumps
42	Moraceae	<i>Artocarpus heterophyllus</i> Lam.	Rukhkhathar	Tree	Leaf, Fruit	Consumed by frying and paste	Skin Disease, Dysentery
43	Moringaceae	<i>Moringa oleifera</i> Lam	Sajiwan	Tree	Flower	Consumed by frying	Reduce stress
44	Museceae	<i>Musa paradisiac</i> L.	Kera	Herb	Flower	Mastication	Retained Placenta
45	Mytaceae	<i>Pisidium gujava</i> L.	Amba	Tree	Bark	Consumed as juice	Dysentery
46	Nephrolepiadaceae	<i>Nephrolepis cordifolia</i> L.	Pani Amala	Herb	Rhizome	Mastication	Jaundice, Burning Urination
47	Oxalidaceae	<i>Oxalis corniculata</i> L.	Chari Amilo	Herb	Leaf	Mastication	Throat pain, Snake bite
48	Phyllanthaceae	<i>Phyllanthus emblica</i> L.	Aamala	Tree	Bark, Fruit	Consumed as paste and juice	Dysentery, Burning urination, Asthma
49	Phyllanthaceae	<i>Phyllanthus amarus</i> S chumach. & Thonn.	Bhui amala	Herb	Fruit	Mastication	Diarrhoea

50	Piperaceae	<i>Piper nigrum L.</i>	Marich	Shrub	Seed	Decoction	Throat Pain
51	Plumbaginaceae	<i>Plubago zeylenica L.</i>	Chitu	Shrub	Root	Applying the paste	Indigestion, Tite, Muscle Pain
52	Poaceae	<i>Eleusine coracana</i>	Kodo	Grass	Seed	Fermentation	Diarrhea, Stomach ache
53	Poaceae	<i>Thysanolaena latifolia</i> Roxb. ex Hornem. Honda	Amliso	Grass	Root	Consumed by juice	Labour pain
54	Pteridaceae	<i>Cheilanthes anceps</i> Balanf.	Raniska	Herb	Young Shoot	Applying the paste Consumed by juice and	Wound
55	Rosaceae	<i>Rubus ellipticus</i> Sm.	Ainselu	Shrub	Young shoot	Mastication	Tonsillitis, Fever
56	Rubiaceae	<i>Anthocephalus cadamba</i> Roxb	Kadam	Tree	Bark	Consumed as juice	Diarrhoea, Fever
57	Rubiaceae	<i>Leptodermis lanceolata</i> Wall.	Bhuichampa	Shrub	Root	Consumed by paste	Fracture
58	Rutaceae	<i>Zanthoxylum nepalensis</i>	Boke Timbur	Tree	Leaf, Seed	Decoction	Gastritis
59	Rutaceae	<i>Citrus limon L.</i>	Kagati	Shrub	Fruit	Consumed by juice	scurvy, Gastric
60	Santalaceae	<i>Viscum album</i> L.	Harchur	Climber	Whole Plant	Applying the paste	Facture, Broken limbs
61	Sapindaceae	<i>Sapindus mukorossi</i> Gaertn.	Ritha	Tree	Fruit Shell	Mastication	Remove dandruff
62	Scrophulariaceae	<i>Buddleja asiatica</i> Lour.	Bhimsempate	Shrub	Leaf	Consumed by juice	treat fever, coughs, colds
63	Scrophulariaceae	<i>Buddleja asiatica</i> Lour.	Raune	Shrub	Leaf	Consumed as soup	Fever, Cough
64	Theaceae	<i>Schima wallichii</i> Dc.	Chilaune	Tree	Bark	Decoction	Piles

65	Solanaceae	<i>Mirabilis jalapa</i>	Lankas hari	Herb	Rhizome	Mastication	Consumed while delivery
66	Unidentified	Unidentified	Besiguhelo	Shrub	Late x	Consumed latex	Pneumonia
67	Urticaceae	<i>Urtica dioica</i> L.	Sisno	Shrub	Leaf, Young Shoot, Root	Consumed by soup and juice	Common cold, High blood pressure
68	Verbenaceae	<i>Vitex negundo</i> L. BM 0242	Simali	Shrub	Leaf	Decoction	Swollen body parts
69	Verbenaceae	<i>Chromolaena odorata</i> L. R.M.King & H.Rob.	Seto Banmara	Shrub	Twig	Mastication	Cuts and Wounds
70	Vitaceae	<i>Cissus quadrangularis</i> L.	Haadajoda	Climber	Whole Plant	Applying the paste	Cut, Wounds and Fracture
71	Woodsiaceae	<i>Dryothyrium boryanum</i> Willd.	Kalo Niguro	Herb	Buds, Rhizome	Consumed by frying	Dysentery, Abdominal spasm
72	Zingiberaceae	<i>Zingiber officinale</i> Roscoe	Aduwa	Herb	Rhizome	Mastication	Throat Pain, cough and high altitude sickness
73	Zingiberaceae	<i>Curcuma angustifolia</i>	Besar	Herb	Root	Decoction	Common cold, Cough

