

## From Tradition to Transition: Understanding the Driving Factors of Declining Use of Ethnomedicine for Livestock and Crops among the Indigenous Khasi People in Bangladesh

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### Abstract

For centuries, Indigenous communities have relied on plants, herbs, and shrubs as primary sources of medicine for treating illnesses in both humans and animals. Despite the development and commercialisation of modern medicine, many Indigenous groups—such as the Khasi—continue to depend on traditional healing practices. This study examined current ethnomedicinal practices and the factors associated with the decline in their use in livestock and crop production among the Indigenous Khasi community in Bangladesh.

This qualitative observational study was conducted from January to December 2021 in two Khasi villages. A total of 48 informal conversational interviews were conducted initially to build rapport, gain community access, and identify potential participants. Subsequently, 15 in-depth interviews (IDIs) and five key informant interviews (KIIs) were conducted using a purposive sampling strategy. All interviews were conducted in Bangla. Transcribed and translated textual data were analysed using thematic analysis.

Findings reveal that the Khasi continue to use ethnomedicine for livestock and crops due to its accessibility, availability, affordability, and sustainability. The study documented a range of traditional preparation methods—including crushing, chewing, and decoction—each associated with specific livestock ailments and corresponding plant parts. However, several factors contribute to the declining use of ethnomedicine, including the extensive use of chemical pesticides and fertilisers, depletion of therapeutic plants, the widespread commercialisation of modern medication, the adoption of modern education, and a reduction in the number of traditional healers.

The study demonstrates that the safe and effective use of therapeutic plants can reduce cultivation costs, preserve natural resources, enhance biodiversity, and protect beneficial organisms essential for cultivation. Although ethnomedicine remains a vital component of Khasi cultural heritage, its long-term sustainability is at heightened risk. Revitalising these practices requires scientific validation, conservation of therapeutic plant species, and inclusive policy-making that meaningfully involves Indigenous communities. A co-design approach with active participation of Khasi knowledge holders is crucial to the development for conservation policies. Adopting a multidisciplinary and multi-institutional One Health approach may further strengthen shared values around ethnomedicine and optimise the use of natural and human resources in disease management.

**Keywords:** Ethnomedicine; Therapeutic Plants; Indigenous Khasi Community; Qualitative Research; Bangladesh

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## Introduction

The knowledge and use of medicinal plants for treating diseases in humans, livestock, and crops has been transforming from generation to generation in several cultures globally. In recent years, this traditional use of ethnomedicine has been validated by several scientific studies (Bischoff et al., 2016; Calzetta et al., 2020). This traditional medicine used for livestock and crop remedies is generally referred to as ethnoveterinary medicine (EVM) (Bullitta et al., 2018). The ethno-veterinary pharmacopoeia often contains biological resources from various geographical and environmental settings (Bartha et al., 2015).

Despite its long-standing significance, knowledge of EVM is increasingly threatened worldwide (Anyinam, 1995). The conservation of traditional ethnomedicinal knowledge is vital, as it contributes to the discovery of novel therapeutic applications of plant species, upholds ethno-biodiversity and facilitates the identification of biologically active compounds for medical treatments (Menale et al., 2016). To safeguard the traditional knowledge of ethnomedicine for both crops and domestic animals, several surveys have been conducted in Latin America, Iran, Morocco, Brazil, Pakistan and India (Baharvand-Ahmadi & Asadi-Samani, 2017; Barkaoui et al., 2017; Benarba et al., 2015; Bullitta et al., 2018; Kujawska et al., 2017; Piluzza et al., 2015; Yadav et al., 2016). These studies found that more than 5,000 plants are used for medical purposes worldwide (Hamilton, 2004).

Among the countries where EVM remains part of everyday practice, Bangladesh is particularly notable. It is both a rich reservoir of therapeutic plant resources and the homeland of 54 indigenous communities, who together constitute about 2% of the national population (Bangladesh Bureau of Statistics, 2011). Numerous studies indicate that indigenous peoples tend to rely on EVM as their primary healthcare system, largely due to its accessibility and the limited availability of formal medical facilities in remote areas (Abo et al., 2008; Ghorbani, 2005; González et al., 2010; Mahishi

et al., 2005; Telefo et al., 2011). Importantly, the use of herbal medicine is not confined to indigenous groups: approximately 80% of the mainstream population in Bangladesh also turns to herbal remedies for primary treatment at least once in their lifetime (Yusuf et al., 2009).

Bangladesh hosts an estimated 6,000 therapeutic plant species, although only about 500 are currently used for healing and curative purposes (Islam et al., 2020; Tefera & Kim, 2019). Scholars have identified several factors contributing to the decline in EVM use, with increasing interaction between modern biomedical systems and indigenous cultural practices frequently cited as a major driver of this decline (Dixie et al., 2003). Despite these pressures, many indigenous communities continue to depend on EVM. In our study area, for instance, all residents of the Khasi village routinely use ethnomedicine (Islam et al., 2020; Tefera & Kim, 2019).

Although both indigenous groups and non-indigenous populations in Bangladesh employ ethnomedicine to treat illness, the knowledge and practice of EVM are now under significant threat. This study, therefore, seeks to document the Khasi community's knowledge and practices related to EVM for livestock and crops, and to identify the factors contributing to the declining use of EVM within the Khasi community of Kamalganj (sub-district), Moulvibazar (district), Bangladesh.

Among all the countries that use EVM in their everyday practice, Bangladesh is a treasure trove of therapeutic plants and home to 54 indigenous communities that account for 2% of the total population (Bangladesh Bureau of Statistics, 2011). Studies have shown that indigenous people have a common tendency to use EVM as a primary medication because of its availability and distant healthcare facilities compared with the mainland people (Abo et al., 2008; Ghorbani, 2005; González et al., 2010; Mahishi et al., 2005; Telefo et al., 2011). In addition, 80% of the mainstream population of Bangladesh also uses herbal medicine for their primary treatment at least once in their lifetime (Yusuf et al., 2009).

Moreover, a survey showed that Bangladesh is a treasure house of therapeutic plants, with 6,000 species, of which only 500 are used for healing and curative purposes (Islam et al., 2020; Tefera & Kim, 2019). Scientists identified several causes of the decrease in the use of EVM, and among those, increasing collaboration between modern civilisation and indigenous cultures is claimed as the root cause of the decrease in the use of ethnomedicine (Dixie et al., 2003). However, several indigenous communities are still relying on EVMs. In our study area, everyone living in Khasi village is accustomed to ethnomedicine (Islam et al., 2020; Tefera & Kim, 2019). Although the indigenous community and other plain land people of Bangladesh use ethnomedicine for treat their illnesses, currently, the knowledge and use of EVM is in under threat. This study aimed to understand their knowledge and practices of EVM for livestock and crops, and to explore the influential factors associated with the declining use of EVM for livestock and crops in the *Khasi* community.

## Methods and Materials

### Study Time and Setting

This exploratory qualitative study was conducted between January and December 2021 in two Khasi *punjis* (villages) of Kamalganj Upazila (sub-district), located in Moulvibazar district of the Sylhet division, Bangladesh (Figure 1). Kamalganj was selected as the study area because of its hilly, forested landscape. The region receives heavy rainfall, resulting in extensive tropical evergreen rainforest cover. These ecological conditions make Kamalganj particularly suitable for examining the role of ethnomedicine in sustaining livestock and crop health.

The Khasis are traditionally forest-oriented, with livelihoods deeply intertwined with forest resources. Their settlement in the hilly terrain is historically linked to fertile land, abundant vegetation, and a favourable cool climate. Importantly, they have inherited long-standing cultural practices of forest conservation and medicinal plant use, with knowledge passed down through generations. Given their daily engagement with the forest environment and

reliance on its resources, the Khasi community represents an ideal population for investigating the practice of ethnomedicine and the factors contributing to its declining use for livestock and crops.

