An Exploratory Study on Factors Influencing the Decreasing Use of Ethnomedicine Among Indigenous Khasi Tribe in Bangladesh: A Qualitative Approach

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Abstract

This study aims to assess the institutional, social, individual, and environmental factors associated with the decreasing use of ethnomedicine among Khasi indigenous people. This qualitative study was conducted from January 2021 to December 2021 in two Khasi villages in Bangladesh. We conducted 48 informal conversations, 15 in-depth interviews, and five key informant interviews, with ongoing observations during fieldwork. Through the narrative of native people, several factors, such as institutional, social, cosmological beliefs, individual, and environmental factors, are associated with the decreasing use of ethnomedicine among Khasi indigenous people. Institutional factors include social forestation, land occupation for tea gardens, and land occupation for the reserve forest; social factors include cosmological belief, religious belief, trustworthiness, and longitude of medical care; individual factors influence education, medical accuracy, individual belief, and shortages of healers; environmental factors include the emergence of new diseases and losing therapeutic plants. Ethnomedicine could be a vital source of remedies for novel diseases (virus and bacteria-associated diseases). However, the matter of concern is that the use and significance of therapeutic plants are decreasing gradually. The results underscore the urgency of documenting ethnopharmacological data to conserve therapeutic plants, and clinical tests of therapeutic plants are needed to build trust in ethnomedicine.

Keywords

Bangladesh; ethnomedicine; Indigenous Khasi; traditional healer; therapeutic plants

Background

Ethnomedicine makes a significant contribution to people's primary health care worldwide. It is the traditional medicinal practice used by various ethnic groups to treat diseases, depending on geographical locations, stemming from indigenous traditional knowledge. Nowadays, people are more interested in ethnomedicine and medicinal plants than before to avoid the side impacts of allopathic drugs (Islam et al., 2020). Plants have always been important in ethnomedicine, and real-world data revealed that more than 50,000 out of 422,000 blooming plants are used for medical purposes (Hamilton, 2004; Kong et al., 2003). Statistics showed that more than 60% of the world's population and 80% of people in developing countries rely on ethnomedicine (Mussarat et al., 2014). Among the world population, indigenous people mostly rely on ethnomedicine frequently for treating their primary health care.

Indigenous people, particularly those in forest fringe populations, have a richer knowledge and practice of medicinal plants compared to those in plain land populations based on ecological, economic, and environmental sustainability (Raj et al., 2018). Indigenous people chose to use ethnomedicine because its cheap, easy to collect the raw materials, preserve, process, and handle rather than synthetic chemicals (Abo et al., 2008; Ghorbani, 2005; González et al., 2010; Islam et al., 2020; Mahishi et al., 2005; Telefo et al., 2011). Ethnomedicine was developed to treat illnesses with natural remedies such as roots, leaves, bark, seeds, fruits, flowers, and oil combination to treat health and diseases and also identify healthcare procedures and healing practices (Kokane et al., 2020; Lowe et al., 2000). Though the implication process of ethnomedicine differs from culture to culture, it has contextual patterns and values, especially for developing countries like Bangladesh.

Bangladesh is home to 54 indigenous communities and covers 2% of the population (Barman & Neo, 2014). Most indigenous people in Bangladesh live on the periphery and in hilly areas. Studies showed that Indigenous people have a common tendency to use ethnomedicine as a primary medication because of its availability and the far distance of their residence from health facilities (Abo et al., 2008; Faruque et al., 2018; Ghorbani, 2005; González et al., 2010; Mahishi et al., 2005; Telefo et al., 2011). Not only indigenous people, 80% of the mainstream population of Bangladesh also use therapeutic ethnomedicine for their primary treatment (Yusuf et al., 2009). Bangladesh has 6,000 therapeutic plant species, of which 500 are used for healing and curative purposes (Islam et al., 2020). For that reason, Bangladesh is known as a treasure house of various natural therapeutic plants. Still, researchers felt the lack of a systematic inventory of the rich diversity of therapeutic plants and the knowledge, attitude, and practice of ethnic medication (Dixie et al., 2003). Researchers are concerned that ethnomedicine knowledge and its use are under threat (Olsen & Larsen, 2003).