A total of 73 medicinal plants which lies under 51 family was recorded during the study (Table 1). Among the 73 medicinal plants 1 couldn't be identified scientifically due to the language barrier.

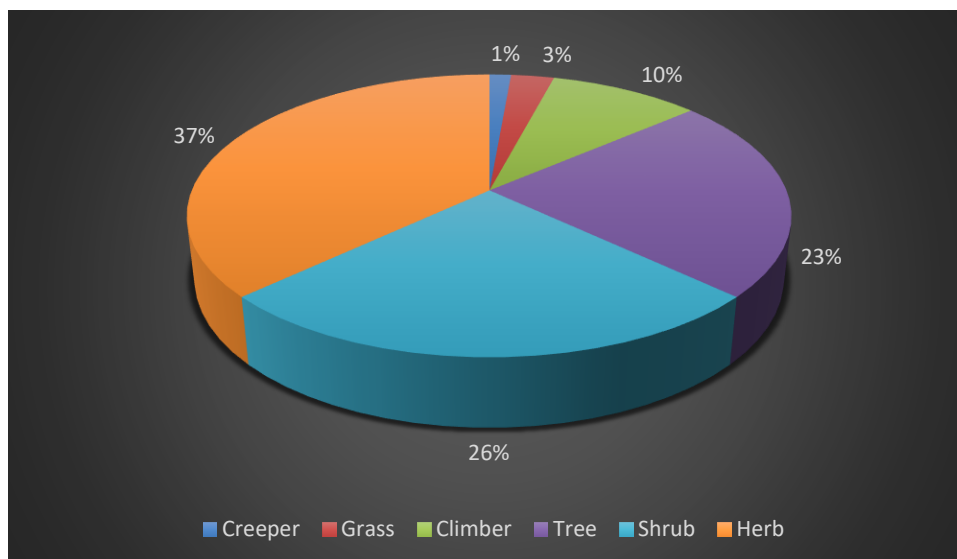


Figure 2: Percentage of life forms of plant used for treatment of different ailments

Of the recorded plant species, the highest number of plants (27 species) were found to be herbs, followed by shrubs (19 species) and trees (17 species) and the least amount were creepers (1 species) and grass (2 species). Different ethnobotanical studies conducted in Dharan and its neighboring district has also revealed similar data (Bhattarai, 2018; Bhattarai & Khadka, 2016; Das *et al.*, 2021; Magar *et al.*, 2022; Rijal, 2011).

Table 2: Ailments categorical division with respect to the number of plants used to treat ailments.

S.N.	Ailment category	Name of ailments	Number of Plants in use
1.	Respiratory disorder	Cough, Asthma, cold, Sore throat, pneumonia	17
2.	Fever	Fever, Jaundice	13
3.	Gastrointestinal disorder	Diarrhea, Dysentery, Stomach pain, Gastritis	15
4.	Skin/Subcutaneous Cellular tissue disorders	Boils, Cuts, Wounds, Skin rashes, Measles, Dandruff, Mumps	15
5.	Musculoskeletal	Fracture and broken limbs, Rheumatoid arthritis, body pain, piles, spleen swelling	12
6.	Sensory system disorders	Toothache, Eye pain	2
7.	Nervous system disorder	Headache, stress reliever	5
8.	Maternal ailments	Child delivery, Labor Pain, retain placenta	3

The recorded medicinal plants were used to cure 30 different types of ailments. The highest was for respiratory disorder such as sore throat, asthma, pneumonia, cough and cold (17 species) followed by gastrointestinal disorder such as Diarrhea, Dysentery, Stomach pain and gastritis (15 species) and skin/sub-cutaneous cellular tissue disorder such as boils, cuts, wounds, skin rashes, measles, dandruff and mumps whereas the least

was for Maternal ailments such as child delivery (3 species) and Sensory system disorder such as Toothache and eye pain (2 species).

