DIVERSITY AND USES OF MEDICINAL PLANTS AMONG THE PEOPLE LIVING AROUND SAL FOREST, DINAJPUR

A THESIS

BY

MST. SANCHITA PARVIN

Registration No. 1805345

Session: 2018

Thesis Semester: July-December, 2019

MASTER OF SCIENCE (M.S.)
IN
AGROFORESTRY AND ENVIRONMENT

DEPARTMENT OF AGROFORESTRY AND ENVIRONMENT

HAJEE MOHAMMAD DANESH SCIENCE AND TECHNOLOGY UNIVERSITY, DINAJPUR

DECEMBER 2019

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Hajee Mohammad Danesh Science and Technology University, Dinajpur.
December 2019

Dedicated

To

My Beloved Parents And

Honorable Teachers

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ABSTRACT

A field survey was conducted among the people living around Birganj, Biral and Nawabganj Sal forests of Dinajpur district, Bangladesh to identify the diversity and uses of medicinal plants and to realize the local dependency and healthcare pattern. The field survey was undertaken from October 2018 to March 2019. A total of 100 informants between 15-75 years old were interviewed with a questionnaire. The independent variables of the study were age, occupation, sex, education, family size, income knowledge about medicinal plants, extinct medicinal plants, medicinal plants present in respondents house, the reason of choosing medicinal plants, source knowledge of medicinal plants and the dependent variable was dependency on medicinal plants. The overall results of the study revealed that the maximum number of respondents (30%) belonged to below 30 years old and the minimum number of respondents (4%) were older than 70 years old. Among them 66% male and 34% female. The educational status was found the maximum (35%) in both primary and secondary level and minimum (6%) was found as above secondary level. Among the occupational status, most of the respondents would like to do agricultural work (56%) whereas the lowest number of the respondents (1%) was under student category. The current investigation identified a total of 30 medicinal plant species used for different ailments. Among them Tulsi (*Ocimum tenuiflorum*), Basok (*Justicia adhatoda*), Gada ful (*Calendula officinalis*), Narikel (*Cocos nucifera*), Tetul (*Tamarindus indica*), Ada (*Zingiber officinale*), Neem (*Azadirachta indica*), Durba ghas (*Cynodon dactylon*), Thankuni (*Cissus quadrangularil*), Anaros (*Ananas sativus*) etc were popular and the people living around sal forests highly used these medicinal plants for the remedies of their ailments. Besides that the respondents also grew necessary medicinal plants in their house like Tulsi (*Ocimum tenuiflorum*), Gada ful (*Calendula officinalis*), Paan (*Piper betel*), Basok (*Justicia adhatoda*) etc. The survey results also showed that there was extinction of some medicinal plants, among them Ulot kombol (*Abroma augusta*) was highest (66%) in percentage for extinction. The research revealed that 61% respondents sought kaviraj for their disease treatment. The survey also showed that most of the people (46%) choose medicinal plants for their primary health care because of the effectiveness of the medicinal plant, 29% emphasized medicinal plants availability, 16% on low price and 9% of people's reasons for choosing medicinal plants are traditional uses. In case of knowledge on medicinal plants 32% had knowledge on the treatment of diseases using these medicinal plant inheritably, 32% had gathered knowledge from others, 22% sought kaviraj and 10% solve their problem by self-medication depends on many factors namely, individual responsibility for one's health, knowledge of health problems (influence of the mass media, medical literature for non-specialists). The study result revealed the most important thing that the majority of the people living around Sal forest, Dinajpur were highly dependent (60%) on medicinal plants for their healthcare and 40% people dependent on general medicine from visiting doctors for the treatment of their diseases. The study revealed that sal forest was a good source of medicinal plants for the people. Therefore threatened species should be conserved properly to restore the forest in its original state.

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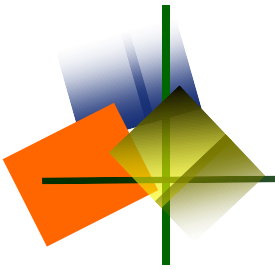

CHAPTER I

INTRODUCTION

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INTRODUCTION

A medicinal plant is a plant that is used with the intention of maintaining health, to be administered for a specific condition, or both, whether in modern medicine or in traditional medicine (Wikipedia, 2019). In medicinal plant one or more of its organ, contains substance that can be used for therapeutic purpose or which is a precursor for synthesis of useful drugs (WHO 2008). Millions of people throughout the world traditionally use medicinal plants for their primary health care since time immemorial (Mukul *et al.,* 2007). In fact, medicinal plants are readily available, environment friendly, cheap and without any side effects. These plants are easily and quickly available (Elliot *et al*., 1986). The global demand for natural medicine is now growing day by day as almost 80% of the human population in developing countries relies chiefly on traditional, largely natural medicine to meet their primary healthcare needs (Farnsworth *et al.,* 1985).

The sal forests of Bangladesh belong to the category of tropical moist or dry deciduous forest. In Bangladesh, it is one of the three major forest resources (other types are tropical evergreen and coastal forest), which covers about 32% of the forested land (Banglapedia, 2006). Sal (*Shorea robusta*, Dipterocarpaceae) is the dominant species of these forests, which are comprised of pure and mixed stands (Ismail and Mia 1973). These forests have a high economical and ecological significance in the central part of Bangladesh. Sal forests have also ethnic and cultural values in Bangladesh as ethnic communities (tribal people) live in these forests and, their livelihood and culture and health care pattern are directly related to the sal forest. In the northern region of Bangladesh, Sal forests is the only remaining natural forest which is seen in Birganj,

Nawabganj, Biral, Birampur upazilas of Dinajpur district and some parts of Thakurgaon and Panchagarh Districts.

Many people live in and around the Sal forest area including ethnic group like Saontal. They use medicinal plants from the forest for their urgent ailment. Plants grown in Sal forests are significant in rural economy for providing fodder, fuel, mat, thatching materials and fencing (Basu and Manna, 1997). Numerous other wild re-source species, e.g. orchids, bromeliads, an-thuriams, heliconias, bulbs, cacti and succulents are also available in the forests. Of these wild and semi-wild plant species, medicinal and aromatic plants have been used over the millennia for human welfare in the promotion of health and as drugs and fragrance materials. According to the World Health Organization (WHO), medicinal plants form the basis of traditional and indigenous health systems used by the majority of the population of most developing countries. In recent years, there has been a growth of interest in traditional medicine, in part driven by the interest in complementary medicine in industrial countries, and in part resulting from the interests of the international pharmaceutical industries. Modern pharmacopeia still contains at least 25% drugs derived from plants and many others which are synthetic analogues built on prototype compounds isolated from plants. China, India, Sri Lanka and a few other countries have officially recognized the use of traditional medicines in health care delivery systems. The system of Unani and Ayurvedic Medicine was also brought under the National Drug Policy of Bangladesh in 1982 to ensure availability, commercial manufacturing and marketing of quality Unani and Ayurvedic Medicine and Drugs (Ahsan *et al.,* 1997). In Bangladesh, the importance of medicinal plants needs no mention. Medicinal plants have been used in Bangladesh by a large number of industries and companies. Pharmaceutical companies use medicinal plant materials for the isolation of single purified drugs, e.g. digitoxin extracted from Digitalis, vincristine from

Catharanthus roseus, senna from *Cassia senna*. Ayurvedic and Unani companie (phytopharmaceuticals) use large number of medicinal plants species as traditional medicines since ancient times. Most im-portant medicinal plants are: *Terminalia arjuna*, *T. chebula, T. bellerica, Aegle marmelos, Withania somnifera, Cassia angustifolia, Saraca asoca*.

Even today, use of medicinal plants in primary health care systems is very important, especially in remote rural communities and poorly accessible areas. Collections of herbs from forest mainly by the poor are a livelihood activity and often a major source of cash in-come for these groups. Forest medicinal plants, therefore, play an invaluable role in the health services and the very livelihood of majority of the rural population. The system of Unani and Ayurvedic medicine was also brought under the National Drug Policy of Bangladesh in 1982 to ensure availability, commercial manufacturing and marketing of quality Unani and Ayurvedic Medicine and Drugs (Ahsan *et al.,* 1997). The loss of habitats and overharvesting has threatened the availability of the medicinal plants that will have a direct effect on the lives of poor people, particularly the poor women as they are directly involved with the management of daily household affairs relating to food, family health care and nutrition, treatment and income etc. If the situation continues unabated, the decline of diversity in medicinal plant genetic re-sources will undermine productivity in herbal medicines that will ultimately lead to irreversible biological loses and a high socio-economic price. So, immediate attention is most needed to save the medicinal and aromatic plant genetic resources in protected areas and regenerate and multiply them in farmers'/users' field to enhance biodiversity and to sustain and support the century old traditional medicinal heritage of Bangladesh.

Bangladesh being a country of this Indian sub continent also possess a great diversity in plants. Around two thousands medicinal plants in this sub continent and 449 medicinal

plants are enlisted in Bangladesh (Ghani A 1998). Though the exact number of used plants is unknown there are some common medicinal plants which are in use by kavirajes, traditional medicines for a long time. The linkage between biodiversity and human health is now well established (Bodeker, 2005). Our study is aimed to assess the diversity and use of medicinal plants among the people living around the Sal Forest, Dinajpur. Medicinal plant is very much related to our health culture. 80% populations of our country are directly or indirectly depends medicinal plant for health problem.

On the basis of our socio-economic and health sectors situation we should need a vast uses of medicinal plants. Many research works about medicinal plants have been done by many researchers (Thapa-Magar and Shrestha, 2015; Kushwaha and Nandy, 2012; Alam *et al.,* 2008; Uddin *et al.,* 2006). But few researches have been done in the sal forest of northern region of Bangladesh specially in Singra sal forest (Mukul *et al.,* 2016; Harun-ur-Rashid *et al.,* 2014). Therefore, the present work was an attempt to fulfill the following specific objectives:

Objectives

1. To identify the diversity of medicinal plants available in the Sal Forest area of Dinajpur.
2. To know the uses of medicinal plants among the people living around the Sal Forest against several diseases.
3. To realize the local dependency and health care pattern through the medicinal plants which are available in Sal forest area.

CHAPTER II

REVIEW OF LITERATURE

CHAPTER II

REVIEW OF LITERATURE

Review is a required part of grant of research works and often a chapter in thesis. The reviews of literature of the past studies related to the present experiment collected through reviewing of journals, thesis, internet browsing, reports, newspapers, periodicals and other form of publications are presented and discussed in this chapter.