The Khasis follow a matrilineal system of property ownership. Each *punji* is led by a Headman, locally known as the *Montri*, who is regarded as the most trusted and respected figure within the community. Religiously, the population comprises two groups: Christians and natural worshippers. Although the number of natural worshippers is gradually declining, cultural and behavioural practices remain largely similar across both groups, with some degree of hybridisation.

The selected study villages—Lawachara and Magurchara *punjis*—are among the oldest Khasi settlements in the region. Magurchara *punji* has a population of 155 individuals, while Lawachara *punji* has a population of 102 individuals. Both villages include Christian and natural-worshipping households and are considered the most prominent and historically significant Khasi settlements in the area. Together, the two *punjis* represent a diverse, culturally rich population well-suited for exploring contemporary ethnomedicinal practices.

### Study Population, Sampling Strategies, and Sample Size

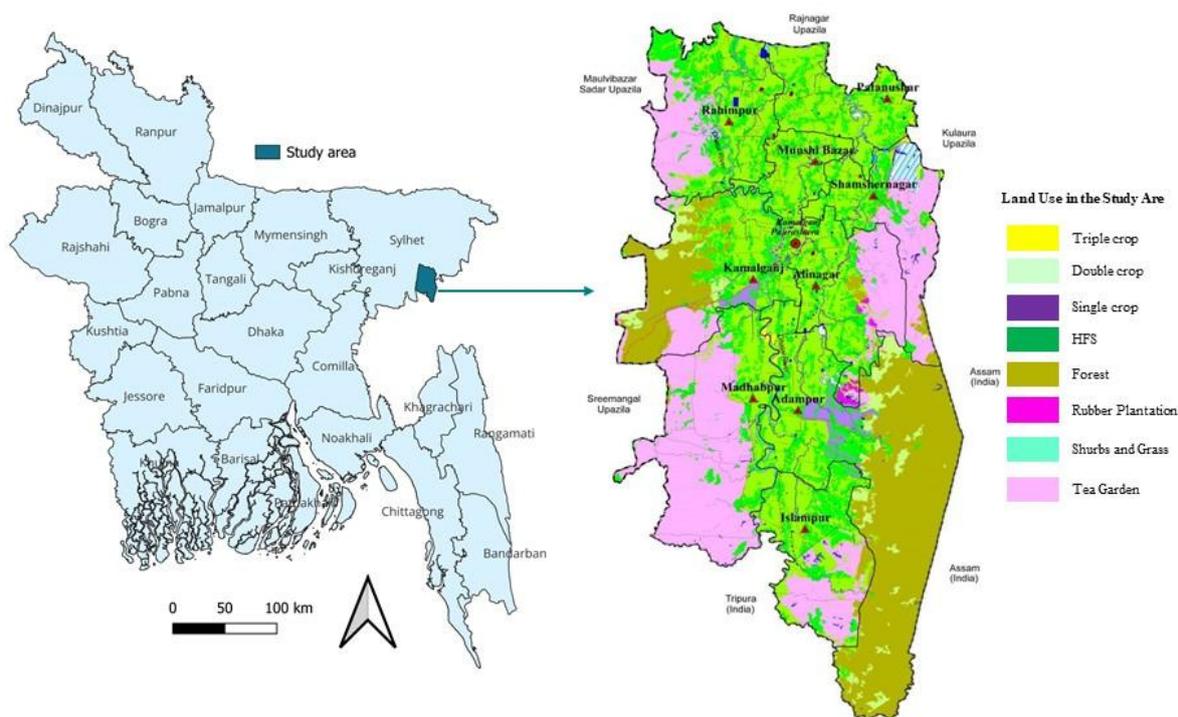
The participants enrolled in this study were primarily members of the Khasi community, along with several individuals possessing specialised knowledge of EVM. In addition, a small number of neighbouring Bengali residents were included. The inclusion criteria required participants to be between 18 and 45 years of age, able to understand and speak Bangla, residents of the selected *punjis* (villages), knowledgeable and experienced in EVM practices, and willing to participate voluntarily.

A purposive sampling strategy was used to recruit participants. The final sample size (Table 1) was determined based on data saturation, defined as the point at which no new themes or insights emerged from the interviews (Braun & Clarke, 2006). To enhance the validity and

robustness of the findings, methodological triangulation was employed, incorporating four complementary data collection methods.

The participants who enrolled were mostly from the Khasi community and included some with specialised knowledge of EVM. In addition, we recruited some neighbouring Bengalis. Inclusion criteria included: participants aged 18-45 years, able to understand and speak Bangla, living in

the selected Punji (village), with knowledge and experience of EVM, and participating voluntarily. A purposive sampling strategy was followed to recruit participants, and the sample size (Table 1) was determined based on the “Principle of Data Saturation- Reaching a point where new data or dimension emerged in the interviews” (Braun & Clarke, 2006). To ensure the validity of the data, we used methodological triangulation (4 data collection methods).



**Figure 1: Location of the Study Area and its Geographical Landscape**  
**Source: Primary Data**

First, we conducted conversational sessions with native Khasi participants. This approach aligns with what many Indigenous scholars describe as storytelling, yarning, talk story, restoring, or remembering (Bishop, 1999). Such conversational methods are informal and help establish a strong rapport with informants, creating a comfortable environment for sharing knowledge (Kovach, 2010).

In-depth interviews (IDIs) were conducted to explore individual knowledge, practices, and experiences related to ethnomedicine. Key informant interviews (KIIs), on the other hand, provided insights that helped clarify participants’ opinions, beliefs, attitudes, behaviours, and perceptions regarding the study topics. All interviews were conducted in private settings, either in an empty room or in a quiet area adjacent to the villages, to ensure confidentiality and participant comfort.

**Table 1: The Distribution of Participants According to Methodology and Study Sites**

SR. No.	Methods	Participants (N=66)	Field Site
1	Conversational Methods (Informal interviews) (n=48)	Native Khasi People (n=48)	Lawyachara village (n=22) Maghurchara village (n=26)
2	In-depth interviews (n=15)	Native Khasi People (n=10) Knowledgeable person (n=5)	Lawyachara village (n=5) Maghurchara village (n=5) Moulvibazar (n=5)
3	Key informant interviews(n=5)	Native Khasi People (n=5)	Lawyachara village (n=2) Maghurchara village (n=3)
4	The observation was going on during fieldwork		Lawyachara village Maghurchara village