4.2 Plants part used

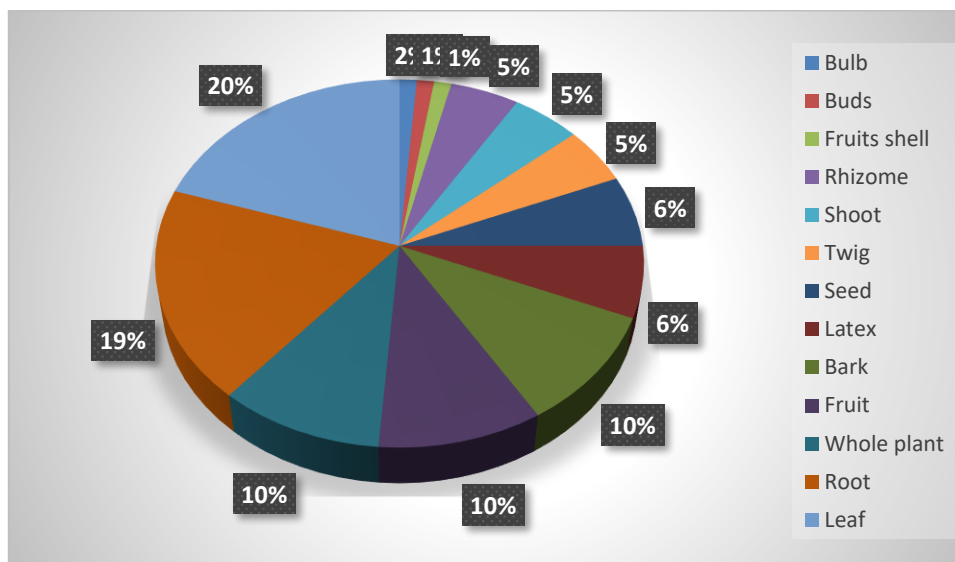


Figure 3: Percentage of plants parts used for treatment of different ailments

The different plant parts used for treatment of different diseases were underground parts which consists of root, rhizome and bulb, while above ground parts consist of seed, bark, fruit, latex, twig, fruits shell, buds and shoot. Mostly whole plant was used for different diseases. The mostly used part for the treatment of different ailments was leaf and roots whereas bulb, bud and fruit shell was least used. (Bhattarai, 2018; Bhattarai & Khadka, 2016; Budha-Magar *et al.*, 2020; Das *et al.*, 2021) have also shown the higher use of leaves and underground part with least use of sap, fruits and flowers. The main reason for this is possible due to presence of higher amount of bioactive compounds in roots and leaves than any other parts (Aththorick & Berutu, 2018; Focho *et al.*, 2009; Sheikh *et al.*, 2013; Srithi *et al.*, 2009).

4.3 Mode of plant's preparation

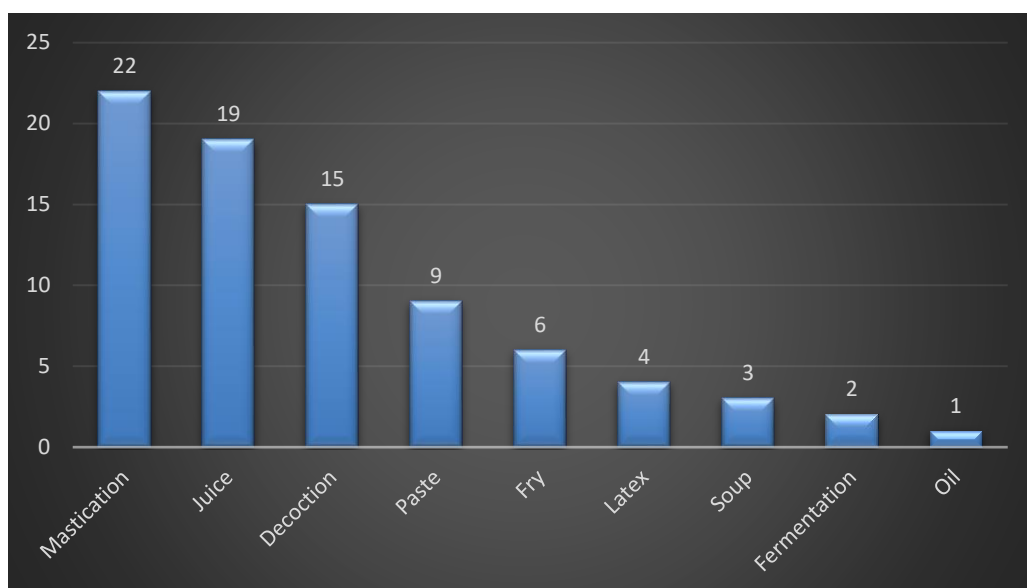


Figure 4: Different modes of plant's preparation with respect to number of plant species used for medicinal purposes