2.1 Medicinal Plants

2.2 Cultivation of medicinal plants

2.3 Preparation of medicinal plants

2.4 Uses of medicinal plants

2.5 Effectiveness of medicinal plants

2.6 Regulation

2.7 Drug discovery

2.8 Safety

2.9 Quality, advertising, and labelling

2.10 Threats

2.11 Review on Medicinal Plants in Bangladesh

2.1 Medicinal Plants

Plants that enable therapeutic properties or favorable pharmacological effects on human body are generally designated as medicinal plants. When a plant is designated as ‘medicinal’, it is under stood that the said plant is necessary as a drug or therapeutic agent or an active ingredient of a medicinal preparation. Medicinal plants, also called medicinal herbs, have been discovered and used in traditional medicine practices since

prehistoric times. Plants synthesise hundreds of chemical compounds for functions including defence against insects, fungi, diseases, and herbivorous mammals. Numerous phytochemicals with potential or established biological activity have been identified. However, since a single plant contains widely diverse phytochemicals, the effects of using a whole plant as medicine are uncertain. Further, the phytochemical content and pharmacological actions, if any, of many plants having medicinal potential remain unassessed by rigorous scientific research to define efficacy and safety (Ahn, 2017).

The earliest historical records of herbs are found from the Sumerian civilization, where hundreds of medicinal plants including opium are listed on clay tablets. The Ebers Papyrus from ancient Egypt, c. 1550 BC, describes over 850 plant medicines. The Greek physician Dioscorides, who worked in the Roman army, documented over 1000 recipes for medicines using over 600 medicinal plants in *De materiamedica*, c. 60 AD; this formed the basis of pharmacopoeias for some 1500 years. Drug research makes use of ethnobotany to search for pharmacologically active substances in nature, and has in this way discovered hundreds of useful compounds. These include the common drugs aspirin, digoxin, quinine, and opium. The compounds found in plants are of many kinds, but most are in four major biochemical classes: alkaloids, glycosides, polyphenols, and terpenes.

Medicinal plants are widely used in non-industrialized societies, mainly because they are readily available and cheaper than modern medicines. The annual global export value of the thousands of types of plants with suspected medicinal properties was estimated to be US$2.2 billion in 2012. (*Traffic.org. Retrieved 20 February 2017*) In 2017, the potential global market for botanical extracts and medicines was estimated at several hundred billion dollars (Ahn, 2017).

In many countries, there is little regulation of traditional medicine, but the World Health Organization coordinates a network to encourage safe and rational usage. Medicinal plants face both general threats, such as climate change and habitat destruction, and the specific threat of over-collection to meet market demand (Ahn, 2017).

Prehistoric times

Plants, including many now used as culinary herbs and spices, have been used as medicines, not necessarily effectively, from prehistoric times. Spices have been used partly to counter food spoilage bacteria, especially in hot climates, (Tapsell *et al.,* 2006*;* Billing *et al.,* 1998) and especially in meat dishes which spoil more readily. (Sherman *et al.,* 2001) Angiosperms (flowering plants) were the original source of most plant medicines. Human settlements are often surrounded by weeds used as herbal medicines, such as nettle, dandelion and chickweed (Stepp *et al.,* 2001). Humans were not alone in using herbs as medicines: some animals such as non-human primates, monarch butterflies and sheep ingest medicinal plants when they are ill. (Sumner, 2000) Plant samples from prehistoric burial sites are among the lines of evidence that Paleolithic peoples had knowledge of herbal medicine. For instance, a 60 000-year-old Neanderthal burial site, "Shanidar IV", in northern Iraq has yielded large amounts of pollen from eight plant species, seven of which are used now as herbal remedies. (Solecki, 1975) A mushroom was found in the personal effects of *Ötzi the Iceman*, whose body was frozen in the Ötztal Alps for more than 5,000 years. The mushroom was probably used against whipworm. (Capasso, 1998).

Ancient times

In ancient Sumeria, hundreds of medicinal plants including myrrh and opium are listed on clay tablets. The ancient Egyptian Ebers Papyrus lists over 800 plant medicines such

as aloe, cannabis, castor bean, garlic, juniper, and mandrake (Sumner, 2000). From ancient times to the present, Ayurvedic medicine as documented in the Atharva Veda, the Rig Veda and the Sushruta Samhita has used hundreds of pharmacologically active herbs and spices such as turmeric, which contains curcumin (Aggarwal *et al.,* 2007; Girish *et al.,* 2007). The Chinese pharmacopoeia, the *Shennong Ben Cao Jing* records plant medicines such as chaulmoogra for leprosy, ephedra, and hemp (Sumner, 2000). This was expanded in the Tang Dynasty *Yaoxing Lun.* U and Wu, 2005) (In the fourth century BC, Aristotle's pupil Theophrastus wrote the first systematic botany text, *Historia plantarum*. (Grene, 2004) In around 60 AD, the Greek physician Pedanius Dioscorides, working for the Roman army, documented over 1000 recipes for medicines using over 600 medicinal plants in *De materia medica*. The book remained the authoritative reference on herbalism for over 1500 years, into the seventeenth century (Collins, 2000).

Middle Ages

In the Early Middle Ages, Benedictine monasteries preserved medical knowledge in Europe, translating and copying classical texts and maintaining herb gardens. (Arsdall and Anne, 2002; Mills and Frank, 2000) Hildegard of Bingen wrote *Causae et Curae* ("Causes and Cures") on medicine. (Ramos-e-Silva Marcia, 1999) In the Islamic Golden Age, scholars translated many classical Greek texts including Dioscorides into Arabic, adding their own commentaries. (Castleman and Michael, 2001). Herbalism flourished in the Islamic world, particularly in Baghdad and in Al-Andalus. Among many works on medicinal plants, Abulcasis (936–1013) of Cordoba wrote *The Book of Simples*, and Ibn al-Baitar (1197–1248) recorded hundreds of medicinal herbs such as *Aconitum*, nux vomica, and tamarind in his *Corpus of Simples*. (Castleman and Michael, 2001). Avicenna included many plants in his 1025 *The Canon of Medicine*. (Jacquart and

Danielle, 2008) Abu-Rayhan Biruni, (Kujundzić and Masić, 1999) Ibn Zuhr, (Krek, 1979) Peter of Spain, and John of St Amand wrote further pharmacopoeias (Brater and Daly, 2000).

Early Modern

The Early Modern period saw the flourishing of illustrated herbals across Europe, starting with the 1526 *Grete Herball*. John Gerard wrote his famous *The Herball or General History of Plants* in 1597, based on Rembert Dodoens, and Nicholas Culpeper published his *The English Physician Enlarged*. (*Singer and Charles*, 1923) Many new plant medicines arrived in Europe as products of Early Modern exploration and the resulting Columbian Exchange, in which livestock, crops and technologies were transferred between the Old World and the Americas in the 15th and 16th centuries. Medicinal herbs arriving in the Americas included garlic, ginger, and turmeric; coffee, tobacco and coca travelled in the other direction. (Nunn *et al.,* 2010; Heywood and Vernon, 2012) In Mexico, the sixteenth century *Badianus Manuscript* described medicinal plants available in Central America (Gimmel, 2008).

19th and 20th centurie

The place of plants in medicine was radically altered in the 19th century by the application of chemical analysis. Alkaloids were isolated from a succession of medicinal plants, starting with morphine from the poppy in 1806, and soon followed by ipecacuanha and strychnos in 1817, quinine from the cinchona tree, and then many others. As chemistry progressed, additional classes of pharmacologically active substances were discovered in medicinal plants. Commercial extraction of purified alkaloids including morphine from medicinal plants began at Merck in 1826. Synthesis of a substance first discovered in a medicinal plant began with salicylic acid in 1853.

Around the end of the 19th century, the mood of pharmacy turned against medicinal plants, as enzymes often modified the active ingredients when whole plants were dried, and alkaloids and glycosides purified from plant material started to be preferred. Drug discovery from plants continued to be important through the 20th century and into the 21st, with important anti-cancer drugs from yew and Madagascar periwinkle (Atanasov *et al.,* 2015).

2.2 Cultivation of medicinal plants

Medicinal plants demand intensive management. Different species each require their own distinct conditions of cultivation. The World Health Organization recommends the use of rotation to minimise problems with pests and plant diseases. Cultivation may be traditional or may make use of conservation agriculture practices to maintain organic matter in the soil and to conserve water, for example with no-till farming systems (WHO, 2003). In many medicinal and aromatic plants, plant characteristics vary widely with soil type and cropping strategy, so care is required to obtain satisfactory yields.

2.3 Preparation of medicinal plants

Medicinal plants are often tough and fibrous, requiring some form of preparation to make them convenient to administer. According to the Institute for Traditional Medicine, common methods for the preparation of herbal medicines include decoction, powdering, and extraction with alcohol, in each case yielding a mixture of substances. Decoction involves crushing and then boiling the plant material in water to produce a liquid extract. Powdering involves drying the plant material and then crushing it to yield a powder that can be compressed into tablets. Alcohol extraction involves soaking the plant material in cold wine or distilled spirit to form a tincture. (Dharmananda, 1997).

Traditional poultices were made by boiling medicinal plants, wrapping them in a cloth, and applying the resulting parcel externally to the affected part of the body (Mount, 2015).

When modern medicine has identified a drug in a medicinal plant, commercial quantities of the drug may either be synthesized or extracted from plant material, yielding a pure chemical. Extraction can be practical when the compound in question is complex (Pezzuto, 1997).

2.4 Uses of medicinal plants

Plant medicines are in wide use around the world. In most of the developing world, especially in rural areas, local traditional medicine, including herbalism, is the only source of health care for people, while in the developed world, alternative medicine including use of dietary supplements is marketed aggressively using the claims of traditional medicine. As of 2015, most products made from medicinal plants had not been tested for their safety and efficacy, and products that were marketed in developed economies and provided in the undeveloped world by traditional healers were of uneven quality, sometimes containing dangerous contaminants (Chan, 2015). Traditional Chinese medicine makes use of a wide variety of plants, among other materials and techniques. Researchers from Kew Gardens found 104 species used for diabetes in Central America, of which seven had been identified in at least three separate studies (Giovannini *et al.,* 2017). The Yanomami of the Brazilian Amazon, assisted by researchers, have described 101 plant species used for traditional medicines (Milliken, 2015).

Drugs derived from plants including opiates, cocaine and cannabis have both medical and recreational uses. Different countries have at various times made use of illegal drugs, partly on the basis of the risks involved in taking psychoactive drugs.