Further, these are not just the scenario of Bangladesh but also for other countries such as Nepal (Olsen & Larsen, 2003). In the era of change and development, there is hardly any innovation in ethnomedicine; eventually, the practice of ethno-medication is decreasing. Although the average success rate of captivating new medicines from botanical sources is 1 in 125 (Grifo & Rosenthal, 1997), and synthetic chemicals are about 1 in 10,000 (Chadwick & Marsh, 1994), people invest in synthetic medicine rather than ethnomedicine. The researchers are concerned that the knowledge of ethnomedicine is decreasing because of the increasing connection between modern civilization and indigenous culture, the passing of older tribal without transmitting their knowledge to the younger, migration due to social conflict, the introduction

of contemporary medication and synthetic drugs are thought to be a leading cause (Islam et al., 2020; Kong et al., 2003; Shrestha & Dhillion, 2003; Tefera & Kim, 2019). The researcher expressed why ethnomedical knowledge is decreasing. However, they hardly expressed the root cause of therapeutic plant use and the influential factors associated with reducing the use of ethnomedicine. Although the 16th principle of the National Health Policy 2011 of Bangladesh showed the significance of alternative medication and promised to reach it every door (Murshid & Haque, 2020), there were hardly practical actions taken.

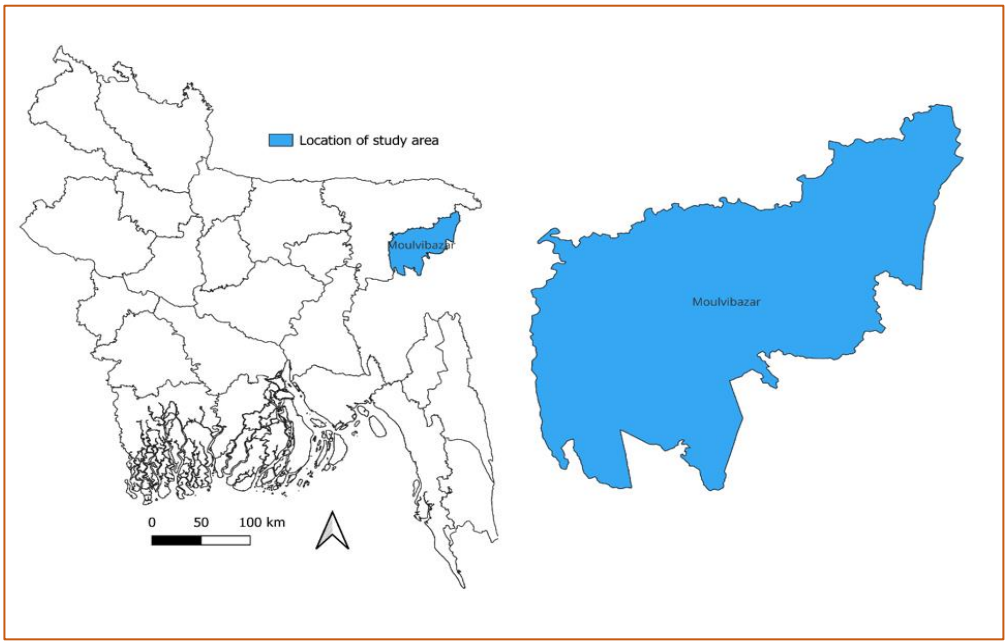
Identifying the factors associated with the decreasing use of ethnomedicine is significant to conserving therapeutic plants for ethnomedicine and establishing it as part of popular culture. The use of ethnomedicine as popular culture can help reach Sustainable Development Goal 3 (SDG 3) by providing primary care to the people of hard-to-reach areas, ensuring healthy lives, and promoting well-being for all by achieving Universal Health Coverage (UHC) (United Nations, 2023). By incorporating ethnomedicine into national health strategies, we can harness the strengths of traditional practices and modern medicine to create a more inclusive, effective, and sustainable healthcare system. These integrated medication facilities can play a vital role in achieving SDG 3 by improving health outcomes and ensuring all individuals have access to quality healthcare. Therefore, this study aimed to assess the institutional, social, individual, and environmental factors associated with decreasing the use of ethnomedicine among Khasi indigenous people.