Total of nine different methods were found to prepare plant's which were applied for treatment of different ailment. Of the recorded different modes, plants were mostly used in form of mastication, juice, decoction and paste (Figure 3). Similar finding were recorded in many studies such as (Bhattarai & Khadka, 2016; Budha-Magar *et al.*, 2020; Das *et al.*, 2021; Rai & Singh, 2015).

4.4 Analysis of different categorial data

Categorical data analysis was done using Spss. The statistically significant difference between the presumptive variables for categorial data was assessed using the Chi-square test.

4.4.1 Age group and level of ethno botanical knowledge

X-squared = 351.000, df = 9, p-value < 2.6e-16

From the analysis it was found that categorial variable of ages were significant to people's level on ethnomedicinal knowledge (p-value=2.6e-16) which defines the level of ethnomedicinal knowledge varied with age category. The Pearson chi-square value is 351.000, calculated with 9 degrees of freedom (df). The associated p-value (asymptotic

significance) is reported as $2.6e-16$, which is very low. This shows that the variables under study have a statistically significant link. When compared to younger generations, older adults were shown to know more about ethnomedicinal plants and their medical applications. This has revealed a sizable divide in the transmission of ethnomedical knowledge from the older to the younger generations. However, it is important to note that a portion of the cells have low expected counts, so the results should be interpreted with caution.

4.4.2 Gender type and level of ethnomedicinal knowledge

X-squared = 5.162, df = 3, p-value 0.076

When gender categorial data were tested for corelation, gender differences showed a low positive relation (p-value = 0.076) to level of ethnomedicinal knowledge. This suggests that gender had an impact on the degree of ethnomedicinal knowledge. According to the survey, men were found to have a better level of knowledge about the usage of medicinal herbs than women did.

Chapter 5

5. Discussion, conclusion and recommendation

5.1 Discussion and Conclusion

Research conducted in this study showed that the Rai community in the Sub-Metropolitan city of Dharan is highly familiar with local medicinal plants. This study reveals great potential for new knowledge from documenting and scrutinizing information on ethnomedicine in Rai communities. This study provides various insights into the use of ethnomedicine in Rai communities and can be used to identify new medicinal sources, develop new drugs, and preserve traditional knowledge to improve public health. You will also gain valuable insight into the potential therapeutic properties of local medicinal plants and explore new avenues for healthcare research and development.

In addition, this study also identified some limitations and dark threats surrounding ethnic medicinal practitioner in Rai communities. In this study, we documented 73 medicinal plant species under 51 family. Similarly, 33 medicinal plants under 20 families were recorded by (Magar *et al.*, 2022) at Dharan sub-metropolitan city. The numbers seem a little low. Dharan is a large, modern city and one of the most developed cities in eastern Nepal. This is also one of the reasons for the low number of observed medicinal plants. The preference of modern allopathic medicines over traditional medicinal plants by the inhabitants of the urbanized Sub-Metropolitan city of Dharan is also a factor in the marked decline in the use of ethnobotanical medicinal plants in Dharan, as analyzed by (Magar *et al.*, 2022) too. Similarly, according to a 2011 report, 15,662 residents were absent from their households in the sub-major city of Dharan, accounting for 11.37 per cent of the total population. A total of 11,623 male absentees accounted for 17.97% of the total 64,671 male. Similarly, 4,039 women were absent, accounting for her 5.53 percent of the 73,034 women (Planning & Secretariat, 2012). Most of the absentees were working-class people employed abroad, and this further isolated young people from the elderly and experienced population, and as a result they knew nothing about medicinal plants in their region and its usage. Of course, if these practices are not rectified in time, it could lead to the disappearance of ethnomedicine in the Rai community of the Sub-Metropolitan city of Dharan. Strong political action to protect and promote medicinal

plants therefore appears to be the most urgent need at this time (Bhattarai, 2018, 2020; Dahal, 2016). Encouraging younger generations to use local medicinal plants for basic medicine and raising awareness of the sustainable use of medicinal plants among the local population will help protect ethnomedicinal knowledge (Bhattarai, 2018).