**Source: Primary Data**

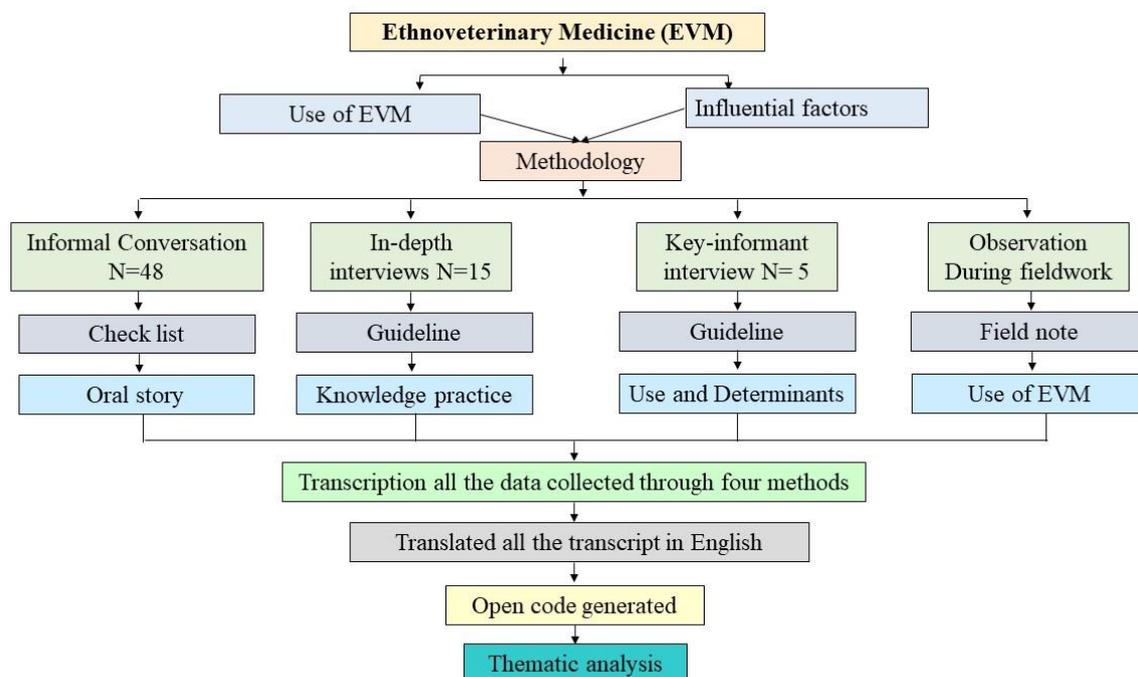
**Data Collection Procedures**

Data were collected by a two-member research team, both of whom held graduate degrees in anthropology and had substantial experience in qualitative fieldwork. Prior to data collection, the researchers received training on qualitative research techniques and ethical considerations, along with a detailed orientation to the socio-cultural context of the study population. All data collection tools and interactions were conducted in Bangla, the common language shared by both researchers and participants.

The study primarily employed conversational methods, which offer an informal yet effective approach for understanding Indigenous culture and knowledge (Kovach, 2010). This flexible method enabled participants to share their experiences naturally, without the constraints of structured questioning. Data collection commenced only after obtaining permission from the *Montri* (Headman or Headwoman), the highest traditional authority in each *punji* (village).

A checklist was developed and piloted among Khasi individuals outside the study sites to assess its clarity and relevance. This checklist guided the conversational sessions. For in-depth interviews (IDIs), a semi-structured questionnaire was used to explore participants’ EVM practices and to identify factors contributing to the decline in its use. Each IDI typically lasted 45–60 minutes, while key informant interviews (KIIs) lasted 60-90 minutes. Follow-up visits were conducted when necessary to clarify missing information or gather additional insights.

Throughout the data collection process, detailed field notes were maintained to document interview content and researchers’ observations. All interviews and conversational sessions were audio-recorded with participants’ consent. Verbatim transcription and double-checking of translations were subsequently undertaken to ensure accuracy and reliability (Figure 2). Finally, a map of the study area was created in QGIS (version 3.32, Lima; QGIS Development Team, 2023) to visually depict the landscape of the research sites.



**Figure 2: Flowchart of Data Collection and Data Extraction Procedure**  
**Source: Primary Data**

**Data Analysis**

Data were analysed using thematic analysis, following the six-step framework proposed by Braun and Clarke (2006). All textual data were analysed manually to ensure a deep, context-sensitive understanding of participants’ narratives.

To begin, the research objectives were broken down into several core themes, which were subsequently refined into subthemes to guide the analytical process. The data were then systematically coded through open coding, allowing patterns and categories to emerge inductively from the material. Relevant excerpts from interviews and conversations were organised under their corresponding themes and subthemes to capture both shared experiences and variations across participants’ responses (Bhuiya et al., 2025).

Through iterative reading and coding, the researchers interpreted the data in relation to each theme, ensuring internal consistency and conceptual coherence. The full analytical process—from data organisation to theme generation—is illustrated in Figure 2.

During data collection, key informant interviews (KIIs), in-depth interviews (IDIs), and informal conversations were conducted to explore Indigenous knowledge and practices related to ethnomedicine, as well as the factors shaping both the use and decline of EVM. All interviews were transcribed verbatim and subsequently translated into English to maintain accuracy and interpretive fidelity.

**Ethical considerations**

Ethical approval for this study was obtained from the Department of Anthropology at Shahjalal University of Science and Technology (SUST), Sylhet, Bangladesh. Prior to data collection, permission was granted by the relevant authorities, and written informed consent was obtained from each participant. The consent process clearly outlined the research objectives, the voluntary nature of participation, the right to withdraw at any stage of the interview, and the intended use of the data in future publications. Participants were fully informed about the study's purpose, and the research objectives were explained in detail. Confidentiality was strictly maintained throughout the study. Personal identifiers were removed, and access to

all data and related records was restricted to the research team. Data were stored securely to ensure privacy and protection. Each participant was assigned a unique identification number, which was removed prior to reporting the findings.

**Results**

A total of 68 participants were included in the study: 48 through conversational methods, 15 through in-depth interviews, and 5 as key informants. The overall mean age of participants was 40 ± 5 years. Most participants were Khasi

(n = 63), with a small number of Bengali participants (n = 5). The majority were male (n = 47). Christianity was the predominant religion (n = 61), followed by Hindu natural worshippers (n = 4) and Muslims (n = 3). Only a minority of participants had formal education (n = 22), and nearly all resided in hilltop settlements (n = 63). Agriculture was the primary occupation (n = 53), supplemented by a smaller number employed in government service (n = 8) or working as academicians and locally knowledgeable persons (n = 7) (Table 2).

**Table 2: Sociodemographic Characteristics of the Participants**

Socio-Demographic Characteristics of the Participants	Conversational Methods (Informal Interviews) (n = 48)	In-depth Interviews (n = 15)	Key Informant Interviews (n = 5)	Total (summation)
<b>Age in years (mean ± SD)</b>	35 (±5)	50 (± 5)	50 (± 5)	40 (± 5)
<b>Ethnicity</b>				
Khasi	48	10	5	63
Bengali	–	5	–	5
<b>Gender</b>				
Male	30	12	5	47
Female	18	3	–	21
<b>Religion</b>				
Christian	46	10	5	61
Muslim	–	3	–	3
Hindu (natural worshipper)	2	2	–	4
<b>Formal Education</b>				
Has formal education	17	4	1	22
No formal education	31	11	4	46
<b>Residence</b>				
Hilltop	48	10	5	63
Plain land	–	5	–	5
<b>Profession</b>				
Agriculture	43	6	4	53
Government Job	3	5	–	8
Academician / Local Knowledgeable Person	2	4	1	7

**Source: Primary Data**

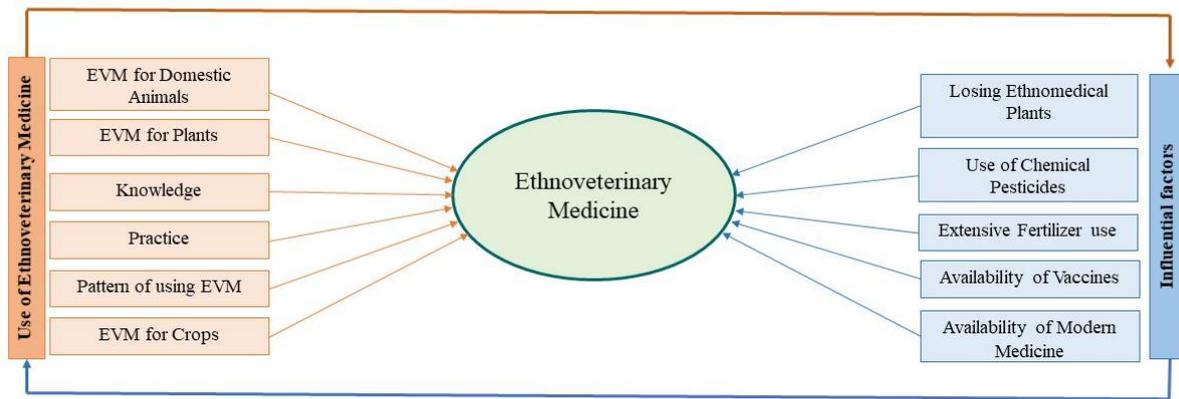
The following sections elaborate on these five factors, providing a nuanced understanding of the socio-cultural and environmental dynamics shaping the use of EVM among the Khasi community (Figure 3).