Methods and materials

Study time and setting

This study was conducted through a qualitative approach from January to December 2021 in two Khasi villages, Lawyachara and Maghurchara, of Kamalganj Upazila (sub-district), Moulvibazar district, Sylhet division of Bangladesh (Figure 1).

Figure 1: Location of Study Area



Each of the villages is locally called "Punji." The Magurchara village comprises 155 people, and Lawachara village comprises 102 people. We selected these two villages because they are situated in the forest area and are the oldest villages in the region. The villagers have a professional variety, which helped to collect diversified data. We selected the Kamalganj sub-district as our study area because it is a hilly and forest area. Due to heavy rainfall, most forests in the study area are tropical evergreen rainforests. Like Khasi, many indigenous communities live here because of the fertile land, green fields, forest area, and one of the coolest weather in this country. The Khasi follow matrilineal property ownership. Every village in the community has a headman known as a *Montri*. For the peasants, the headman is the most dependable individual. Religiously, there are two categories of people: Christian and Nature Worshiper. Nonetheless, the number of Nature Worshipers is decreasing day by day.

Study population and sampling strategy

We conducted 48 conversations with Khasi people, ten in-depth interviews (IDIs) with natives and five IDIs with outsiders who know about Khasi people and these forest areas, five key informant interviews (KIIs) with two headmen and three traditional healers [*Nong Sumar*] because they have vast knowledge about the community, the perception of the community, row materials of ethnomedicine, the usefulness of ethnomedicine. During the fieldwork, observation was going on. We also engaged specialists with excellent knowledge about the Khasi community and their ethnomedicine. Inclusion criteria required that participants be between ages ≥ 18 and ≤ 55 so they would have ethnomedicine knowledge and could express their perspectives and experiences, know the Bengali language, live in selected villages, and participate voluntarily.

Table 1: Methodology and Participants

Method	Participant (N = 68)	Field Site
Conversation (n = 48)	Native Khasi People (n = 48)	Lawyachara village (n = 24)
		Maghurchara village (n = 24)
In-depth interview (n = 15)	Native Khasi People (n = 10)	Lawyachara village (n = 5)
		Maghurchara village (n = 5)
	Knowledgeable person (n = 5)	Moulvibazar (n = 5)
Key informant interview (n = 5)	Native Khasi People (n = 5)	Lawyachara village (n = 2)
		Maghurchara village (n = 3)

For this purpose, we invited people with a positive interest in revealing their personal and community experiences. The participants were purposefully enlisted, and the sample size followed the principle of data saturation, where a point is reached where no new data or dimension emerges in interviews (Braun & Clarke, 2006). To ensure the validity of the data, we used methodological triangulation. Our key informants help us to find knowledgeable people and cross-check data. The conversations were coded as CO_1, CO_2, CO_3, the IDIs with native Khasi people were coded as IDI_N_1, IDI_N_2, IDI_N_3 and IDIs with knowledgeable person were recorded as IDI_K_1, IDI_K_2, IDI_K_3, the KIIs were coded as KII_1, KII_2, KII_3.

Data collection procedures and techniques

For data collection in the study area, we sought permission from the government administrative authority and later from the headmen of the villages. We explained our aim and study procedure to the authority and the study population. We enrolled participants who agreed to volunteer participation and gave written consent. A research team of four members who graduated from anthropology and public health disciplines conducted the data collection procedure. These team members were trained in qualitative research methods and had extensive field involvement. Since Bengali is the common language between the researchers and the subjects, Bengali was used for all procedures in this study.