It is also considered important to protect intellectual property rights related to ethnomedicinal knowledge of the Rai community. This is the best way to ensure that knowledge about medicinal plants, their uses and other uses is preserved and that in the near future younger generations will be able to learn about medicinal plants. This makes the transfer of knowledge to the next generation smoother and more efficient. This also ensures royalty that will benefit the community for generations to come. Nonetheless, the knowledge gained from this study represents an important contribution to the understanding of ethno-medicinal plants in the Rai community of the Sub-Metropolitan city of Dharan, and may influence decision-making processes in many areas

5.2 Novelty and national prosperity aspect of the project

The outcome of this research includes elements of novelty and national prosperity that can have a significant impact on the success of various projects. Only 73 medicinal plants of the 51 family were recorded during the study, but they will undoubtedly provide a basis for future research. The current study is new as it may provide guidance for future researchers on ethno-medicinal plants in the Rai community. In terms of novelty, this study developed a unique approach covering the ethnomedicinal knowledge of plants used in Rai communities. This research also has great potential to attract a lot of interest, funding and support at the international level. This can lead to new cooperation and partnership opportunities that contribute to the development of new drugs, new job opportunities, and drive economic growth and medical research.

5.3 Limitation of the work

- Some plants could not be recognized due to language barrier.
- Older people were found to be conservative towards sharing of any information regarding beneficial medicinal herb.

5.4 Recommendation

The study found that the ethnomedical practices of the Rai community in the Sub-Metropolitan city of Dharan are under extreme strain. Therefore, there appears to be an urgent need for efficient and rigorous government policies to preserve and promote ethnomedicine practice in Rai communities.

Furthermore, although this study was conducted only in the sub-metropolitan city of Dharan, there are many more Rai communities, especially across eastern Nepal. Therefore, the urgent need for research and documentation for its preservation seems clear. Only if this is successful can the knowledge of ethnomedicinal plants be preserved and passed on to the next new generation. In addition to documentation, phytochemical and microbial test are essential to validate the ethnomedicine of Rai communities in a more scientific way.

REFERENCE

- Alexiades, M. N. (1996). Standard techniques for collecting and preparing herbarium specimens. *Advances in Economic Botany*, 10, 99–126.
- Alves, R. R., & Souto, W. M. (2011). Ethnobotany in Brazil: current status and perspectives. *Journal of Ethnobiology and Ethnomedicine*, 7(1), 22.
<https://doi.org/10.1186/1746-4269-7-22>
- Aththorick, T. A., & Berutu, L. (2018). Ethnobotanical study and phytochemical screening of medicinal plants on Karonese people from North Sumatra, Indonesia. *Journal of Physics: Conference Series*, 1116(5), 52008.
- Bailey, B. J. (1995). Tales of a Shaman's Apprentice: An Ethnobotanist Searches for New Medicines in the Amazon Rain Forest. *JAMA*, 273(4), 355–356.
<https://doi.org/10.1001/jama.1995.03520280103059>
- Bain, W. K. (2018). An Anthropological Venture into the Rai Community of Darjeeling Hills, West Bengal, India. *Heritage: Journal of Multidisciplinary Studies in Anthropology*, 6(June), 1039–1057.
- Balick, M. J. (2005). The Purposes and Teaching of Applied Ethnobotany. *Economic Botany*, 59(2), 200–201. [https://doi.org/10.1663/0013-0001\(2005\)059\[0200:tpatoa\]2.0.co;2](https://doi.org/10.1663/0013-0001(2005)059[0200:tpatoa]2.0.co;2)
- Balick, M. J., & Cox, P. A. (2020). *Plants, people, and culture: the science of ethnobotany*. Garland Science.
- Bhandary, H. R., & Shrestha, P. (1982). Ethnobotanical approach on the poisonous plants of Annapurna and Langtang Himal area. *J. Nat. His. Mus*, 6(4), 125–135.
- Bhattarai, K. R. (2018). Ethnobotanical study of plants used by Thami community in Ilam District, eastern Nepal. *Our Nature*, 16(1), 55–67.
- Bhattarai, K. R. (2020). Ethnobotanical survey on plants used in Mai Municipality of Ilam district, eastern Nepal. *Banko Janakari*, 30(2), 11–35.
<https://doi.org/10.3126/banko.v30i2.33476>
- Bhattarai, K. R., & Khadka, M. K. (2016). Ethnobotanical survey of medicinal plants from Ilam District, East Nepal. *Our Nature*, 14(1), 78–91.
- Bhattarai, K. R., Måren, I. E., & Chaudhary, R. P. (2013). Medicinal plant knowledge of the Panchase region in the Middle Hills of the Nepalese Himalayas. *Banko Janakari*, 21(2), 31–39. <https://doi.org/10.3126/banko.v21i2.9127>
- Budha-Magar, S., Bhandari, P., & Ghimire, S. K. (2020). Ethno-medicinal survey of