2.5 Effectiveness of medicinal plants

The bark of the cinchona tree (*Cinchona officinalis*) contains the alkaloid quinine, traditionally given for malaria. Plant medicines have often not been tested systematically, but have come into use informally over the centuries. By 2007, clinical trials had demonstrated potentially useful activity in nearly 16% of herbal medicines; there was limited in vitro or in vivo evidence for roughly half the medicines; there was only phytochemical evidence for around 20%; 0.5% were allergenic or toxic; and some 12% had basically never been studied scientifically (Cravotto *et al.,* 2010). Cancer Research UK caution that there is no reliable evidence for the effectiveness of herbal remedies for cancer.

A 2012 phylogenetic study built a family tree down to genus level using 20,000 species to compare the medicinal plants of three regions, Nepal, New Zealand and the South African Cape. It discovered that the species used traditionally to treat the same types of condition belonged to the same groups of plants in all three regions, giving a "strong phylogenetic signal". Since many plants that yield pharmaceutical drugs belong to just these groups, and the groups were independently used in three different world regions, the results were taken to mean 1) that these plant groups do have potential for medicinal efficacy, 2) that undefined pharmacological activity is associated with use in traditional medicine, and 3) that the use of a phylogenetic groups for medicines in one region may predict their use in the other regions.

2.6 Regulation

The World Health Organization (WHO) has been coordinating a network called the International Regulatory Cooperation for Herbal Medicines to try to improve the quality of medical products made from medicinal plants and the claims made for them. (World Health Organization. Retrieved 2 October 2017). In 2015, only around 20% of countries had well-functioning regulatory agencies, while 30% had none, and around half had limited regulatory capacity. In India, where Ayurveda has been practiced for centuries, herbal remedies are the responsibility of a government department, AYUSH, under the Ministry of Health and Family Welfare (Kala and Sajwan, 2007).

WHO has set out a strategy for traditional medicines (WHO, 2003) with four objectives: to integrate them as policy into national healthcare systems; to provide knowledge and guidance on their safety, efficacy, and quality; to increase their availability and affordability; and to promote their rational, therapeutically sound usage. (WHO, 2003) WHO notes in the strategy that countries are experiencing seven challenges to such implementation, namely in developing and enforcing policy; in integration; in safety and quality, especially in assessment of products and qualification of practitioners; in controlling advertising; in research and development; in education and training; and in the sharing of information (WHO, 2003).

2.7 Drug discovery

The pharmaceutical industry has roots in the apothecary shops of Europe in the 1800s, where pharmacists provided local traditional medicines to customers, which included extracts like morphine, quinine, and strychnine. Therapeutically important drugs like camptothecin (from *Camptotheca acuminata*, used in traditional Chinese medicine) and taxol (from the Pacific yew, *Taxus brevifolia*) were derived from medicinal plants. The

Vinca alkaloids vincristine and vinblastine, used as anti-cancer drugs, were discovered in the 1950s from the Madagascar periwinkle, *Catharanthus roseus*.

Hundreds of compounds have been identified using ethnobotany, investigating plants used by indigenous peoples for possible medical applications. Some important phytochemicals, including curcumin, epigallocatechin gallate, genistein and resveratrol are pan-assay interference compounds, meaning that in vitro studies of their activity often provide unreliable data. As a result, phytochemicals have frequently proven unsuitable as lead compounds in drug discovery. (Baell and Walters, 2014; Dahlin *et al.,* 2014). In the United States over the period 1999 to 2012, despite several hundred applications for new drug status, only two botanical drug candidates had sufficient evidence of medicinal value to be approved by the Food and Drug Administration

The pharmaceutical industry has remained interested in mining traditional uses of medicinal plants in its drug discovery efforts. Of the 1073 small-molecule drugs approved in the period 1981 to 2010, over half were either directly derived from or inspired by natural substances (Newman and Cragg, 2012).

2.8 Safety

Plant medicines can cause adverse effects and even death, whether by side-effects of their active substances, by adulteration or contamination, by overdose, or by inappropriate prescription. Many such effects are known, while others remain to be explored scientifically. There is no reason to presume that because a product comes from nature it must be safe: the existence of powerful natural poisons like atropine and nicotine shows this to be untrue. Further, the high standards applied to conventional medicines do not always apply to plant medicines, and dose can vary widely depending

on the growth conditions of plants: older plants may be much more toxic than young ones, for instance. (Pinn *et al.,* 2001).

Pharmacologically active plant extracts can interact with conventional drugs, both because they may provide an increased dose of similar compounds, and because some phytochemicals interfere with the body's systems that metabolise drugs in the liver including the cytochrome_P450 system, making the drugs last longer in the body and have a more powerful cumulative effect. Plant medicines can be dangerous during pregnancy (Born and Barron, 2005). Since plants may contain many different substances, plant extracts may have complex effects on the human body.

2.9 Quality, advertising, and labelling

Herbal medicine and dietary supplement products have been criticized as not having sufficient standards or scientific evidence to confirm their contents, safety, and presumed efficacy. A 2013 study found that one-third of herbal products sampled contained no trace of the herb listed on the label, and other products were adulterated with unlisted fillers including potential allergens.

2.10 Threats

Where medicinal plants are harvested from the wild rather than cultivated, they are subject to both general and specific threats. General threats include climate change and habitat loss to development and agriculture. A specific threat is over-collection to meet rising demand for medicines. (Kling, 2016) A case in point was the pressure on wild populations of the Pacific yew soon after news of taxol's effectiveness became public. The threat from over-collection could be addressed by cultivation of some medicinal plants, or by a system of certification to make wild harvesting sustainable.

2.11 Review on Medicinal Plants in Bangladesh

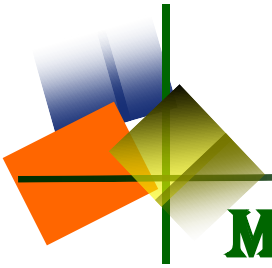
Mukul *et al*. (2007) reported that the area is very rich in medicinal plants and peoples living in and proximity of the conservation area relies traditionally on these plants for their primary health care purpose. During the study a total of 40 species were identified having medicinal or curative value, including 15 tree, 11 shrub, 11 herb and 3 climbers. Among the identified MPs, local people's traditionally collected 60% species from the wild sources (i.e. from the conservation area) followed by cultivated (13%) and domestic (7%) sources. It was also observed that, local people used the identified MPs mostly for curing cold ailments followed by cough, cut and wounds, fever, dysentery, skin diseases and for other common ailments. Leaves were found to use heavily for medicinal preparations; other plant parts used to manufacture medicine were bark followed by fruit, root/rhizome, seed and whole plant.

Khatun and Rahman (2019) found that a total of 105 plant species under 97 genera belonging to 57 families were recorded which are used by the Santals for the treatment of 67 ailments. Out of these plant species 44% belonged to herbs, 28% trees, 18% shrubs, 10% climbers. In herbal formulations, leaves were found to be mostly used (29%) followed by roots (12%), fruits (12%), whole plant (10%), seeds (9%), barks (9%), stems (5%), flowers (4%), latex (2%), rhizomes (2%), petioles (2%), gums (2%), bulbs (1%), tubers (1%), pods (1%) and buds (1%). The Santal medicinal wealth have been presented with scientific name, family, Bangla name, Santal name, part(s) used, ailments to be treated and formulations. This study also provides data on diversity, distribution and habitats for conservation and prioritization of the medicinal plants

Asraf *et al*. (2014) reported that medicinal plants include a various types of plants used in herbalism with medicinal activities. These plants are considered as rich resources of

ingredients which can be used as complementary and alternative medicines and, also in drug developments and synthesis. In addition, some plants regarded as valuable origin of nutrition. Thus, all these plants are recommended as therapeutic agents. Information related to medicinal plants and herbal drugs accumulated over the ages are scattered and unstructured which make it prudent to develop a curated database for medicinal plants. MPDB 1.0 database is dedicated to provide the first window to find the plants around Bangladesh claimed to have medicinal and/or nutritive values by accumulating data from the published literatures. This database contains 406 medicinal plants with their corresponding scientific, family and local names as well as utilized parts for treatment from different districts of Bangladesh. Information regarding ailments is available for 353 plants. In addition, we have found active compounds for 78 plants with their corresponding PubMed ID.

Haque *et al*. (2014) reported that the Kavirajes of the 11 villages surveyed used a total of 55 plants distributed into 35 families in their formulations. The Mimoceseae family provided 4 plants, while the Acanthaceae, Liliaceae, Lamiaceae and Fabaceae families provided 3 plants each. Mainly leaves were used for this purpose. Other plant parts roots and stems were also used. The various ailments treated included gastrointestinal disorders, cuts and wounds, fever, respiratory tract disorders, snake bites, pain, menstrual problems, physical weakness, diabetes, mental disorders, cardiovascular disorders, skin disorders, chicken pox, burns, spermatorrhea, bone fractures and cattle ailments.



CHAPTER III

MATERIALS AND METHODS

CHAPTER III

MATERIALS AND METDODS

In any research paper, methodology plays an important role. Appropriate methodology enables the researcher to collect valid and reliable information and to analyze the information properly in order to arrive at valid conclusion. In this section the materials and methods have been presented which include brief description of location of the study area, materials used and methodology followed in the study. The details of this sections are described below.

3.1 Study Area

The experiment has been conducted in and around the people living near Singra (Birganj) Nawabganj and Biral Sal forest of Dinajpur, Bangladesh.

The total area of Singra Sal forest is 355 ha and almost whole area was declared as National Park (305.69 ha) in 2010 (Source: Forest Department of Dinajpur). In this forest mainly decidous Sal (*Shorea robusta*) is the main species. Other associates are different types of trees, herbs, shrubs including medicinal plants. Many people live in and around the forest area including ethnic group like Saontal. They use medicinal plants from the forest for their urgent ailment.

Nawabganj is located at 25.4167°N 89.0833°E. It has 34999 households and total area 314.68 km². Dighipara, a village of Nawabganj Upazila: 60 Thousand metric tonnes of coal are stored. Nawabganj has 9 Unions/Wards, 212 Mauzas/Mahallas, and 271 villages. A well balanced ecosystem in the 517.61 hectare Ashorar Bill and Shal forests is a tourist attraction. It includes a unique canal system and a 3–4 km region with ambient atmosphere. Guest birds are available year-round. It was declared as National forest under the Name "Nawabganj National Forest" at 24/10/2010 by the People's Republic of Bangladesh.

Biral sal forest in Dinajpur which lies in the north-western part of Bangladesh (88° 42'-89° E, 25° 18'N-25° 29'N). The forest covers 1104.5 ha. The annual rainfall is 1726 mm throughout the area. Sal is the main species in Biral. It is mostly of coppice origin and comprises about 96%of the total tree population with 1353 trees per hectare. To satisfy the objectives of the present study a total of 100 houses near Singra (Birganj) Nawabganj and Biral Sal forest were selected for intensive survey.