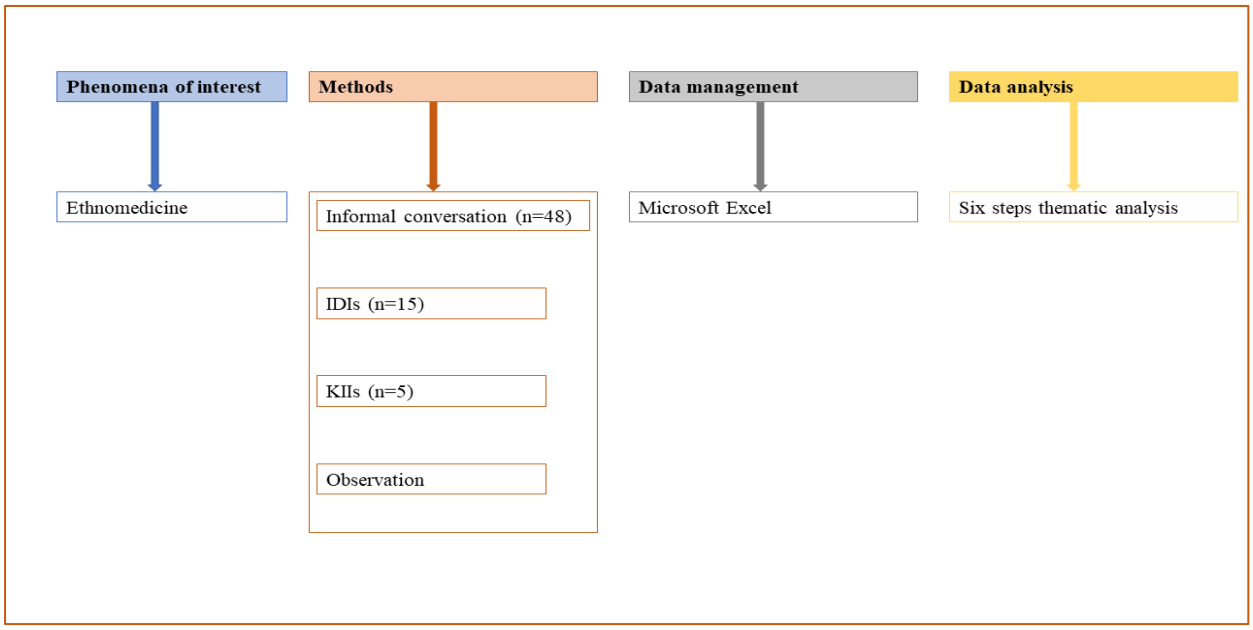
First, we conduct conversations with the natives. This method resembles what various Indigenous researchers globally call storytelling, yarning, talk story, re-storying, or re-mummering (Absolon & Willett, 2004; Bishop, 1999; Kovach, 2019). This informal conversation method helps establish good rapport (Kovach, 2019). Conversation methods are an informal way to understand a particular culture and its knowledge. In the conversation method, there are no strict bindings for formalities. If the headman permits the study to be conducted, there is no problem. We developed a checklist for this purpose. For an IDI, we developed an IDI guideline to explore the use of ethnomedicine and the influential factors associated with taking ethnomedicine as a healing procedure. One IDI took 45 to 60 minutes, and KII took 60 to 90 minutes.

In some cases, we conducted several follow-ups to gather missing data. During the fieldwork, we prepared detailed observation field notes. All the interviews and conversations were electronically recorded.