- plants used by Magar (Kham) community, Rolpa district, Western Nepal. *Ethnobotany Research and Applications*, 19, 1–29.
- Chaudhary, S. K., & Rai, S. K. (2017). Ethnobotany of Tharu community of Pakali, Sunsari, Nepal. *Nepalese Journal of Biosciences*, 7(1), 58–71. <https://doi.org/10.3126/njbs.v7i1.41767>
- Cunningham, A. B. (2001). *Applied ethnobotany: people, wild plant use and conservation*. Earthscan.
- Dahal, A. (2016). ETHNO BOTANICAL STUDY OF MEDICINAL PLANTS USED BY TRADITIONAL HEALERS IN THE MANAGEMENT OF DIABETES MELLITUS IN SANKHUWASABHA, NEPAL. *International Journal of Ayurveda and Pharma Research*.
- Dangol, D. R., & Gurung, S. B. (1991). Ethnobotany of the Tharu tribe of Chitwan district, Nepal. *International Journal of Pharmacognosy*, 29(3), 203–209.
- Das, B. D., Paudel, N., Paudel, M., Khadka, M. K., Dhakal, S., & Amrit, K. C. (2021). Ethnobotanical knowledge of Kewrat community of Morang district, eastern Nepal. *Ethnobotany Research and Applications*, 21, 1–11.
- District, R. (2009). Ethnobotanical Study of Medicinal Plants Used By Tharu Community of Parroha Vdc ., *Scientific World*, 7(7), 80–84.
- Dobremez, J. F. (1976). Exploitation and prospects of medicinal plants in eastern Nepal. *Mountain Environment and Development*, 97–107.
- Focho, D. A., Nkeng, E. A. P., Lucha, C. F., Ndam, W. T., & Afegenui, A. (2009). Ethnobotanical survey of plants used to treat diseases of the reproductive system and preliminary phytochemical screening of some species of Malvaceae in Ndog Central sub-division, Cameroon. *Journal of Medicinal Plants Research*, 3(4), 301–314.
- Gaoue, O. G., Coe, M. A., Bond, M., Hart, G., Seyler, B. C., & McMillen, H. (2017). Theories and Major Hypotheses in Ethnobotany. *Economic Botany*, 71(3), 269–287. <https://doi.org/10.1007/s12231-017-9389-8>
- Jain, S. K. (2010). *Manual of ethnobotany*. Scientific publishers.
- Jain, S. K., & Borthakur, S. K. (1980). Ethnobotany of the mikirs of India. *Economic Botany*, 34(3), 264–272. <https://doi.org/10.1007/BF02858646>
- Jones, G. E. (1994). Agricultural advisory work in England and Wales: The beginnings. *Agricultural Progress*, 69, 55–69.
- Kunwar, R. M., & Bussmann, R. W. (2008). Ethnobotany in the Nepal Himalaya.