**Patterns of Using Ethnomedicine**

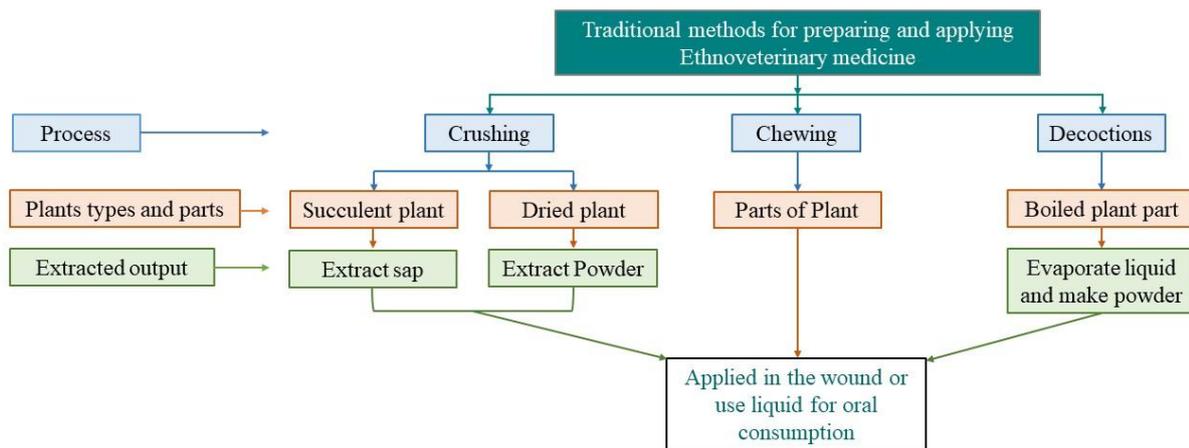
The preparation of ethnoveterinary medicines varied according to the plant parts used and the specific livestock conditions being treated. Participants described several common Indigenous preparation techniques, including

crushing (to extract sap or produce powder), chewing, and decoction (boiling or heating plant materials) (Figure 4). Another method, homogenisation—used to extract juices from plants, herbs, and shrubs—was reported to be more costly and to require greater technical skill.

Participants emphasised that the careful selection of plant species, plant parts, preparation techniques, and modes of administration is essential for achieving effective therapeutic outcomes in ethnoveterinary medicine.



**Figure 3: The Conceptual Framework of the Study Findings and Interpretations**  
 Source: Primary Data



**Figure 4: Traditional Methods for Preparing and Applying Ethnoveterinary Medicine**  
 Source: Primary Data

Another commonly reported method of preparing ethnomedicine was crushing, which participants explained is primarily used for both succulent and dried plants to extract sap or produce a fine powder. This process typically involves using a pestle and mortar to crush whole plants or specific plant parts. Participants

noted that dried plants, when properly preserved, can be stored and used for extended periods.

Chewing was also identified as a notable Indigenous method of preparing ethnomedicine. Although this technique is more frequently associated with human traditional medicine,

participants reported that it is occasionally used for pets and domestic animals when rapid therapeutic action is required. However, this method can be challenging, as animals must be compelled to chew medicinal plants—particularly when they are unfamiliar with the taste. One key participant explained:

If the animal has to chew the plants or parts of the plants, we cover the medicine with green grass or the leaf of a jackfruit or banana tree. If this process does not work, we chew the plant ourselves and make a sticky paste, which is then applied to the wound to promote healing and stop bleeding.

Another widely used preparation method is decoction, in which plant materials are broken or cut into small pieces and boiled for a specified period. Participants noted that the duration and intensity of boiling depend on the size, texture, and hardness of the plant parts being used. The resulting liquid extract, or decoction, is then administered to livestock according to the nature and severity of the ailment.

### **Ethnomedicine for Crops and Plants**

The long-term detrimental effects of chemical fertilisers on soil quality, vegetation, and beneficial insects are well documented. Despite this, such fertilisers continue to be used globally to enhance crop productivity. In contrast, the Khasi farmers in the study area demonstrated extensive reliance on traditional ethnomedical knowledge for crop protection. They primarily used extracts from leaves, roots, and bark as natural pesticides (Table 2). During an in-depth interview (IDI), one participant described the practice:

We make neem water by ourselves. This natural pesticide is trustworthy. We have been using it for generations. (Native Khasi farmer)

The use of neem water was not limited to the Khasi highlands; farmers in the surrounding plains were also familiar with its application. Participants identified several advantages of neem-based formulations, including their affordability, ease of preparation, availability of

raw materials, long shelf life, and lack of harmful side effects. A key informant interview (KII) participant elaborated on the preparation process:

We boil the neem leaves in water. When the water becomes thick, we let it cool and then filter out the leaves. After that, we spray this neem water on the infected plants. (Elderly Khasi farmer, >60 years)

Although some farmers continued to use chemical pesticides for quick results, agricultural field officers expressed concerns about their long-term consequences. As one agricultural worker from Kamalganj Subdistrict explained: Chemical products work rapidly, that is true. But once a farmer starts using them, they must continue every season. After using chemical pesticides, natural pesticides no longer work effectively. (Agriculture field officer, Kamalganj)

Most participants emphasised that natural formulations help preserve soil fertility and maintain ecological balance, whereas chemical agents often degrade land quality. Betel leaf (*Piper betle*) cultivation was identified as the principal agricultural activity among the Khasi population. Farmers reported two major diseases affecting this crop—root rot and leaf rot. A female participant, who assisted her family in farming, described the issue:

The main obstacle in cultivating betel leaf is root rot disease. There is no proper remedy. We use fresh cow dung on the affected areas; sometimes it works, but often it does not. If the disease persists, we remove the infected plants and submerge them in water. (Native Khasi woman)

In addition to pest management, ethnoveterinary and plant-healing practices were also evident. One participant described using cow-derived products to treat fruit tree infections:

If any fruit tree, like jackfruit or mango, is affected, we clean the infected bark and

apply fresh cow dung or cow urine. It works like a natural antibiotic (Native Khasi farmer)

Farmers also expressed concern about betel leaf's sensitivity to environmental fluctuations and synthetic chemicals. As noted by one cultivator in IDI:

We are very careful with betel leaf. It is very sensitive to temperature changes. If any tree in the boroj (betel leaf farm) is infected, it can destroy the whole garden. Researchers from Sylhet Agricultural University visited us several times to investigate root rot, but there is still no definitive cure. (Khasi betel leaf cultivator)

The findings indicate that Khasi farmers possess extensive Indigenous knowledge related to ethnomedicine for crop protection, which contributes significantly to sustainable agricultural practices. However, their geographically and culturally marginalised position limits both visibility and institutional support, constraining their ability to address persistent agricultural challenges such as betel leaf diseases.

### **Ethnomedicine for Domestic Animals**

According to observational notes, the Khasi people are not traditionally pastoralists. Their settlements are located on hilltops, where pastureland is scarce, making large-scale animal rearing difficult. The lack of adequate grazing areas remains the primary constraint limiting the development of pastoral practices. Nonetheless, for household consumption and as a supplementary source of income, Khasi families commonly rear small numbers of livestock such as pigs and cows.

Overall, pastoral activity within the Khasi community is limited, and consequently, the use of ethnomedicine for livestock is not widespread. Most respondents reported relying on modern veterinary interventions—such as vaccinations and antibiotics—for treating domestic animals. However, some traditional practices persist, particularly for common ailments.