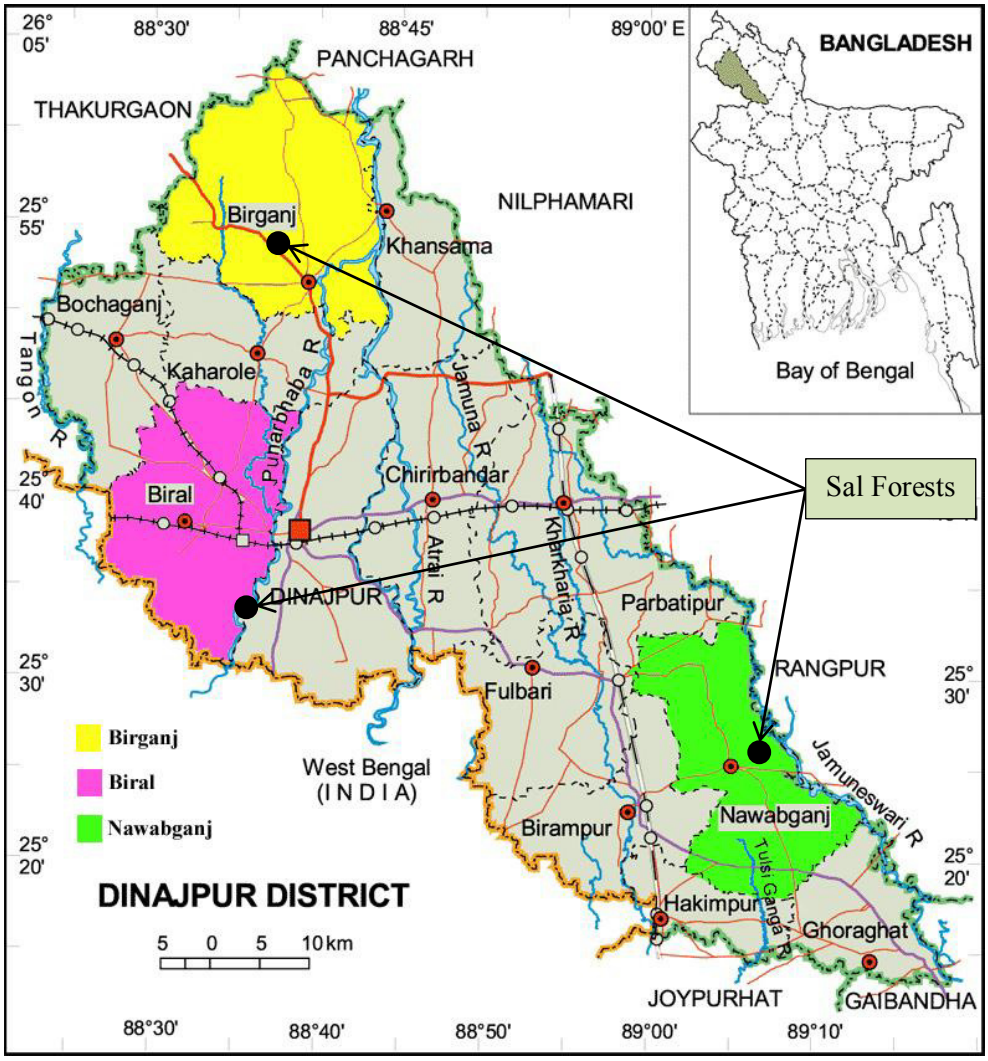


Figure 3.1.1: GIS map of study area

3.2 Time of data collection

The extensive survey has been conducted during the period of October 2018 to March 2019. Data has been collected from the respondents through a personal interview by using a questionnaire. The qualitative data were converted into quantitative by means of suitable scoring techniques.

3.3 Sampling procedure

Random sampling has been applied to select the sampling size. A sample of 100 people was selected, twenty two (22) from Birganj (Singra sal forest), twenty eight (28) from Nawabganj and fifty (50) from Biral Sal Forest.

Table-3.3.1: Distribution of population and sample size in the study area

Location	No. of respondents selected for data collection
Birganj (Singra sal forest)	22
Nawabganj sal forest	28
Biral sal forest	50
Total	100

3.4 Questionnaire Preparation

The information that has been included in the questionnaire were personal and family information, known medicinal plants, medicinal plants present in past but not now, medicinal plants present in homestead, used medicinal plants, the reason of choosing medicinal plants, source knowledge of medicinal plants and dependency on medicinal plants, etc. Both open and close ended questions were included in the questionnaire.

The questionnaire was translated in Bengali for clarification to the respondents. The questionnaires were pre-tested in actual field situations before using the same for the final collection of data of the study area. Necessary correction, additions and alternations were made in the questionnaire on the basis of results of the pre-test

3.5 Data collection method

3.5.1 Primary data collection

Primary data has been collected from the local people using both formal and informal interviews with the households' owner, kaviraj (local herbal medical practitioner), forest officials and other key informants through a questionnaire. Informal discussions with various classes of people and direct field visits have also been done.

3.5.2 Secondary data collection

Secondary data has been collected from published journals, books, official records, etc.

3.5.3 Variables of the study

Independent variables

Independent variables were age, occupation, sex, education, family size, income, known medicinal plants, medicinal plants present in past but not now, medicinal plants present in respondent’s homestead, the reason of choosing medicinal plants, source of knowledge of medicinal plants

Dependent variables

The dependent variables of the study were the dependency on medicinal plants and, dependency on kaviraj.

3.6 Measurement of independent variables

3.6.1 Age

The age of the respondents was measured in terms of years from his birth to the time of the interview.

3.6.2 Sex

The sex type of respondents was also mentioned in the questionnaire.

3.6.3 Family size

The family size of a respondent measured in terms of the number of members in his family including children, wife, parents etc. The actual number of family members of a respondent was considered as his family size scored.

3.6.4 Level of education

The level of education of respondents was measured by the years of schooling he or she completed

3.6.5 Occupation

Different ty known medicinal plants pes of incoming sources of the respondents were measured in the study area.

3.6.6 Annual income

This variable was measured by the total income earned by a respondent's family from agricultural and non-agricultural sources.

3.6.7 Known medicinal plants

It refers to the respondent's knowledge about the medicinal plants through their experience.

3.6.8 Extinct Medicinal Plant

The lost medicinal plants were measured in terms of the respondent's opinion.

3.6.9 Medicinal plants present in the respondent's homestead

The medicinal plants that were present in the respondent's homestead were also measured.

3.6.10 Reason of choosing medicinal plants

The reason of choosing medicinal plants was measured in terms of the respondent's opinion

3.6.11 Source of knowledge of medicinal plants

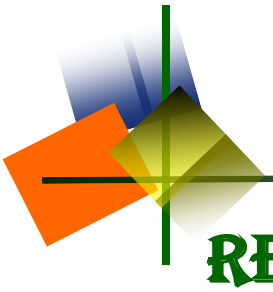
The source of knowledge of medicinal plants on the basis o of the respondent's opinion.

3.7 Measurement of dependent variables

Before selecting the dependent variables the researcher reviewed available books, journals, research reports etc. He also discussed with the resource persons in this area for a better understanding of the dependent variables. The dependent variables were the dependency on medicinal plants and dependency on kaviraJ. Those were measured in number.

3.8 Data processing and analysis

The collected data were coded, tabulated and analyzed according to the objectives of the study. Local units of measurement were converted into standard units. The responses to the question in the questionnaire were transferred to a master sheet to facilitate tabulation. The data were entered into the computer by using the SPSS package program. On the basis of farm size, the data were classified and presented in tabular form. In addition, graphs and tables were also used to interpret the findings.



CHAPTER IV

RESULTS AND DISCUSSION

CHAPTER IV

RESULTS AND DISCUSSION

The findings of the study and discussion of the results have been presented in this chapter. These are presented in five sub-sections according to the objectives of the objectives.

4.1 Age of the respondent

An individual's age is one of the most important factors pertaining to his personality makeup, science his need and the way in which he thinks and behaves are all closely related to the number of years he has lived. It is a norm in Bangladeshi traditional cultures that people respect the elder people, seek advice from them and obey their decisions. The elders are important in many ways they have long experience in many spheres of life. The age of the respondents ranged from below 30 to older than 70. There are 6 categories of the respondents one the basis of their age, these were below 30, 31-40, 41-50, 51-60, 61-70 and older than 70 years old. Age group, percent, mean and standard deviation of the respondents are shown in Table-4.1.1 The mean value of the respondents was found 2.58 years with standard deviation 1.49. The result was showed that category below 30 years old represents the highest (30%) in percentage and the category older than 70 years old showed the lowest (4%) in percentage.

Table-4.1.1 Age of the respondent

Age group (Years)	Respondents (%)	Mean	Standard Deviation
Below 30	30.0	2.58	1.492
31-40	28.0		
41-50	14.0		
51-60	14.0		
61-70	10.0		
Older than 70	4.0		
Total	100		

4.2 Sexual status of respondents

Gender identity (or core gender identity) has been defined as a person's basic sense of self as a male or female (Stoller, 1964a). Because most males have a male gender identity and most females have a female gender identity (in accordance with one's original legal sex and usually based on the appearance of the genitalia at birth), gender identity often is conceptualized in a bipolar, dichotomous manner with a male gender identity at one pole and a female gender identity at the other pole. For collecting data respondents were taken by distributing sex. The study showed that the percentage of respondents by male and female was 66% and 34%, respectively. The sexual status of the respondents is graphically represented at figure 4.2.1.

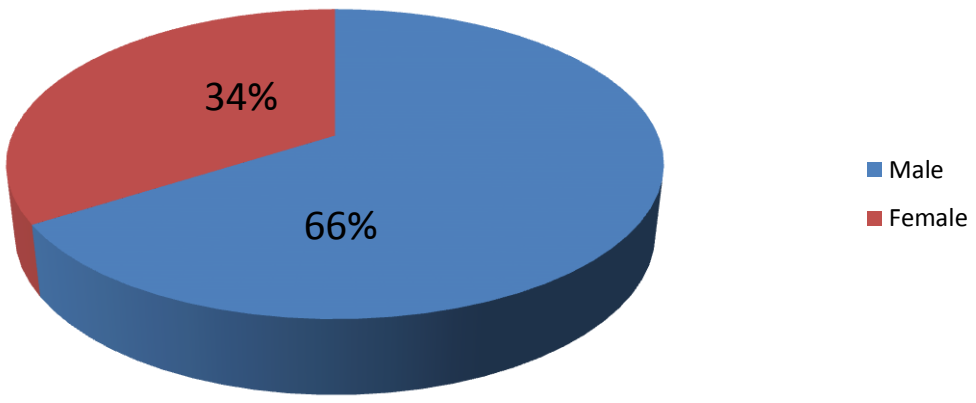


Figure 4.2.1: Sexual status of respondents

4.3 Family size of the respondents

Category of family size, percent, range, mean and standard deviation of the respondents are shown in table-4.3.1. The study showed family occupying 5 members was highest (27%) in percentage and family occupying 9 and 14 members were lowest (1%) in percentage. The mean and standard deviation were 5.9 and 1.84, respectively. Becker (1991) as expatiated in www.hhs.gov (2005) shows that family size is an important determinant of whether a family or individual is in poverty because the official poverty measure incorporates family size. Family size depends on the family income cost of children, wages, government transfers and preferences.