Data analysis

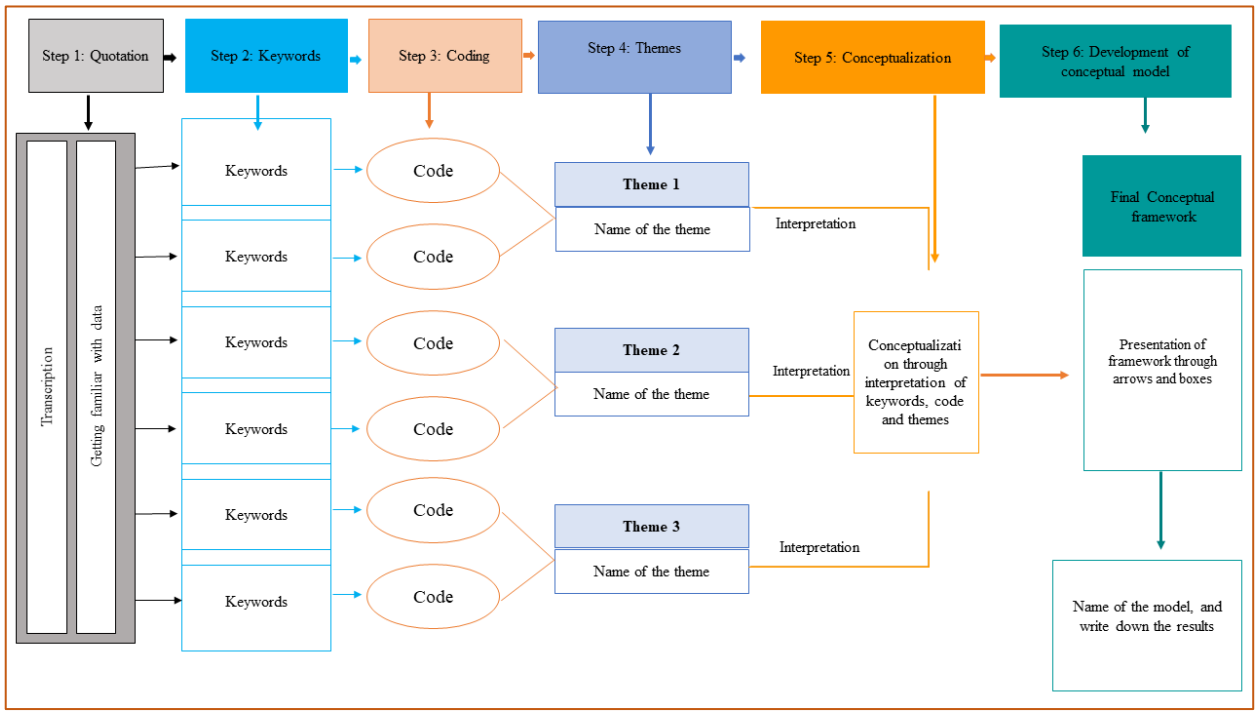
Audio-recorded data was transcribed verbatim and then translated into English. Two individual co-authors read again and again to familiarize themselves with the data. An open code list was generated following the major themes and sub-themes of the study. We used thematic analysis to analyze the textual data (Braun & Clarke, 2006), which was analyzed manually. The step-by-step process of the data collection and analysis procedure is visualized in Figure 2.

Figure 2: Data Collection to Data Analysis Procedure



When the code generation was completed, we addressed them in different clusters regarding sub-themes. Then, similar data was collated and analyzed thematically, following six steps of thematic analysis to develop a conceptual model and interpret the findings (Figure 3) (Naeem et al., 2023).

Figure 3: Six Steps Data Analysis Procedure for Thematic Analysis



Ethical considerations

The Higher Study Committee of the Department of Anthropology, Shahjalal University of Science and Technology, Sylhet, Bangladesh, approved this research on January 27, 2021. After obtaining ethical approval from the institute, we approached the local government and the headmen of the villages. We showed them our authorization from the department and the usefulness and associated risks of this study. Respective authority (Headmen and local administration [sub-district officer]) gave permission, and written informed consent was taken from each informant after clarifying the research objectives, voluntary nature of the participant, right to withdraw at any time during the interview and utilization of data in a further publication.