Participants identified foot-and-mouth disease as one of the most prevalent livestock illnesses, affecting the hooves, mouth, tongue, and lips. According to local accounts, the disease typically occurs during cold spells or the rainy season. Despite the growing adoption of modern treatments, several farmers continue to use traditional remedies for this condition (Table 3). One farmer described the Indigenous treatment process during an interview:

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The first duty is to move the infected animal to a clean, bright, and breezy place. Then, the infected parts are washed with water boiled with neem, jujube, and mango leaves. After cleaning the area with a cotton cloth, the leaves of gada ful (marigold) are applied to the affected parts and bandaged with cotton

cloth for several days. (Native Khasi farmer)

This treatment is considered essential once an animal becomes infected. Some farmers also reported using a mixture of naphthalene and marigold leaves to prevent further infection.

According to participants, animals typically recover within two to five days following this treatment. Nevertheless, there is a growing tendency among Khasi livestock owners to rely on vaccination and antibiotic therapy for disease prevention and control.

**Table 3: Potential Medicinal Plants for Treatment of Prioritised Livestock Diseases among the Khasi Indigenous Community in Bangladesh**

Disease	Plant species	Habit	Part used	Used for
Foot and mouth disease	<i>Azadirachta indica</i>	Tree	Leaves	Animal
	<i>Ziziphus</i>	Tree	Leaves	Animal
	<i>Mangifera indica</i>	Tree	Leaves	Animal
	<i>Tagetes</i>	Herb	Leaves	Animal
Fungal	<i>Azadirachta indica</i>	Tree	Leaves	Trees and crops
Bone Fracture	<i>Costus speciosus (J. konig.) sm</i>	Herb	Root	Animal
Anthrax	<i>Senna occidentalis</i>	Herb	Leaves	Animal
	<i>Allium sativum</i>	Herb	Bulb	Animal
	<i>Albizia lebbbeck</i>	Tree	Bark	Animal
	<i>Piper nigrum</i>	Vine	Leaves	Animal
Brucellosis	<i>Allium sativum</i>	Herb	Bulb	Animal
Ectoparasite	<i>Azadirachta indica</i>	Tree	Leaves, Seeds	Animal
	<i>Annona squamosa</i>	Tree	Leaves	Animal
	<i>Khaya senegalensis</i>	Tree	Seeds, leaves, bark	Animal
	<i>Citrus maxima</i>	Tree	Fruit	Animal
	<i>Mentha pulegium</i>	Herb	Leaves	Animal
Endoparasites	<i>Allium sativum</i>	Herb	Clove	Animal
	<i>Cannabis sativa</i>	Herb	Leaves	Animal
	<i>Carica papaya</i>	Tree	Seeds, latex	Animal
	<i>Cucurbita maxima</i>	Creeper	Seeds	Animal
	<i>Ocimum sanctum</i>	Plant	Leaves	Animal

Source: Primary Data

**Influential Factors**

**Extensive Use of Chemical Pesticides**

Chemical pesticides have emerged as another significant factor contributing to the decline in the use of ethnomedicine in the study area. The data indicate that farmers are becoming increasingly dependent on chemical pesticides to enhance agricultural productivity. Explaining the reasons behind this growing dependency, a government agricultural field officer stated in a KII:

Currently, farmers are bound to use chemical pesticides. If one farmer uses chemical pesticides while the neighboring farmer relies on natural ones, the insects tend to migrate into the

neighbor’s field. The natural pesticide made from Neem does not work as effectively as before. Therefore, farmers feel compelled to use chemical pesticides to protect their crops from insects. (Agriculture Field Officer)

As a result, farmers—whether willingly or unwillingly—find themselves increasingly dependent on chemical pesticides. Reflecting on this shift, an elderly Khasi farmer expressed concern about the potential disappearance of traditional knowledge:

Within 10 to 20 years, the knowledge of natural pesticides will disappear, the attitude toward using them will disappear, the practice will disappear,

the importance of therapeutic plants will disappear, and finally, those trees may face extinction. (Khasi elder farmer)

The data suggest that the disappearance of therapeutic plants is occurring primarily due to their declining use and practice. This erosion of traditional plant knowledge and the loss of associated biological resources pose a significant challenge to the preservation and long-term sustainability of ethnomedicine in the region.

### **Increased Fertiliser Use to Boost Domestic Production**

The findings reveal that among local farmers (excluding betel leaf cultivators), there is a widespread belief that higher crop yields require increased use of chemical fertilisers. Consequently, Khasi farmers have become dependent on these inputs to ensure sufficient production.

Participants explained that once a farmer begins using chemical fertilisers or pesticides, continued use becomes inevitable. They described this situation during interviews:

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Participants explained that once a farmer begins using chemical fertilisers or pesticides, continued use becomes inevitable. They described this situation during interviews:

It becomes mandatory to use chemical pesticides once you have used them previously. After applying chemical pesticides, new types of insects appear in the field. When new crops are cultivated, new insects come, and over time, these insects develop stronger adaptation capabilities. In such cases, natural pesticides no longer work effectively, and the farmer faces a decrease in production. (Native Khasi Farmer)

The Khasi village headman and other farmers also discussed the advantages and drawbacks of

chemical inputs, emphasising that this dependency is a primary reason for choosing chemical products over traditional ethnomedicinal alternatives for crop protection. The findings suggest that once chemical pesticides are introduced, their continued use becomes inevitable, as new, more resistant insect populations emerge, rendering natural pesticides increasingly ineffective.

### **Losing Ethnomedical Plants**

Medicinal plants serve as the fundamental raw materials for traditional healing practices. However, their numbers are steadily declining, posing a significant threat to the preservation of ethnomedicine. One traditional practitioner described this situation:

Once, we had hundreds of medicinal plants that helped us treat illnesses. Currently, approximately one-fifth of those plants remain. Moreover, the availability of these therapeutic plants depends on the remoteness of the forest; the rarer species are found only in the deepest parts of the forest. (Khasi Native Physician)

This study found that the abundance of medicinal plants is rapidly decreasing. Although the Khasi people retain both knowledge of and a positive attitude toward ethnomedicine, its practical use has declined significantly compared with previous generations. As a result, the lack of regular practice has led to the gradual erosion—and in some cases, the disappearance—of valuable ethnobotanical knowledge.

### **Widespread Commercialisation of Modern Medication**

The findings indicate that the Khasi community possesses considerable awareness of livestock diseases and their corresponding treatments. During a key informant interview (KII), the Khasi Headman highlighted the community's growing familiarity with modern preventive measures:

Our farmers are aware of their cattle. They know that vaccinating livestock ensures protection for a season or even several years. In contrast, traditional

medicines take longer to show results and require further scientific exploration to validate their effectiveness. (Khasi Headman)

Participants further reported that approximately two decades ago, chemical pesticides and fertilisers were virtually unavailable in the region. In contrast, more than twenty shops now operate in the Kamalganj sub-district, selling a wide range of agricultural chemicals. The increasing accessibility and promotion of these commercial products have significantly influenced local agricultural and veterinary practices, contributing to a gradual shift from Indigenous ethnomedical knowledge toward modern, market-driven solutions.

#### **Adoption of modern education and decline of traditional healers:**

Education emerged as a key factor in the decline in EVM use within the Khasi community. The findings reveal that educated individuals are generally less inclined to rely on traditional healing practices, instead favouring modern medical and diagnostic systems. As one ethnomedicine specialist explained during a KII:

Ethnomedicine is mostly practised by elderly people and women who stay at home. Educated individuals have little faith in it; they are far more accustomed to modern diagnosis and treatment. (KII, Ethnomedicine Specialist)

Furthermore, educated mothers in the community were reported to encourage their children to seek modern medical care rather than rely on traditional plant-based remedies. Although the traditional healers, known as *Nong Sumar*, possess extensive knowledge of the appropriate use of therapeutic plants, their numbers and influence are rapidly declining. One traditional physician reflected on this generational shift:

I am a physician, and this has been our family profession for four generations. However, I do not want my son to continue this path. I believe he should pursue a profession that brings financial stability and respect. Moreover, my son

himself has no interest in ethnomedicine. (Native Khasi Physician, 2021)

Participants collectively expressed concern that traditional physicians serve as living repositories of ethnomedical knowledge. The decreasing number of practitioners, coupled with the growing preference for modern education and healthcare, threatens the intergenerational transmission of this knowledge and may ultimately lead to its disappearance.