Table 4.3.1: Distribution of respondents according to their family size

Family Size	Respondents (%)	Mean	Standard Deviation
3.00	5.0	5.91	1.84
4.00	16.8		
5.00	26.7		
6.00	16.8		
7.00	13.9		
8.00	14.9		
9.00	1.0		
10.00	3.0		
14.00	1.0		
Total	100		

4.4 Level of education

Education is one of the basic needs for human development and to escape from poverty' (Sivakumar and Sarvalingam, 2010), it is necessary for national development and prosperous society. According to Rahman and Uddin (2009) education is the responsibility of the government and should be managed through national resources. Furthermore, higher education is important for social and economic impacts in society (Brennan and Teichler, 2008). The educational level of the respondents ranged from 0-16 (Illiterate to graduate level). There were 4 (four) categories of level of education in the study area. These were illiterate(00), primary level (1-5), secondary level (6-10), above the secondary level(>10). The category of respondents, percent, mean, standard deviation is shown in table-4.4.1. The mean was 2.23 and the standard deviation was 0.886. The result was shown that the higher secondary level category was the lowest (6%) in percentage and the primary and secondary level was the highest (35%) in percentage, while the illiterate respondents percentage was 24%.

Table-4.4.1: Distribution of respondents according to their level of education.

Education	Percent	Mean	Standard Deviation
Illiterate(00)	24.0	2.23	0.886
Primary level(1-5)	35.0		
Secondary level(6-10)	35.0		
Above secondary(>10)	6.0		
Total	100		

4.5 Occupation of the respondents

Occupational status is very important on which peoples livelihood is depend. The source of income. The occupational categories, percent, mean and standard deviation of the respondents are shown in table-4.5.1. The mean and standard deviation were 2.06 and 1.57. There were 7 categories of the respondent's occupation. The results were indicated that agriculture was the highest portion (56%), while business, housewife, labor, student, service and other categories were 15%, 15%, 5%, 1%, 6% and 2%, respectively.

Table-4.5.1: Distribution of respondents according to their occupational status

Occupation	Respondents (%)	Mean	Std. Deviation
Agriculture	56.0	2.06	1.575
Business	15.0		
Housewife	15.0		
Labor	5.0		
Student	1.0		
Service	6.0		
Others	2.0		
Total	100		

4.6 Annual income

The annual income of the respondents was categorized into 6 categories. The categories, percent, mean and standard deviation of the annual income of the respondents are shown in table-4.6.1. The mean and standard deviation of the respondent's annual income were 3.18 and 1.28, respectively. The results also indicated that income below to equal to

30000 Tk is the lowest (5%) in percentage on the other hand income 130100-180000tk is the highest (27%) in percentage.

Table-4.6.1: Distribution of respondents according to their annual income.

Annual income (Tk)	Respondents (%)	Mean	Standard Deviation
≤ 30000	5.0	3.18	1.28
30100-80000	33.0		
80100-130000	21.0		
130100-180000	27.0		
180100-230000	8.0		
Above 230000	6.0		
Total	100		

4.7 Knowledge about medicinal plants

Patterns of medicinal plant use by local peoples are considered to vary as a function of plant habitat collection, cultural changes and ecological and biochemical aspects (Stepp and Moerman, 2001). Various varieties of medicinal plants have been observed in Dinajpur Sal Forest. Medicinal plants have provided mankind a large variety of potent drugs to alleviate or eradicate infections and suffering from diseases in spite of advancements in synthetic drugs, some of the plant-derived drugs still retained their importance and relevance. The use of plant-based drugs all over the world is increasing (Bhat, 1995) There have been recorded about 30 medicinal plants on the basis of the opinion of the respondents. The respondents have knowledge about these 30 medicinal plants and their uses for the treatment of diseases. Name of the medicinal plants, knowledge of the respondent in percent, mean and standard deviation are presented in

table-4.7.1. The results were shown that about 85% (highest) respondent have knowledge about Tulsi (*Ocimum tenuiflorum*) which mean and standards deviation were 0.85 and 0.359 respectively, while 3% (lowest) have knowledge about Harjora (*Cissus quadrangularil*) which mean and standard deviation were 0.03 and 0.171, respectively.

Table 4.7.1: Distribution of respondents according to their knowledge about medicinal plants

Medicinal plant species	Knowledge of the respondents (%)	Mean	Standard Deviation
Basok (*Justicia adhatoda*)	80.0	0.80	0.402
Thankuni (*Centella asiatica*)	61.0	0.61	0.490
Anaros (*Ananas sativus*)	60.0	0.60	0.492
Arjun (*Terminalia arjuna*)	53.0	0.53	0.501
Shorno lota (*Cuscuta reflexa*)	19.0	0.19	0.394
Khoyer (*Acacia catechu*)	16.0	0.16	0.368
Tetul *(Tamarindus indica*)	69.0	0.69	0.464
Tokma (*Hyptis suaveolens*)	5.0	0.05	0.219
Tulsi (*Ocimum tenuiflorum*)	85.0	0.85	0.359
Daruchini (*Cinnamomu mverum*)	4.0	0.04	0.197
Ulot kombol (*Abroma augusta*)	9.0	0.09	0.287
Neem (*Azadirachta indica*)	66.0	0.66	0.476
Bel (*Aegle marmelos*)	11.0	0.11	0.314
Harjora (*Cissus quadrangularil*)	3.0	0.03	0.171
Durba ghas (*Cynodon dactylon*)	63.0	0.63	0.485
Ada (*Zingiber officinale*)	67.0	0.67	0.472
Ghritokumari (*Aloe barbadensis*)	5.0	0.05	0.219
Kalomegh *(Andrograph paniculata*)	47.0	0.47	0.502
Gada ful (*Calendula officinalis*)	71.0	0.71	0.456
Narikel (*Cocos nucifera*)	70.0	0.70	0.461
Dhutura (*Datura metel*)	11.0	0.11	0.314

Chalta (*Dillenia indica*)	12.0	0.12	0.327
Gab (*Diospyros peregrina*)	9.0	0.09	0.288
Jaba (*Hibiscus rosasinensis*)	23.0	0.23	0.423
Paan (*Piper betel*)	63.0	0.72	0.965
Amloki (*Phyllanthus emblica*)	23.0	0.23	0.423
Horitoki (*Terminalia chebula.*)	32.0	0.32	0.469
Bohera (*Terminalia belerica*)	37.0	0.37	0.485
Shatamull (*Asparagus racemosus*)	29.0	0.29	0.456
Akanda (*Calotropis gigantean*)	21.0	0.21	0.409

4.8 Medicinal plants present in respondents house

People have always used medicinal plants for various purposes and the tradition has been passed down from generation to generation. Treatment with medicinal plants is considered very safe as there are no or minimal side effects. The cultivation of medicinal plants requires intensive care and management. Most people like to grow medicinal plants such as Tulsi (*Ocimum tenuiflorum*), Thankuni (*Centella asiatica*), Basok (*Justicia adhatoda* L), Neem (*Azadirachta indica*), Gada ful (*Calendula officinalis*), Ada (*Zingiber officinale*), Amloki (*Phyllanthus emblica*) etc. in their homestead to cure several common ailments. These are considered as home remedies in many parts of Bangladesh. The name of the medicinal plants present in respondents houses, their percent, mean and standard deviation are shown in table-4.8.1. Among these medicinal plants Tulsi (*Ocimum tenuiflorum* 56%) was present most of the respondents house which mean and standard deviation were 0.56 and 0.499.

Table 4.8.1: Distribution of respondents on the basis of the medicinal plants present in their house

Medicinal plants	Respondents (%)	Mean	Std. Deviation
Basok (*Justicia adhatoda*)	16.0	0.1600	0.368
Thankuni (*Centella asiatica*)	11.0	0.1100	0.314
Arjun (*Terminalia arjuna*)	10.0	0.1000	0.301
Tulsi (*Ocimum tenuiflorum*)	56.0	0.5600	0.499
Neem (*Azadirachta indica*)	12.0	0.1200	0.327
Ada (*Zingiber officinale*)	12.0	0.1200	0.327
Gada ful (*Calendula officinalis*)	18.0	0.1800	0.386
Narikel (*Cocos nucifera*)	15.0	0.1500	0.359
Chalta (*Dillenia indica*)	3.0	0.0300	0.171
Jaba (*Hibiscus rosasinensis*)	16.0	0.1600	0.368
Paan (*Piper betel*)	17.0	0.1700	0.378
Amloki (*Phyllanthus emblica*)	6.0	0.0600	0.239

4.9 Extinct medicinal plants from the sal forest

The medical plant is an important wealth in our country. From long ago medicinal plants assails their leaf, stem, root, fruit, etc. are used to protect desire. But with the much destructing of the forest, they are also destroyed. According to the scientist, many of them are already extinct. Once there was a lot of medicinal plant in our country. But almost 50% of them are extinct for the lack of proper conservation policy and scientific used. Below the list of nearly extinct medicinal plants in the sal forest, Dinajpur is mentioned. To save the diversity of medicinal plants is to save ourselves. First, we have to save the medicinal plant, and then we can proceed to the development our health

situation. The extinct medicinal plants from Dinajpur Sal Forest, their percent, the mean and standard deviation on the basis of respondent's opinions are shown in table-4.9.1. Among these medicinal plants extinction of *Abroma augusta* (66%) is high which mean and standard deviation were 0.66 and 0.476 while *Acacia catechu* (40%), *Terminalia arjuna* (43%), *Hyptis suaveolens* (63%), *Cissus quadrangularil* (61%), *Asparagus racemosus* (65%), *Calotropis gigantean* (35%) are also going to extinct.