For illiterate participants, the informed consent was explained to the patient/guardian in the presence of a witness, and the witness's signature was also collected and dated to indicate that they witnessed the consenting process. If the respondent provided consent to participate in the study, a left-thumb impression of the respondent was collected. This project does not involve any therapeutic or novel interventions. However, we maintained the confidentiality of all participants' identification, access to data, and other records, which were restricted except for the research team, and we ensured that data was stored in a secure file. We developed participant identification numbers, which were removed before reporting the findings.

Results

Regarding the participants' sociodemographic characteristics, the data indicated that the participants were between the ages of 18 to 55. Table 1 shows that the mean number of conversation participants was 23 (SD $\pm$ 5) years, while it was 50 (SD $\pm$ 5) years for in-depth interviews (IDIs) and key informant interviews (KIIs). We also attached Bengali—the mainstream population of the country—with the main concerned population (Khasi). Most of the Khasi were Christians who lived on the hilltop in the forest area. Along with Christians, we enrolled Muslims and Hindus who had various professional and practical knowledge about ethnomedicine. To understand the ethnomedicine of the Khasi people, we selected some government officers working to improve the forest, some ethnomedicine specialists with intensive knowledge of ethnomedicine and Khasi people, and university professors who conduct studies in the Khasi community.

Table 2: Sociodemographic Characteristics of the Participants

Characteristic	**Method**		
	Conversation (n = 48)	IDI (n = 15)	KII (n = 5)
Age in year (mean $\pm$ SD)	23–50	50 $\pm$ 5	50 $\pm$ 5
Ethnic Identity			
Khasi	48	10	5
Bengali		5	
Gender			
Male	48	12	5
Female	18	3	
Religious Identity			
Christian	48		5

Characteristic	Method		
	Conversation (n = 48)	IDI (n = 15)	KII (n = 5)
Muslim	-	4	
Hindu	-	1	
Literacy			
Literate (At least Primary Pass)	31	10	2
Illiterate	17	5	3
Settlement			
Hilltop	48	10	5
Plain land		5	
Profession			
Agriculture	43	6	2
Government Job	3	5	
Academician and Local Knowledgeable person	2	4	3

Data was analyzed through these central themes and arranged in the ray of sub-themes. Regarding the thematic analysis, our data revealed four main factors determining the use of ethnomedicine among Khasi people.

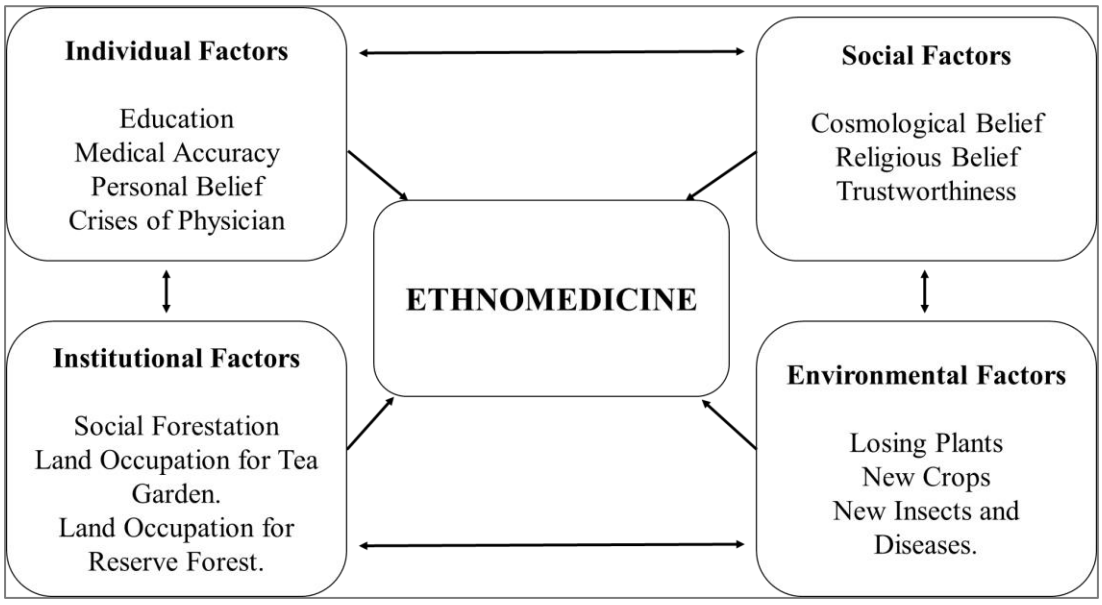
Table 3: Key Quotation of Study Participants Related to Factors Associated with the Use of Ethnomedicine