- Journal of Ethnobiology and Ethnomedicine*, 4(1), 24.
<https://doi.org/10.1186/1746-4269-4-24>
- Magar, R. A., Mallik, A. R., Chaudhary, S., & Parajuli, S. (2022). Ethno-medicinal plants used by the people of Dharan, Eastern Nepal. *Indian Journal of Traditional Knowledge*, 21(1), 72–80.
- Manandhar, N. P. (1980). Some less known medicinal plants of Rasuwa district (Nepal). *Quarterly Journal of Crude Drug Research*, 18(3), 147–151.
- Manandhar, N. P. (1982). An ethnobotanical study of Nuwakot. *Proceedings of First National Science and Technology Congress*, 72–79.
- Manandhar, N. P. (1985). Ethnobotanical notes on certain medicinal plants used by Tharus of Dang-Deokhuri District, Nepal. *International Journal of Crude Drug Research*, 23(4), 153–159.
- Manandhar, N. P. (1986). Ethnobotany of Jumla District, Nepal. *International Journal of Crude Drug Research*, 24(2), 81–89.
- Milan, D. (2000). Ethnobotany of Aathpahariya Rai in and around Dhankuta Bazar-phase second. *Bio-Technology Applications for Reforestation and Biodiversity Conservation. Proceedings of the 8th International Workshop of BIO-REFOR, Kathmandu, Nepal, November 28-December 2, 1999*, 310–311.
- MoFSC. (2002). NEPAL BIODIVERSITY STRATEGY His Majesty ' s Government of Nepal Ministry of Forests and Soil Conservation. *Nature*, 1–117.
- National Statistical Office. (2014). *National Population and Housing Census 2011 ARGHAKHANCHI Government of Nepal National Planning Commission Secretariat. 01.*
- Pangeni, B., Bhattarai, S., Paudyal, H., & Chaudhary, R. P. (2020). Ethnobotanical Study of Magar Ethnic Community of Palpa District of Nepal. *Ethnobotany Research and Applications*, 20, 1–17. <https://doi.org/10.32859/era.20.44.1-17>
- Pei, S., Alan, H., & Wang, Y. (2020a). Vital roles for ethnobotany in conservation and sustainable development. *Plant Diversity*, 42(6), 399–400.
<https://doi.org/10.1016/j.pld.2020.12.001>
- Pei, S., Alan, H., & Wang, Y. (2020b). Vital roles for ethnobotany in conservation and sustainable development. *Plant Diversity*, 42(6), 399–400.
<https://doi.org/10.1016/j.pld.2020.12.001>
- Planning, N., & Secretariat, C. (2012). http://cbs.gov.np/image/data/Population/VDC-Municipality%20in%20detail/VDC_Municipality.pdf - Google Search. 02.

- https://www.google.com/search?q=http%3A%2F%2Fcbcs.gov.np%2Fimage%2Fdata%2FPopulation%2FVDC-Municipality%2520in%2520detail%2FVDC_Municipality.pdf&ie=utf-8&oe=utf-8&client=firefox-b-1
- Rahman, I. U., Afzal, A., Iqbal, Z., Ijaz, F., Ali, N., Shah, M., Ullah, S., & Bussmann, R. W. (2019). Historical perspectives of ethnobotany. *Clinics in Dermatology*, 37(4), 382–388. <https://doi.org/10.1016/j.clindermatol.2018.03.018>
- Rai, R., & Singh, N. B. (2015). Medico-ethnobiology in Rai Community: A Case Study from Baikunthe Village Development Committee, Bhojpur, Eastern Nepal. *Journal of Institute of Science and Technology*, 20(1), 127–132. <https://doi.org/10.3126/jist.v20i1.13935>
- Rajbanshi, N., & Thapa, L. B. (2019). Traditional knowledge and practices on utilizing medicinal plants by endangered Kisan ethnic group of eastern Nepal. *Ethnobotany Research and Applications*, 18, 1–9.
- Rijal, A. (2011). Surviving on Knowledge: Ethnobotany of Chepang community from mid-hills of Nepal. *Ethnobotany Research and Applications*, 9, 181–215.
- Sacherer, J. (1979). The high altitude ethnobotany of the Rolwaling Sherpas. *Contribution to Nepalese Studies*, 6(2), 45–64.
- Sharma, S., Bajracharya, R., & Sitaula, B. (2009). Indigenous technology knowledge in Nepal - A review. *Indian Journal of Traditional Knowledge*, 8(4), 569–576.
- Sheikh, N., Kumar, Y., Misra, A. K., & Pfoze, L. (2013). Phytochemical screening to validate the ethnobotanical importance of root tubers of Dioscorea species of Meghalaya, North East India. *Journal of Medicinal Plants*, 1(6), 62–69.
- Sherpa, N. S. (2005). Original : English UNITED NATIONS Division for Social Policy and Development Secretariat of the Permanent Forum on Indigenous Issues Panama City , 21-23 September 2005 Indigenous Peoples of Nepal and Traditional Knowledge Contribution by Ngwang Sonam Sher. *World, September*, 21–23.
- Sitaula, P. R. (2009). *Conservation and Utilization of Medicinal plants: Status and Economic Prospect in Community forests of Kavrepalanchowk district*. Department of Environmental Science.
- Srithi, K., Balslev, H., Wangpakapattanawong, P., Srisanga, P., & Trisonthi, C. (2009). Medicinal plant knowledge and its erosion among the Mien (Yao) in northern Thailand. *Journal of Ethnopharmacology*, 123(2), 335–342.
- Thapa, S. (2013). Medico-ethnobotany of Magar Community in Saliya VDC of Parbat

District, Central Nepal. *Our Nature*, 10(1), 176–190.