#### **Discussion**

The Khasi are one of the prominent trees-crop-farming Indigenous communities in northeast Bangladesh. Our findings indicate that the first line of treatment for illness among the Khasi people—and their livestock—relies primarily on traditional EVM. Field observations revealed that knowledge and practice of EVM, including the use of medicinal plants to manage diseases and pests in humans and agriculture, have gradually declined across generations. The Khasi community identified accessibility, availability, sustainability, and affordability as key reasons for continued use of traditional medicine. However, our analysis suggests that a wide range of interrelated factors now shape the practice of EVM, contributing to its declining role as a primary healthcare system. These factors include the extensive use of chemical pesticides and fertilisers, the depletion of therapeutic plants, the commercialisation of modern medicines, the adoption of modern education, and the decline in the number of traditional healers.

Previous studies similarly note that the Khasi rely on traditional knowledge of plants and diseases to sustain their livelihoods through crop cultivation (Arnold & Dewees, 2013; Majumder, 2017; Zakaria & Majumder, 2019). Our data show that Indigenous Khasi farmers apply traditional treatments to manage livestock diseases and use plant-based preparations—such as extracts from leaves, roots, and bark—as natural pesticides. Neem water, for example, is widely used in their fields, a practice also documented in other Indigenous communities (Gabalebatse et al., 2013; SriBalaji & Chakravarthi, 2010). The most common

methods of preparing ethnomedicine include crushing (to extract sap or produce powder), chewing, and decoction, which aligns with findings from Southern Ethiopia (Kebebew & Mohamed, 2017). The resulting sap or powder is applied to animal wounds, infected crops, and fertilised farmland.

This investigation further revealed that the use of natural products helps maintain soil fertility among the Khasis. Farmers frequently apply limestone powder to preserve soil quality and prevent betel leaf root rot and fungal infections, consistent with findings from Bangladesh (Majumder, 2017). The Khasi also use fresh cow dung and cow urine as remedies for tree diseases. Fresh hot cow dung, in particular, is applied to prevent microbial infections in plants, a practice supported by earlier research (Brodt, 1999). Foot-and-mouth disease emerged as the most common livestock illness in the study area, affecting the hooves, mouth, tongue, and lips. According to participants, outbreaks typically occur during cold spells or the rainy season. While livestock are susceptible to various bacterial diseases, Indigenous communities often rely on plants with known antimicrobial properties (Adewuyi et al., 2014).

Although ethnomedicine was historically the primary healthcare system for the Khasi, the situation is changing rapidly. Our analysis revealed a broad spectrum of interconnected factors influencing EVM practices, ultimately rendering ethnomedicine a less dominant healthcare option (Figure 2). The core ingredient of ethnomedicine—therapeutic plants—is becoming increasingly scarce. Global deforestation is a major driver of this decline. According to the Food and Agriculture Organization (FAO), between 2015 and 2020 the world lost approximately 10 million hectares of forest annually, compared with 80 million hectares lost in 1990 (Food and Agriculture Organization (FAO), 2020). Bangladesh mirrors this trend: between 1990 and 2010, the country lost an estimated 52,000 hectares of forest, equivalent to 3.5% of its total forest cover (Staff, 2020). This environmental degradation poses a serious threat to the survival of therapeutic plant

species, many of which are integral to Indigenous ethnomedical practices.

Another major factor is the increasing preference for chemical pesticides over natural plant-based alternatives. Studies show that pesticide use in Bangladesh doubled during the 1990s (Rahman et al., 1995), and Asia now consumes more than half of the world's pesticide production (Nayak & Solanki, 2021). Although eco-friendly and microbial biopesticides are available in local markets, farmers overwhelmingly favour chemical pesticides due to their rapid action and strong pest-inhibitory effects (Kumar et al., 2021; Liu et al., 2021). Driven by the pressure to meet rising food demands, farmers often apply chemical pesticides intensively, without full awareness of their long-term impacts on soil fertility and human health.

Concerns about the accuracy and reliability of ethnomedicine also contribute to its declining use. Restoring trust in ethnomedicine requires scientific validation of therapeutic plants and their effectiveness in preventing severe disease outcomes (Madibela, 2017). Broader acceptance could be strengthened through the production of rigorous scientific evidence and its nationwide dissemination (Danø & Bøgh, 1999).

Despite offering valuable insights, this study has several limitations inherent to qualitative research. First, due to its ethnographic emphasis on depth rather than breadth, the research was conducted in only two Khasi villages in Kamalganj. The findings are therefore context-specific and should not be generalised to all Khasi communities or other Indigenous groups in Bangladesh. Nonetheless, the study documents the rapid decline of community-based ethnomedical knowledge. By capturing the lived experiences and practices of the Khasi people, it contributes to preserving Indigenous medical heritage and informs future research and policy efforts toward sustainable health and agricultural systems. Second, the study relied on self-reported narratives obtained through informal conversations and interviews, which may be subject to recall bias or selective disclosure. These challenges, inherent to oral

accounts, were mitigated by triangulating perspectives across multiple participants and methods. Third, the absence of quantitative measurement of ethnomedicine use or pharmacological testing of specific plants limits direct comparison with biomedical interventions; however, the study's aim was to privilege emic understandings rather than biomedical validation. Fourth, community perceptions of environmental change and medicinal plant availability were not corroborated through ecological or agronomic assessments. While this limits external verification, it nevertheless captures how local actors themselves experience ecological transformations. Finally, because fieldwork was confined to a single year, the study does not account for inter-annual variability or long-term shifts in practice—a common limitation of short-term qualitative investigations. Despite these constraints, the study advances understanding of the cultural and ecological drivers of ethnomedicine decline among the Khasi and highlights the need for future multidisciplinary and One Health-oriented research that integrates qualitative, quantitative, and longitudinal approaches.

### Conclusion

This study demonstrates that although the Khasi community continues to rely on traditional ethnomedicine and therapeutic plants, these practices are undergoing a rapid decline driven by ecological, cultural, and agricultural transformations. The findings underscore the potential of ethnomedicine as a valuable reservoir of therapeutic knowledge, particularly for future sustainable health and agricultural systems. Field evidence suggests that biopesticides derived from local plants could serve as viable alternatives to chemical pesticides, offering environmentally sustainable and cost-effective options for crop protection. However, systematic empirical research is needed to rigorously evaluate the efficacy of these natural pesticides across diverse cropping systems. Equally urgent is the documentation and preservation of ethnopharmacological knowledge to protect therapeutic plant species,

which are increasingly threatened. Clinical validation of traditional plant-based remedies would strengthen trust and legitimacy, facilitating their integration into broader healthcare frameworks. Furthermore, policy support from national institutions—such as the Ministry of Fisheries and Livestock—and scientific collaboration with research bodies like Bangladesh Agricultural University are essential to encourage Indigenous communities to conserve and revitalise therapeutic plant use. By coupling community engagement with multidisciplinary and One Health-oriented research, there remains a meaningful opportunity to regenerate ethnomedical practices and ensure their continuity for future generations.