Table 4.9.1: Distribution of respondents according to the extinct medicinal plants from the sal forest

Extinct medicinal plants	Respondents (%)	Mean	Std. Deviation
Ulot kombol (*Abroma augusta*)	66.0	0.6600	0.476
Khoyer (*Acacia catechu*)	40.0	0.4000	0.492
Arjun (*Terminalia arjuna*)	43.0	0.4300	0.497
Tokma (*Hyptis suaveolens*)	63.0	0.6300	0.485
Harjora (*Cissus quadrangularil*)	61.0	0.6100	0.490
Shatamull (*Asparagus racemosus*)	65.0	0.6500	0.479
Akanda (*Calotropis gigantean*)	35.0	0.3500	0.479

4.10 Treatment from kaviraj

Kavirajes or traditional medicinal practitioners form the primary healthcare providers of the predominantly rural population of Bangladesh. Kavirajes use a variety of medicinal plants for treatment of different ailments. In the study area it was found that about 60% people sought kaviraj for the treatment of diseases and the rest didn't have faith on kaviraj treatment. This is graphically represented at figure 4.10.1.

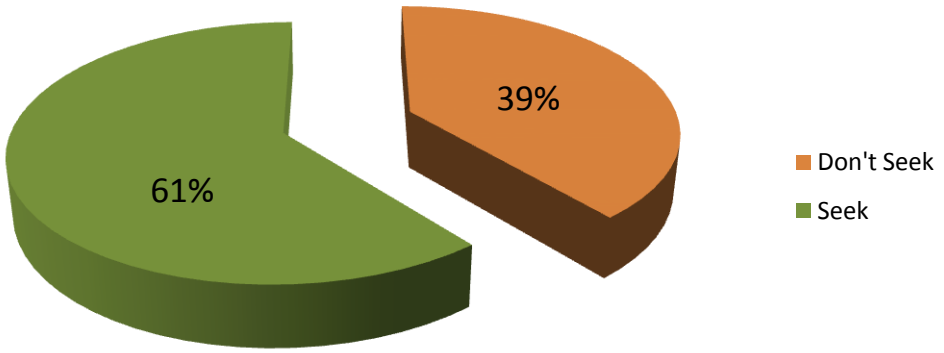


Figure 4.10.1: Treatment from kaviraj

4.11 Reason for choosing medicinal plants

The use of medicinal plants for treating diseases is as old as the human species. The *reason* for this are because of their higher effectiveness, easy availability comparatively low price and traditional uses which are adaptable with the human body and pose lesser side effects. From the results (fig. 4.11.1) it was found. That 46% of respondents choose medicinal plants for their effectiveness, 29% choose for their availability, 16% for a low price and 9% for the reason of tradition.

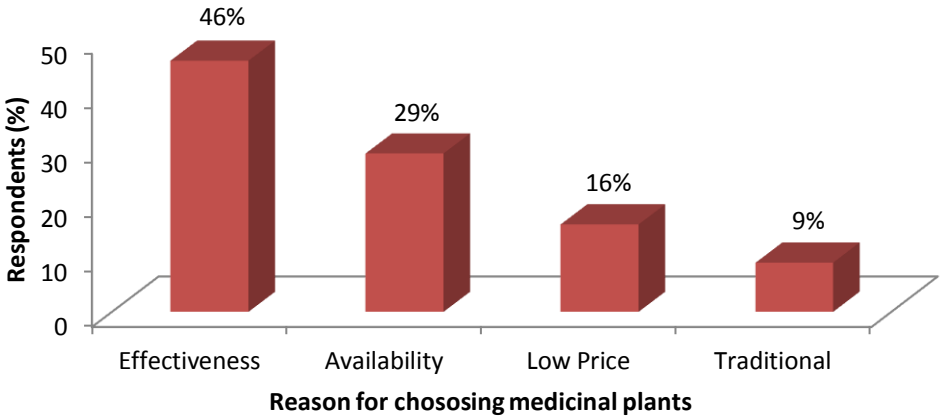


Figure 4.11.1: Reason for choosing medicinal plants

4.12 Source of knowledge of medicinal plants

Medicinal plants have provided mankind a large variety of potent drugs to alleviate or eradicate infections and suffering from diseases in spite of advancements in synthetic drugs, some of the plant-derived drugs still retained their importance and relevance. The use of plant-based drugs all over the world is increasing (Bhat,1995). The source of knowledge of medicinal plants of the respondents are graphically represented in figure 4.12.1. The research result also showed that 32% people have knowledge about medicinal plants and treatment of diseases using these medicinal plants inheritably,32% have gathered knowledge from others,22% seek to kaviraj and 10% solve their problem by self-medication depends on many factors (Pohorec, 1997), namely, individual responsibility for one's health, knowledge of health problems (influence of the mass media, medical literature for non-specialists).

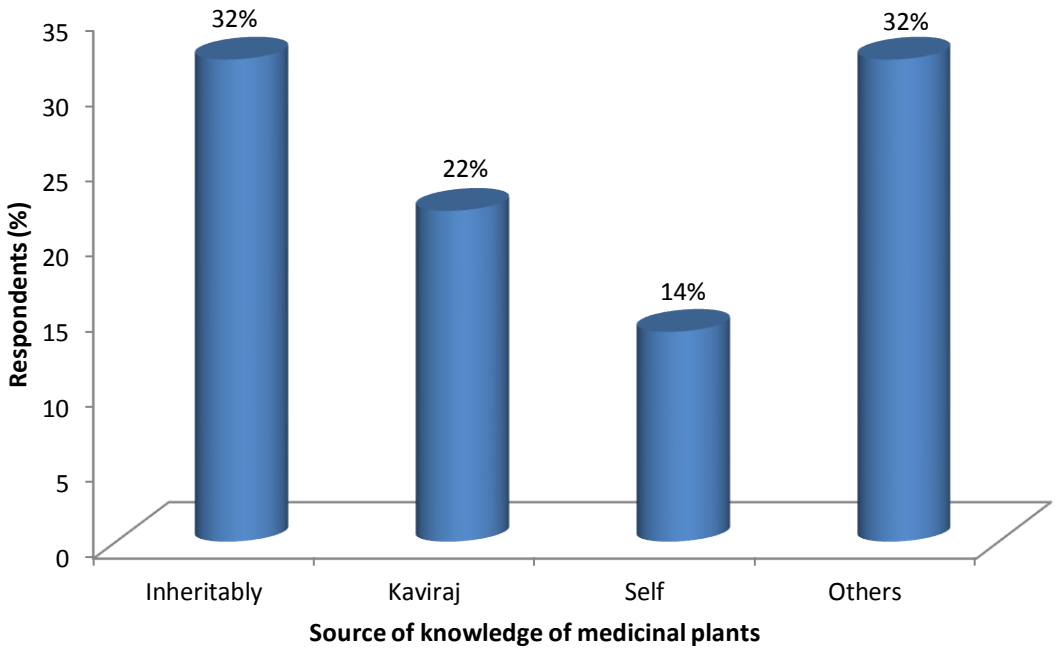


Figure 4.12.1: Source of knowledge of medicinal plants

4.13 Dependency on medicinal plants

The plant is an important source of medicine and plays a key role in world health (Sandberg and Corrigan, 2001) medicinal herbs or plants have been known to be an important potential source of therapeutics or curative aids. The use of medicinal plants has attained a commanding role in health systems all over the world. This involves the use of medicinal plants not only for the treatment of diseases but also as potential material for maintaining good health and conditions. Many countries in the world, that is, two-thirds of the world's population depend on herbal medicine for primary health care. The research result revealed that about 60% of people depend on medicinal plants for remedies of ailments while 40% depends on general medicine and doctors for the treatment of their diseases (figure 4.13.1).

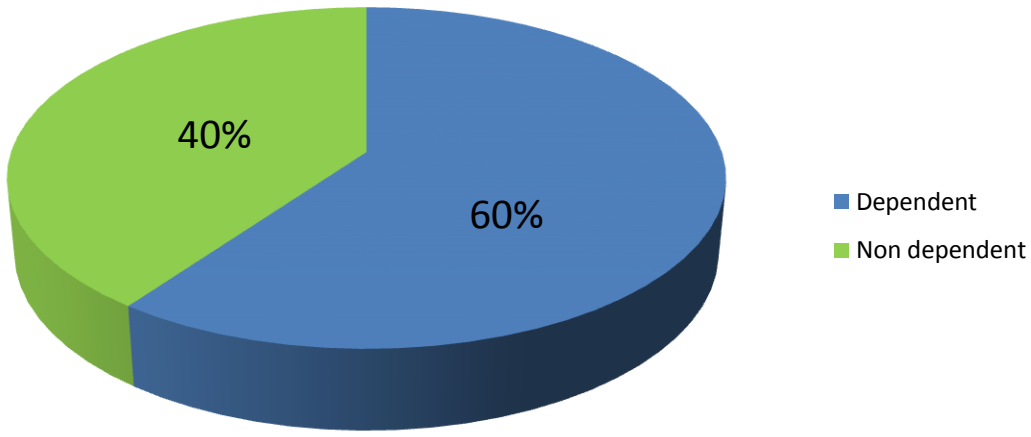
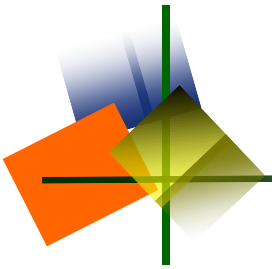


Figure 4.13.1: Dependency of the respondents on the medicinal plants



CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The people living around Sal Forests (Singra, Nawabganj and Biral Sal forest) of Dinajpur, Bangladesh. heavily depend on the medicinal plants for their primary health care, especially fever, cough, cold, headache, body pain, diarrhea, dysentery, constipation, indigestion, skin diseases and urinary troubles.

From the overall findings of the present study it might be concluded that due to high dependency of local people to the sal forests proper protection conservation of the existing medicinal plants is an immense need. Besides this plantation program of extinct species may be a good opinion to restore the forest in its original state.

5.2 Recommendations

Based on the present research results the following recommendation may be considered.

1. The local community of the Dinajpur sal forest should be involved in the conservation and management of medicinal plant resources and their indigenous knowledge in their locality.
2. Identifying effective medicinal plants and encouraging the local people to grow medicinal plants in, home gardens, mixing with crops as live fences of their residents and surroundings is necessary.
3. Reforestation programs should be concluded with the rare and extinct medicinal species inside the Sal forest.

REFERENCES

REFERENCES

Aggarwal, B. B., Sundaram, C., Malani, N. and Ichikawa, H. (2007). Curcumin: the Indian solid gold. Adv. Exp. Med. Biol. Advances in Experimental Medicine and Biology. 595. pp. 1–75.