<https://doi.org/10.3126/on.v10i1.7780>

Toba, S. (1975). *Plant names in Khaling: a study in ethnobotany and village economy*.

Appendix i: Photo Plates



Photographs 1: Ethnobotanical Survey in Dharan 4



Photographs 2: Ethnobotanical Survey in Dharan 5



1

Photographs 3: A file photo with local resident during in-depth individual interview



Photographs 4: A file photo during in-depth individual interview in Dharan 13



Photographs 5: A file photo during in-depth interview with local resident



Photographs 6: A file photo during group discussion



Photographs 7: A file photo during in-depth individual interview



Photographs 8: A file photo during in-depth individual study



Photographs 9: A file photo during in-depth individual interview



Photographs 10: A file photo during an in-depth individual interview



Photographs 11: A file photo with traditional medicinal practitioner



Photographs 12: A file photo of group discussion with a traditional medicine practitioner

Appendix ii: Questionnaire

Questionnaire prepared for in-depth individual interview

- Before the beginning of questionnaire, individual's concerns and doubts were addressed. They were thoroughly explained about the study and those who were satisfied to respond were only interviewed.

➤ Name of respondent

.....

➤ Age/Sex

.....

➤ Occupation

.....

➤ Plant's being used locally for healing, which sources are MEK

i)

ii)

iii)

iv)

v)

vi)

➤ Plant specific Human ailment treatment

.....

➤ Life form of plants, Parts of plant used, mode of preparation (plant specific), mode of application

.....

.....

व्यक्तिगत प्रश्नोत्तर

नाम :

उमेर :

लिङ्ग :

ठेगाना :

पेशा/ व्यवसाय :

सम्पर्क नं.

१. तपाईले कति पढ्नु भएको छ ?

क. पढेको छैन

ख. आधारभूत शिक्षा (१-८)

ग. माध्यमिक तह (९-

१२)

घ. माध्यमिक तह भन्दा माथी

२. तपाईलाई जडिबुटी बारे केहि जानकारी छ ?

क.छ

ख. छैन

३. तपाईले जडीबुटी बारे जानकारी कहाँबाट प्राप्त गर्नुभयो ?

क. घरपरिवारको सदस्य

ख. छिमेकी

ग.किताब

घ. अन्य

४. तपाईको नजिक जडिबुटी कतिको पाईन्छ?

क. धेरै

ख. थोरै

ग. पाईदैन

५. तपाईले जडिबुटिको प्रयोग कतिको गर्नुहुन्छ ?

क. धेरै

ख. अलिअलि

ग. प्रयोग गर्दैन

६. तपाईले कुन कुन जडिबुटि र केका लागि प्रयोग गर्नुहुन्छ ?

क्र.स.	प्रयोग हुने जडिबुटिको नाम	प्रयोग हुने भाग	प्रयोग गर्ने तरिका/मात्रा	वर्गिकरण

वर्गिकरण: १. औषधिजन्य हिसाबले अति महत्वपूर्ण २. औषधिजन्य हिसाबले महत्वपूर्ण ३. औषधिजन्य हिसाबले ठिकै ४. व्यापारिक दृष्टिकोणले अति महत्वपूर्ण ५. व्यापारिक दृष्टिकोणले महत्वपूर्ण ६. व्यापारिक दृष्टिकोणले कम महत्वको

Focus Group Discussion

क्र.स.	सहभागीको नाम	ठेगाना	उमेर	लिङ्ग	पेशा/ व्यवसाय	सम्पर्क नं.

१. तपाईंले जडिबुटिको प्रयोग कतिको गर्नुहुन्छ ?

धेरै अलिअलि प्रयोग गर्दिन

२. तपाईंले कुन कुन जडिबुटि र केका लागि प्रयोग गर्नुहुन्छ ?

क्र.स.	प्रयोग हुने जडिबुटिको नाम	प्रयोग हुने भाग	प्रयोग गर्ने तरिका / मात्रा

३. तपाईंले जडिबुटि संकलन गर्नुहुन्छ ?

धेरै अलिअलि गर्दिन