Broad theme	Sub-theme	Verbatim of study participant
Use of ethnomedicine	Belief	"People (like us) who live in the remote site of the forest do not have a proper communication and transportation system. We cannot afford modern medication (for distance and cost). We have to rely on ethnomedicine." (IDI_N_2, Older Khasi native)
		"We believe that, before taking medicine, if you take medicine faithfully, it will cure half of your diseases and the rest of half will be cured by nature, trees, and the healer [Nong Sumar]." (KII_1, Headman)
	Faith	"The headman [Montri] of our villages [punjis] is an educated man. He has a car also. He can take diagnostic treatment if he wants. But he is very much used to or likes to take traditional treatment. If he doesn't get sick badly, he takes ethnomedicine or traditional medicine." (IDI_N_1, Khasi farmer)
	Connection with nature	"Tree is our best friend. It fulfills our economic demand (Betel leaf cultivation), gives us shelter, provides food, and cures diseases. We believe in trees and have faith in traditional healers (physicians). That helps us to recover from our illness." (KII_2, Native healer)
Individual Factor	Education	"Educated people don't believe in prediction; rather, they have faith in facts. People in our village (punji) are educated and conscious. We tried to get appropriate medication. On the contrary, the assumption of Nong Sumar." (IDI_N_7, Native Khasi)
	Medical Accuracy	"Ethnomedicine is not accurate. It is used through prediction. Most importantly, we do not have enough plants for our remedy" (IDI_N_5, Educated new Khasi generation).
	Crises of healer	"The number of healers is decreasing in our area day by day because of decreasing patients, therapeutic plants, and income." (KII_1, Headman)

Broad theme	Sub-theme	Verbatim of study participant
Social Factor	Religious and Cosmological Belief	"Our ancestors were nature worshipers. They had a belief and faith nature. After the conversion to Christianity, people devoted themselves to the newly converted religion. Now they (Khasi) are more interested in allopathic (scientific) medication rather than the ethnomedicine." (KII_3, Native healer)
Institutional Factors	Social Forestation	"Due to social forestation, we lost more than half of our land and therapeutic plants." (IDI_N_3, Khasi farmer)
Environmental Factors	Losing plants	"Due to social forestation, tea garden, and natural disasters, we lose more than half of our therapeutic plants." (KII_4, Native healer)
	New crops, new diseases	"Due to new crops and various food habits, many new diseases are introduced in our community, but we don't have enough resources to experiment for remedy." (KII_2, Native healer)

Institutional factors, such as government and administrative officers, key stakeholders of the study area; social factors, which the community people regulate; individual factors, which are regulated by individual beliefs, knowledge, and practice; and environmental factors, which are all interrelated and interdependent with each other (Figure 4).

Figure 4: Conceptual Framework of Factors Associated With Decreasing Use of Ethnomedicine Among Indigenous Khasi People in Bangladesh



Use of ethnomedicine

In the indigenous Khasi community context, medication for human beings is the prime concern, and therapeutic plants are the raw materials. Table 4 shows the names of some common therapeutic plants frequently used by the study population. First, we portray the local name of the plants, then the scientific name of the plants, the utilized parts like roots, leaves, stems, seeds, fruit, and bark, then the ailments, and last of all, the methods of preparation or administration. The healer [Nong Sumar] told the Khasi names of the plants,

and Benedict, an indigenous Khasi-originated person and a graduate student of the Department of Botany from the University of Dhaka, helped us identify the plant.