Ahn, K. (2017). The worldwide trend of using botanical drugs and strategies for developing global drugs. BMB Reports. 50 (3): 111–116.

Ahsan, A.T.M.K., Shabuddin, M., Choudhuri, K., Shahriar, M., Huda, A.N. and Chowdhury, Z. (1997). Genetic Resources Conservation and Utilization of Medicinal and Aromatic Plants. Plant Genetic Resources-Bangladesh Perspective. Proceedings of National Workshop on Plant Genetic Re-sources. 26-29 August, 1997. Bangladesh Agric. Res. Council, Farm Gate, Dhaka.

Alam, M., Furukawa, Y., Sarker, S.K. and Ahmed, R. (2008). Sustainability of Sal (*Shorea robusta*) forest in Bangladesh: past, present and future actions. Int. Forestry Rev. 10(1): 29-37.

Ashraf, M. A., Khatun, A., Sharmin, T., Mobin, F., Tanu, A. R., Morshed, T., Fakir, T.A., Begum, R.A., and Nabi, A. N. (2014). MPDB 1.0: a medicinal plant database of Bangladesh. Bio information. 10(6): 384-386.

Atanasov, A. G., Waltenberger, B., Pferschy-Wenzig, E. M., Linder, T., Wawrosch, C., Uhrin, P. and Rollinger, J. M. (2015). Discovery and resupply of pharmacologically active plant-derived natural products: A review. Biotechnology advances, 33(8): 1582-1614.

Baell, J. and Walters, M. A. (2014). Chemistry: Chemical con artists foil drug discovery. Nature News, 513(7519): 481–483.

Banglapedia. (2006). Sal forest. National Encyclopedia of Bangladesh

Basu, S.K. and Manna, M.K. (1997). Conservation of Some Wetland Species of Socio Economic Importance with reference to West Bengal, India. Pro-gramme and Abstract, 9th Biennial 2nd ISMF and MP-Botanical Conference, Bangladesh Bot. Soc. 8-9 January 1997, University of Dhaka, Dhaka.

Becker, G.S. (1991). A Treatise on the Family, 2nd ed. Cambridge, MA: Harvard University Press.

Bhat, K.K.P. (1995). Medicinal plant information databases. In: Non-Wood Forest Products. Medicinal Plants for Conservation and Health Care, Rome: Food and Agriculture Organization.

Billing, J. and Sherman, P. W. (1998). Antimicrobial functions of spices: why some like it hot. The Quarterly review of biology, 73(1): 3-49.

Bodeker, G. (2005). Medicinal Plant Biodiversity and Local Healthcare: Sustainable Use and Livelihood Development. In: Proceedings of the 17th Commonwealth Forestry Conference held at Colombo, Sri Lanka. pp. 14.

Born, D. and Barron, M.L. (2005). Herb use in pregnancy: what nurses should know. MCN Am J Matern Child Nurs. 30(3): 201–206.

Brater, D. C. and Daly, W. J. (2000). Clinical pharmacology in the Middle Ages: Principles that presage the 21st century. Clinical Pharmacology & Therapeutics, 67(5): 447-450.

Brennan, J. and Teichler, U. (2008). The future of higher education and of higher education research. Higher Education, 56(3): 259–264.

Capasso, L. (1998). 5300 years ago, the Ice Man used natural laxatives and antibiotics. Lancet. 352 (9143): 1864.

Castleman, Michael (2001). The New Healing Herbs: The Classic Guide to Nature's Best Medicines Featuring the Top 100 Time-Tested Herbs. Rodale.p. 15.ISBN 978-1-57954-304-4.

Chan, M. (2015). WHO Director-General addresses in traditional medicine forum. WHO.

Collins, M. (2000). Medieval herbals: the illustrative traditions. University of Toronto Press. p. 115.

Cravotto, G., Boffa, L., Genzini, L. and Garella, D. (2010). Phytotherapeutics: an evaluation of the potential of 1000 plants. Journal of Clinical Pharmacy and Therapeutics. 35 (1): 11-48.

Dahlin, J. L. and Walters, M. A. (2014). The essential roles of chemistry in high-throughput screening triage. Future Medicinal Chemistry, 6(11): 1265-1290.

Dharmananda, S. (1997). The Methods of Preparation of Herb Formulas: Decoctions, Dried Decoctions, Powders, Pills, Tablets, and Tinctures. Institute of Traditional Medicine, Portland, Oregon.

Elliot, S. and Brimacombe, J. (1986). The Medical Plants of GunungLeuser National Park, Indonesia. WWF, Gland, Switzerland.

Farnsworth, N.R., Akerele, O., Bingel, A.S., Soejarto, D.D., andGuo, Z. (1985). Medicinal plants in therapy. Bulletin of the world health organization. 63(6): 965-981.

Ghani, A. (1998). Medicinal plants of Bangladesh: chemical and uses, pp: 467.

Gimmel M. (2008). "Reading Medicine in The Codex De La Cruz Badiano". Journal of the History of Ideas. 69 (2): 169–192.

Giovannini, P. (2017). Managing diabetes with medicinal plants. KewGardens. Retrieved 3 October 2017.

Girish Dwivedi, Shridhar Dwivedi (2007). History of Medicine: Sushruta – the Clinician – Teacher par Excellence (PDF). National Informatics Centre. Archived from the original (PDF) on 10 October 2008. Retrieved 8 October 2008.

Grene, M. (2004). The philosophy of biology: an episodic history. Cambridge University Press. p. 11.

Haque, M. A., Bari, L., Hasan, M. M., Sultana, M. M. and Reza, S. A. (2014). A Survey on Medicinal Plants used by the Folk Medicinal Practitioners in Tangail Sadar Upazilla, Tangail, Bangladesh. Journal of Environmental Science and Natural Resources, 7(1): 35-39.

Harun-ur-Rashid, M., Rashid, M.E., and Rahman, M.A. (2014). Inventory of threatened plants of Bangladesh and their conservation management. Int. J. Environ. 3(1): 141-167.

Heywood, Vernon H. (2012). "The role of New World biodiversity in the transformation of Mediterranean landscapes and culture" (PDF). Bocconea. 24: 69–93.

International Regulatory Cooperation for Herbal Medicines (IRCH). World Health Organization. Retrieved 2 October 2017.

Ismail, M. and Mia, M.M.K. (1973). Studies on some deciduous 'sal' forests of Bangladesh. Ecology of Bangladesh vegetation, No.2. Department of Botany, University of Dhaka, Bangladesh, pp. 79-103.

Jacquart, D. (2008). Islamic Pharmacology in the Middle Ages: Theories and Substances. European Review. 16(2): 219–227.

Kala, C. P. and Sajwan, B. S. (2007). Revitalizing Indian systems of herbal medicine by the National Medicinal Plants Board through institutional networking and capacity building. Current Science. 93(6): 797–806.

Khatun, M. R. and Rahman, A. M. (2019). Ethnomedicinal uses of plants by Santal Tribal peoples at Nawabganj upazila of Dinajpur district, Bangladesh. Bangladesh Journal of Plant Taxonomy, 26(1): 117-126.

Kling, J. (2016). Protecting medicine's wild pharmacy. Nature Plants. 2(5): 16064.

Krek, M. (1979). The Enigma of the First Arabic Book Printed from Movable Type. Journal of Near Eastern Studies. 38(3): 203–212.

Kujundzić, E.; Masić, I. (1999). [Al-Biruni--a universal scientist]. Med. Arh. (in Croatian). 53(2): 117–120.

Kushwaha, S.P.S. and Nandy, S. (2012). Species diversity and community structure in sal (*Shorea robusta*) forests of two different rainfall regimes in West Bengal, India. Biodiversity and Conservation. 21(5): 1215-1228.

Medicinal and aromatic plants trade programme. Traffic.org. Retrieved 20 February 2017.

Milliken, W. (2015). "Medicinal knowledge in the Amazon". Kew Gardens.

Mills and Frank A. (2000). "Botany". In Johnston, William M. (ed.). Encyclopedia of Monasticism: M-Z. Taylor and Francis. p. 179.

Mount, T. (2015). Nine weird medieval medicines. British Broadcasting Corporation.

Mukul, S. A., Uddin, M. B. and Tito, M. R. (2007). Medicinal plant diversity and local healthcare among the people living in and around a conservation area of Northern Bangladesh. International Journal of Forest Usufructs Management, 8(2): 50-63.

Mukul, S.A., Rashid, A.M. and Khan, N.A. (2016). Forest protected area systems and biodiversity conservation in Bangladesh.

Mukul, S.A., Uddin, M.B. and Tito, M.R. (2007). Medicinal plant diversity and local healthcare among the people living in and around a conservation area of Northern Bangladesh. International Journal of Forest Usufructs Management. 8(2): 50-63.

Newman, D. J. and Cragg, G. M. (2012). Natural products as sources of new drugs over the 30 years from 1981 to 2010. Journal of natural products, 75(3): 311-335.

Nunn, Nathan; Qian, Nancy (2010). "The Columbian Exchange: A History of Disease, Food, and Ideas". Journal of Economic Perspectives. 24 (2): 163–188.

Pezzuto, J. M. (1997). Plant-derived anticancer agents. Biochemical Pharmacology. 53 (2): 121–133.

Pinn, G. (2001). Adverse effects associated with herbal medicine. Aust Fam Physician. 30 (11): 1070–1075.

Pohorec, D. (1997). Samozdravljenje v Sloveniji. Zbornik referatov sekcije farmacevtskih tehnikov o bolečini. Ptuj, 5-12.

Rahman, A.U. and Uddin, S. (2009). Statistical analysis of different socio economic factors affecting education of NW. FP (Pakistan). Journal of Applied Quantitative Methods, 4(1): 88–94.

Ramos-e-Silva Marcia (1999). "Saint Hildegard Von Bingen (1098–1179) "The Light Of Her People And Of Her Time"". International Journal of Dermatology. 38(4): 315–320.

Sandberg, F., Corrigan, D. (2001). Natural Remedies. Their Origins and Uses. Abingdon: Taylor and Francis.

Sherman, P. W. and Hash, G. A. (2001). Why vegetable recipes are not very spicy. Evolution and Human Behavior. 22(3): 147-163.

Singer, Charles (1923). "Herbals". The Edinburgh Review. 237: 95–112.

Sivakumar, M. and Sarvalingam, A. (2010). Human deprivation index: A measure of multidimensional poverty.

Solecki, R. S. (1975). "Shanidar IV, a Neanderthal Flower Burial in Northern Iraq". Science. 190 (4217): 880–881.