### References

- Abo, K., Fred-Jaiyesimi, A., & Jaiyesimi, A. (2008). Ethnobotanical studies of medicinal plants used in the management of diabetes mellitus in South Western Nigeria. *Journal of Ethnopharmacology*, 115(1), 67-71. <https://doi.org/10.1016/j.jep.2007.09.005>
- Adewuyi, A., Fasusi, O. H., & Oderinde, R. A. (2014). Antibacterial activities of acetone extracts prepared from the seed oils of *Calophyllum inophyllum* and *Pterocarpus osun*. *Journal of Acute Medicine*, 4(2), 75-80. <https://doi.org/10.1016/j.jacme.2014.02.001>
- Anyinam, C. (1995). Ecology and ethnomedicine: exploring links between current environmental crisis and indigenous medical practices. *Social Science & Medicine*, 40(3), 321-329. [https://doi.org/10.1016/0277-9536\(94\)E0098-D](https://doi.org/10.1016/0277-9536(94)E0098-D)
- Arnold, J. M., & Dewees, P. A. (2013). *Farms Trees and farmers: Responses to agricultural intensification*. Routledge. <https://api.taylorfrancis.com/content/books/mono/download?identifierName=doi&identifierValue=10.4324/9781315071107&type=googlepdf>
- Baharvand-Ahmadi, B., & Asadi-Samani, M. (2017). A mini-review on the most important effective medicinal plants to treat hypertension in ethnobotanical evidence of Iran. *Journal of nephro pharmacology*, 6(1), 3.

- <https://doi.org/https://pubmed.ncbi.nlm.nih.gov/28197520/>
- Bangladesh Bureau of Statistics. (2011). *Population & Housing Census 2011*. DHAKA: Government of the People's Republic of Bangladesh. Retrieved from [https://bbs.portal.gov.bd/sites/default/files/files/bbs.portal.gov.bd/page/7b7b171a\\_731a\\_4854\\_8e0a\\_f8f7dede4a4a/PHC2011PreliminaryReport.pdf](https://bbs.portal.gov.bd/sites/default/files/files/bbs.portal.gov.bd/page/7b7b171a_731a_4854_8e0a_f8f7dede4a4a/PHC2011PreliminaryReport.pdf)
- Barkaoui, M., Katiri, A., Boubaker, H., & Msanda, F. (2017). Ethnobotanical survey of medicinal plants used in the traditional treatment of diabetes in Chtouka Ait Baha and Tiznit (Western Anti-Atlas), Morocco. *Journal of Ethnopharmacology*, 198, 338-350. <https://doi.org/https://doi.org/10.1016/j.jep.2017.01.023>
- Bartha, S. G., Quave, C. L., Balogh, L., & Papp, N. (2015). Ethnoveterinary practices of covasna county, transylvania, Romania. *Journal of Ethnobiology and Ethnomedicine*, 11(1), 1-22. <https://doi.org/https://doi.org/10.1186/s13002-015-0020-8>
- Benarba, B., Belabid, L., Righi, K., amine Bekkar, A., Elouissi, M., Khaldi, A., & Hamimed, A. (2015). Ethnobotanical study of medicinal plants used by traditional healers in Mascara (North West of Algeria). *Journal of Ethnopharmacology*, 175, 626-637. <https://doi.org/https://doi.org/10.1016/j.jep.2015.09.030>
- Bhuiya, S., Liza, Z. A., Islam, M. A., & Miah, M. S. (2025). An Exploratory Study on Factors Influencing the Decreasing Use of Ethnomedicine Among Indigenous Khasi Tribe in Bangladesh: A Qualitative Approach. *Journal of Population and Social Studies [JPSS]*, 33, 220-242. <https://doi.org/http://doi.org/10.25133/JPSSv332025.012>
- Bischoff, T., Vogl, C. R., Ivemeyer, S., Klarer, F., Meier, B., Hamburger, M., & Walkenhorst, M. (2016). Plant and natural product based homemade remedies manufactured and used by farmers of six central Swiss cantons to treat livestock. *Livestock science*, 189, 110-125. <https://doi.org/https://doi.org/10.1016/j.livsci.2016.05.003>
- Bishop, R. (1999). *Collaborative Storytelling: Meeting Indigenous Peoples' Desires for Self-Determination in Research*. <https://doi.org/https://eric.ed.gov/?id=ED467396>
- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77-101. <https://doi.org/https://doi.org/10.1191/1478088706qp063oa>
- Brodth, S. B. (1999). Interactions of formal and informal knowledge systems in village-based tree management in central India. *Agriculture and Human Values*, 16(4), 355-363. <https://doi.org/https://doi.org/10.1023/A:1007537809389>
- Bullitta, S., Re, G. A., Manunta, M. D. I., & Piluzza, G. (2018). Traditional knowledge about plant, animal, and mineral-based remedies to treat cattle, pigs, horses, and other domestic animals in the Mediterranean island of Sardinia. *Journal of Ethnobiology and Ethnomedicine*, 14(1), 1-26. <https://doi.org/https://doi.org/10.1186/s13002-018-0250-7>
- Calzetta, L., Pistocchini, E., Leo, A., Roncada, P., Ritondo, B. L., Palma, E., di Cave, D., & Britti, D. (2020). Anthelmintic medicinal plants in veterinary ethnopharmacology: A network meta-analysis following the PRISMA-P and PROSPERO recommendations. *Heliyon*, 6(2). <https://doi.org/https://doi.org/10.1016/j.heliyon.2020.e03256>
- Danø, A., & Bøgh, H. (1999). Use of herbal medicine against helminths in livestock: renaissance of an old tradition. *World Animal Review (FAO) Revue Mondiale de Zootechnie (FAO) Revista Mundial de Zootecnia (FAO)*. <https://doi.org/https://www.cabidigitallibrary.org/doi/full/10.5555/20000807867>
- Dixie, G., Hussain, M., & Imam, S. (2003). Medicinal plant marketing in Bangladesh, Dhaka. *Bangladesh: Interco-operation and South Asia Enterprise Development Facility*, 8-

22.  
<https://doi.org/https://doi.org/10.1186/1746-4269-9-19>
- Food and Agriculture Organization (FAO) (2020). *The state of the world's forest 2020* Retrieved 08/09/23 from <https://www.fao.org/state-of-forests/en/>
- Gabalebatse, M., Ngwenya, B. N., Teketay, D., & Kolawole, O. D. (2013). Ethno-veterinary practices amongst livestock farmers in Ngamiland District, Botswana. *African Journal of Traditional, Complementary and Alternative Medicines*, 10(3), 490-502.  
<https://doi.org/https://doi.org/10.4314/ajtcam.v10i3.16>
- Ghorbani, A. (2005). Studies on pharmaceutical ethnobotany in the region of Turkmen Sahra, north of Iran:(Part 1): General results. *Journal of Ethnopharmacology*, 102(1), 58-68.  
<https://doi.org/https://doi.org/10.1016/j.jep.2005.05.035>
- González, J. A., García-Barriuso, M., & Amich, F. (2010). Ethnobotanical study of medicinal plants traditionally used in the Arribes del Duero, western Spain. *Journal of Ethnopharmacology*, 131(2), 343-355.  
<https://doi.org/https://doi.org/10.1016/j.jep.2010.07.022>
- Hamilton, A. C. (2004). Medicinal plants, conservation and livelihoods. *Biodiversity & Conservation*, 13(8), 1477-1517.  
<https://doi.org/https://doi.org/10.1023/B:BIOC.0000021333.23413.42>
- Islam, A. R., Hasan, M., Islam, T., Rahman, A., Mitra, S., & Das, S. K. (2020). Ethnobotany of medicinal plants used by Rakhine indigenous communities in Patuakhali and Barguna District of Southern Bangladesh. *Journal of evidence-based integrative medicine*, 25, 2515690X20971586.  
<https://doi.org/https://doi.org/10.1177/2515690X20971586>
- Kebebew, M., & Mohamed, E. (2017). Indigenous knowledge on use of medicinal plants by indigenous people of Lemo district, Hadiya zone, Southern Ethiopia. *International Journal of Herbal Medicine*, 5(4), 124-135.  
<https://doi.org/https://www.florajournal.com/archives/2017/vol5issue4/PartB/6-3-17-801.pdf>
- Kovach, M. (2010). Conversation method in Indigenous research. *First Peoples Child & Family Review*, 5(1), 40-48.  
<https://doi.org/https://doi.org/10.7202/1071291ar>
- Kujawska, M., Klepacki, P., & Łuczaj, Ł. (2017). Fischer's Plants in folk beliefs and customs: a previously unknown contribution to the ethnobotany of the Polish-Lithuanian-Belarusian borderland. *Journal of Ethnobiology and Ethnomedicine*, 13(1), 1-15.  
<https://doi.org/https://doi.org/10.1186/s13002-017-0149-8>
- Kumar, J., Ramlal, A., Mallick, D., & Mishra, V. (2021). An overview of some biopesticides and their importance in plant protection for commercial acceptance. *Plants*, 10(6), 1185.  
<https://doi.org/https://doi.org/10.3390/plants10061185>
- Liu, X., Cao, A., Yan, D., Ouyang, C., Wang, Q., & Li, Y. (2021). Overview of mechanisms and uses of biopesticides. *International Journal of Pest Management*, 67(1), 65-72.  
<https://doi.org/https://doi.org/10.1080/09670874.2019.1664789>
- Madibela, O. R. (2017). A perspective on ethnomedicine research for livestock production: Focus on Botswana. *PULA: Botswana Journal of African Studies*, 31(2).  
[https://doi.org/https://www.researchgate.net/publication/340952580\\_A\\_perspective\\_on\\_ethnomedicine\\_research\\_for\\_livestock\\_production\\_Focus\\_on\\_Botswana](https://doi.org/https://www.researchgate.net/publication/340952580_A_perspective_on_ethnomedicine_research_for_livestock_production_Focus_on_Botswana)
- Mahishi, P., Srinivasa, B., & Shivanna, M. (2005). Medicinal plant wealth of local communities in some villages in Shimoga District of Karnataka, India. *Journal of Ethnopharmacology*, 98(3), 307-312.  
<https://doi.org/https://doi.org/10.1016/j.jep.2005.01.035>
- Majumder, N. M. (2017). Khasi traditional tree farming practice on pest and disease management in the Northeast uphill of

- Bangladesh. *Journal of Bioscience and Agriculture Research*, 15(01), 1238-1245.  
<https://doi.org/https://doi.org/10.18801/jbar.150117.152>
- Menale, B., De Castro, O., Cascone, C., & Muoio, R. (2016). Ethnobotanical investigation on medicinal plants in the Vesuvio National Park (Campania, southern Italy). *Journal of Ethnopharmacology*, 192, 320-349.  
<https://doi.org/https://doi.org/10.1016/j.jep.2016.07.049>
- Nayak, P., & Solanki, H. (2021). Pesticides and Indian agriculture—A review. *International Journal of Research -Granthaalayah*, 9(5), 250-263.  
<https://doi.org/https://doi.org/10.29121/granthaalayah.v9.i5.2021.3930>
- Piluzza, G., Viridis, S., Serralutzu, F., & Bullitta, S. (2015). Uses of plants, animal and mineral substances in Mediterranean ethno-veterinary practices for the care of small ruminants. *Journal of Ethnopharmacology*, 168, 87-99.  
<https://doi.org/https://doi.org/10.1016/j.jep.2015.03.056>
- Rahman, M., Malek, M., & Matin, M. (1995). Trend of pesticide usage in Bangladesh. *Science of the Total Environment*, 159(1), 33–39.  
[https://doi.org/https://doi.org/10.1016/0048-9697\(94\)04206-3](https://doi.org/https://doi.org/10.1016/0048-9697(94)04206-3)
- SriBalaji, N., & Chakravarthi, V. P. (2010). Ethnoveterinary practices in India-A review. *Veterinary world*, 3(12), 549.  
[https://doi.org/https://md.aiesec.org/BOOK=/kshortw/76435MQ/210126/ethnoveterinary\\_\\_practices\\_\\_in\\_india\\_a\\_\\_review.pdf](https://doi.org/https://md.aiesec.org/BOOK=/kshortw/76435MQ/210126/ethnoveterinary__practices__in_india_a__review.pdf)
- Staff, D. (2020). *Deforestation rate globally declined between 2015 and 2020: FAO report, While the world lost 178 million hectares of forest in the last 30 years, the rate of net forest loss declined.* *downtoearth*. Retrieved 08/09/23 from  
<https://www.downtoearth.org.in/news/forests/deforestation-rate-globally-declined-between-2015-and-2020-fao-report-71107>
- Tefera, B. N., & Kim, Y.-D. (2019). Ethnobotanical study of medicinal plants in the Hawassa Zuria District, Sidama zone, Southern Ethiopia. *Journal of Ethnobiology and Ethnomedicine*, 15, 1-21.  
<https://doi.org/https://doi.org/10.1186/s13002-019-0302-7>
- Telefo, P., Lienou, L., Yemele, M., Lemfack, M., Mouokeu, C., Goka, C., Tagne, S., & Moundipa, F. (2011). Ethnopharmacological survey of plants used for the treatment of female infertility in Baham, Cameroon. *Journal of Ethnopharmacology*, 136(1), 178-187.  
<https://doi.org/https://doi.org/10.1016/j.jep.2011.04.036>
- Yadav, M. L., Rajput, D. S., & Mishra, P. (2016). Ethno-veterinary practices among tribes of Banswara District of Rajasthan. *Indian Research Journal of Extension Education*, 15(2), 87-90.  
<https://doi.org/https://doi.org/10.56093/ijans.v9i9.109497>
- Yusuf, M., Begum, J., Hoque, M., & Chowdhury, J. (2009). Medicinal Plants of Bangladesh, Bangladesh Council of Scientific and Industrial Research. *Dhaka, Bangladesh*.  
<https://doi.org/https://doi.org/10.12691/plant-3-2-2>
- Zakaria, A., & Majumder, N. M. (2019). Are Khasis of Bangladesh Eco-Friendly Agro Manager? Reflections on Hill Farming Practices and Forest Conservation. *Journal of Science, Technology and Environment Informatics*, 8(1), 574–582.  
<https://doi.org/https://doi.org/10.18801/jstei.080119.59>

### Ethical Approval

The Members of the Master’s Thesis Committee and the Higher Study Committee, Department of Anthropology, Shahjalal University of Science and Technology, Sylhet-3114, Bangladesh, approved the research.

### Conflict of Interest

The authors confirm that no conflicts of interest exist. During the preparation of this manuscripts the author(s) used “Grammarly” in order to check the spelling and grammatical mistakes. After using this tool/service, the author(s) reviewed and edited the contents as

needed and take(s) full responsibility for the content of the publication.

### **Author Contribution Statement**

Saju Bhuiya conceptualised the manuscript and contributed to data curation, formal analysis, investigation, methodology, project administration, resources, software, validation, visualisation, writing – original draft preparation, and writing – review & editing.

Zafrin Ahmed Liza conducted data curation, investigation, project administration, supervision, validation, and writing – review & editing.

Md. Shahgahan Miah contributed to formal analysis, investigation, methodology, resources, supervision, validation, writing, review, and editing.

### **Informed Consent**

The information on obtaining consent from the research participants is detailed in the methodology section.

### **Funding**

This research received no specific grant from any funding agency, whether public, commercial, or not-for-profit.

### **Data Availability Statement**

The data collected for the research are presented in the manuscript.

### **Acknowledgements**

We sincerely thank the Indigenous Khasi people for their voluntary participation, time, and support throughout this study. We also acknowledge the administrative officers of the study area—including the Officer-in-Charge from the Forest Department, the Judicial Magistrate of this sub-district, and the headmen of the selected villages for granting us permission to conduct the research. Our gratitude extends to the Department of Anthropology, Shahjalal University of Science and Technology, Sylhet, Bangladesh, for providing the opportunity to carry out this study, as well as to the members of the master's thesis committee and higher study committee of this department for giving us the ethical permission of this research, and our mentors for their guidance. Finally, we are grateful to the anonymous reviewers of this manuscript for their valuable time, suggestions, and constructive feedback, which have strengthened and improved the presentation of this work.