Stepp, J. R. and Moerman, D. E. (2001). The importance of weeds in ethnopharmacology. J. Ethnopharmacol. 75(1): 19-23.

Stepp, J.R., Moerman, D.E. (2001). The importance of weeds in ethnopharmacology. J Ethnopharmacol. 75: 19-23.

Stoller, R.J. (1964). A contribution to the study of gender identity. Int. J. Psycho-Anal. 45: 220–226.

Sumner, J. (2000). The Natural History of Medicinal Plants. Timber Press. p. 16.

Tapsell, L. C., Hemphill, I., Cobiac, L., Sullivan, D. R., Fenech, M., Patch, C. S. and Fazio, V. A. (2006). Health benefits of herbs and spices: the past, the present, the future. Med. J. Aust. 185 (4 Suppl): S4–24.

Thapa-Magar, K.B. and Shrestha, B.B. (2015). Carbon stock in community managed hill Sal (*Shorea robusta*) forests of central Nepal. Journal of Sustainable forestry. 34(5): 483-501.

Uddin, M.Z., Hassan, M.A. and Sultana, M. (2006). Ethnobotanical survey of medicinal plants in Phulbari Upazila of Dinajpur District, Bangladesh. Bangladesh Journal of Plant Taxonomy. 13(1): 63-68.

WHO. (2003). Guidelines on Good Agricultural and Collection Practices (GACP) for Medicinal Plants. World Health Organization. 2003. Retrieved 26 February 2017.

Wikipedia contributors. (2019). Medicinal plants. In Wikipedia, The Free Encyclopedia. Retrieved 08:57, September 11, 2019.

WHO. (2013). WHO Traditional Medicine Strategy 2014-2023 (PDF). World Health Organization. ISBN 978-92-4-150609-0.

WHO. (2008). The global burden of disease: 2004 update. Geneva.

Wu, J.N. (2005). An Illustrated Chinese Materia Medica. Oxford University Press. p. 6.

APPENDICES

APPENDICES

Appendix I

Medicinal plants used by the people living around Sal Forest, Dinajpur

SL No.	Scientific Name	Family Name	Local Name	Usable Part(s)	Ailment
1	*Justicia adhatoda* L.	Acanthaceae	Basok	Leaf	Coughs, chest pain, pneumonia. Leaves of Justicia adhatoda are mixed with five flower buds of Syzygium aromaticum and ginger [rhizomesof Zingiber officinale Roscoe (Zingiberaceae)] and taken orally.
2	***Calotropis gigantea***	**Apocynaceae**	Akanda	Leaf,flowerrs,fruits	The plant is reported as effective in treating skin, digestive, respiratory, circulatory and neurological disorders and was used to treat fevers, elephantiasis, nausea, vomiting, and diarrhea. The milky juice of **Calotropis procera** was used against arthritis, cancer, and as an antidote for snake bite.
3	*Ananas sativus*	Bromeliaceae	Anaros h	Young leaf	Reddish color of urine. Young leaves are chewed twice daily for 6-7 days.
4	*Terminalia arjuna*	Combretaceae	Arjun	Bark	Cardiovascular disorders. Juice obtained from macerated bark is taken in the morning on an empty stomach.

5	*Cuscuta reflexa*	Cuscutaceae	Shorno Iota	Whole plant	Jaundice, Juice obtained from macerated whole plant is mixed with ashes from burnt feathers of yellow colored bird. The decoction is taken once daily for 2-3 days.
6	*Acacia catechu* L.	Fabaceae	Khoyer	Wood	Oral lesions. Roots of Diplazium sylvaticum are mixed with pakri khoyer or gach khoyer [produced by boiling the wood of Acacia catechu and then evaporating the resultant brew] and the mixture macerated to obtain juice, which is applied to oral lesions.
7	*Tamarindus indica* L.	Fabaceae	Tetul	Leaf, fruit	Coughs, mucus. Macerated leaves and fruits are taken with molasses.
8	*Hyptis suaveolens* L.	Lamiaceae	Tokma	Fruit	Flatulence, acidity, gastric troubl es. Fruits are added to water in which mishri (crystalline sugar) has been dissolved and made into a sherbet. The sherbet is taken orally.
9	*Ocimum tenuiflorum* L.	Lamiaceae	Tulsi	Leaf, stem	Coughs, cancer, tuberculosis. Juice obtained from macerated le ayes is taken for coughs. Stems of the plant are worn as garland around the neck for cancer and tuberculosis. The healers claimed that if such worn, the juice from

					stems goes inside the body mixed with body sweat and cures cancer and tuberculosis.
10	*Cinnamomum verum* J.	Lauraceae	Daruchini	Bark	Asthma, coughs. Fruits of somrit are mixed with fruits and seeds of lettaria cardamomum J. Presl. (Lauraceae), bark of Cinna momumverum J. Presl. (Lauraceae), and flower bud of *Syzygium aromaticum* (L.) Merr. and L.M. Perry (Myrtaceae). Pills are made from the macerated mix or juice obtained from the macerated mix. One pill is taken daily for 24 days. Alternately, one teaspoon of juice is taken daily for 2-4 days. Note that during this time eating of beef or any sour substance is not advised.
11	*Abroma augusta* (L.)	Sterculiaceae	Ulot-kombol	Leaf bark root	Juice of the leaf and root for treatment of diabetes. Decoction of bark for female sexual disorders. Sap juice to treat menstrual disorders.
12	*Azadirachta indica A. Juss.*	Meliaceae	Neem	Leaf stem	Tooth ache itches. Teeth are bru shed with stem to get relief from tooth ache. Leaves are boiled in water and the water used for bathing to get relief from

					itches.
13	*Aegle marmelos* (L.)	Rutaceae	Bel	Leaf, fruit	Ripe and unripe fruits are eaten for constipation. Decoction of leaves for peptic ulcer. Leaf oil to treat respiratory disorders
14	*Cynodon dactylon* (L.) *Pers.*	Poaceae	Durba ghas	Whole plant	To stop bleedingfrom external cuts and wounds. Macerated whole plant is applied to cuts and wounds. To stop bleeding from external cuts and wounds. See also Serial Number 3.
15	Terminalia belerica	Combretaceae	Bohera	Leaf, fruit	Coughs, cold,asthma,diarrhea,vomiting,hypertantion,cancer.
16	*Cissus quadrangularis* L.	Vitaceae	Harjora	Stem, rhizom e	Pain due to bone fracture, bone fracture. Paste of stem or rhizome is mixed with grounded ginger and applied as a poultice to the fractured area. The place is then covered and tied with bamboo slices and water applied to the area. The poultice is kept in place for 12-15 days.
17	*Zingiber officinale Roscoe*	Zingiberaceae	Ada	Rhizo me	Referred to as ginger throughout the Table. See Serial Numbers 1, 16, 20, 22 and 25.
18	*Aloe barbadensis*	Xanthorrho ea ceae	Ghrita kumari	Leaf Latex	Juice for digestional problem.

19	*Andrograph is paniculata*	Acanthaceae	Kalomegh	Whole Plant	Juice of whole plant for the treatment of fever, boil, ulcer and to enhance appeal for food
20	*Calendula officinalis* L.	Asteraceae	Gada ful	Leaf Hower	Mashed leaf and flower to treat old wound, menstrual problems and itches [1]. Flowers to treat stomach upset, ulcers and inflammation.
21	*Centella asiatica* (L.) *Urb.*	Apiaceae	Thankuni	Leaf	Leaf juice for dysentery [0]. Leaf paste applied on wounds, burns, and skin lesion.
22	*Asparagus racemosus*	Asparagaceae	Shatamull	Root	Treatment of Jaundice.
23	*Cocos nucifera* L.	Arecaceae	Narikel	Fruit	The inner portion of unripe fruit is used to treat skin disease and to remove skin spots [T]. Coconut water for diarrhea.
24	*Terminalia chebula*	Combretaceae	*Haritaki*	Whole plant	people used this *plant* in the treatment of asthma, sore throat, vomiting, hiccough, diarrhea, dysentery, bleeding piles, ulcers, gout, heart and bladder *diseases*..
25	*Phyllanthus emblica*	Euphorbiaceae	Amloki	Fruit	The fruits, which are of both dietary and medicinal use, are shown to possess myriad medicinal benefits and to possess anti-aging effects.
26	*Datura metel*	Solanaceae	Dhutura	Leaf,	Flower and seed for cold and nervous

	L.			Flower, Seed	disorders [0]. Crushed leaf is applied to painful areas.
27	*Dillenia indica* L.	Dilleniaceae	Chalta	Fruit	Fruit juice is taken for fever and cough.
28	*Diospyros peregrina*	Ebenaceae	Gab	Bark, *Fruit*	Bark decoction to treat dysentery and cholera
29	*Hibiscus rosasinensis* L.	Malvaceae	Jaba	Whole plant, Leaf	Whole plant for dysentery. Leaf juice is taken to treat debility.
30	*Piper betel Blanco*	Piperaceae	Paan	Leaf	Juice from leaf for diabetes and acidity

Appendix II

A Sample Questionnaire

Department of Agroforestry and Environment

Hajee Mohammad Danesh Science and Technology University, Dinajpur

A questionnaire of the research study entitled

DIVERSITY AND USES OF MEDICINAL PLANTS AMONG THE PEOPLE LIVING AROUND SAL FOREST, DINAJPUR

Name of Respondent: . . . . . Village:. . . . . .

Union: . . . . . Mobile No (if present): . . . . . .

(Please answer the following questions and put tick (√) whenever necessary)

1. **Age and Sexual status of respondents**

- **Age:** Please mention your present age . . . . . .years.
- **Sex type**

  Male

  Female

2. Education: please mention your educational qualifications

- Illiterate
- Primary level
- Secondary level
- Above secondary Level

3. Family Size: please mention the number of your family members

a) Male _____

b) Female _____

c) Total _____

4. Annual income:…….tk.

5.Occupational status

- Agriculture
- Business
- Housewife
- Labor
- Student
- Service
- Others

6.Known medicinal plants …….

7.Medicinal plants used by the respomdents……..

8.Medicinal plants present in respondents house……

9.Name of extinct medicinal plants from the sal forest……..

10.Plant parts used for the treatment of diseases

Name of tree	Parts used	Name of disease

11.Known kaviraj …….(mention seek treatment from him or not)

12.Reason for choosing medicinal plants

- Effectiveness
- Availability
- Low price
- Traditional

13.Source of khowledge of medicinal plants

- Inheritably
- Kaviraj
- Self
- Others

14.Opinion about medicinal plants

(Please mention other information)

Appendix II

Some Plates of the Research






Fig. Primary Data Collection

Fig. Primary Data Collection