Table 4: The List of Ethnomedicinal Plants, Their Utilized Part, Method of Utilization in Particular Diseases by Indigenous Khasi People in Bangladesh

Serial No	Local Name	Scientific Name	Family Name	Utilized Part	Disease	Method of use
01	Bon ada	Costus speciosus (J. konig.) sm	Costaceae	Root	Bone fracture	Crush the root with a bit of water, apply it to the affected area, and then bandage it.
02	Boroi, Kul	Ziziphus jujuba mill	Rhamnaceae	Leaf	Chickenpox	Clean and fresh leaves boil with water, and then clean the infected areas at least twice daily for 3 to 4 days.
03	Hijol	Semecarpus sub panduriformis wall	Anacardiaceae	Leaf	Bleeding with stool	Two tablespoonfuls of juice obtained from squeezed leaves are taken early in the morning on an empty stomach daily for 10 to 12 days at least.
04	Josti modhu	Licorice	Fabaceae	Root	Cough	Crush the root and mix the squeezed root juice with hot water, then drink the mixed water
05	Refusy lot, Shimul lot	Mikania cordata	Asteraceae	Leaf	To stop bleeding	The juice obtained from squeezed leaves is then applied to the wounded area.
06	Gada ful/ marigold	Tagetes	Asteraceae	Leaf	Minor skin injury or skin diseases	Squeeze the leaves, then apply them to the injured place.
07	Lojjaboti	Mimosa diplotricha	Fabaceae	Root	Toothache	Cleansing is done with a balmy decoction prepared from the root.
08	Neem	Azadirachta indica A. juss	Meliaceae	Leaf, root, fruit, seed	Cuts and allergies, child graying of hair.	Squeezed leaves are used for cuts and wounds.
09	Tej pata	Cinnamomum obtusifolium	Lauraceae	Bark	Coughs, hemorrhoids	The bark has to be soaked overnight in the water in a jar. The following day, one cup of water has to be taken on an empty stomach. This will continue until the cure
10	Tulsi	Ocimum tenuiflorum	Lamiaceae	Leaf	Coughs	Squeeze the leaves, then take them on an empty stomach every morning before sleeping until the cure.
11	Supari/ Betel Nuts	Areca Catechu L.	Arecaceae	Mild leaves and fruits	Ulcer, toothache	Smash the nuts and eat them.
12	Pudina	Mentha spicata	Lamiaceae	Leaf and roots	Cough, Fever, Cold Dysentery	Smash the leaf and roots. Drink the juice and drink it on an empty stomach.

Serial No	Local Name	Scientific Name	Family Name	Utilized Part	Disease	Method of use
13	Arjun	Terminalia arjuna w and A	Combretaceae	Bark	Dysentery and fever	Cut the bark into small pieces and keep it in the water for an entire night, then drink it on an empty stomach.
14	Bel	Aegle marmelos (L) Corr. Serr	Rutaceae	Fruit	Weakness, Diarrhea	Juice of the fruit

These are the common uses of therapeutic plants to heal the illness of indigenous Khasi people. Khasi Indigenous people said that now ethnomedicine is still a meaningful and lifesaving way for them—especially those who live in remote places in the forest. However, therapeutic plants and traditional medication are also significant for connecting individuals with their cultural beliefs and cosmological understanding of indigenous Khasi people. Additionally, older people are fond of using ethnomedicine because of their faith and belief in it, rather than the new generation. Simultaneously, participants explained that the Khasi people's lives are kept up by the gift of nature. Most of their daily needs are fulfilled by nature. However, participants expressed that these faiths and beliefs diminish daily. Our data revealed that the newly educated Khasi generation is not fond of ethnomedicine; instead, they express their interest in modern medication systems. The latest generation believes that poor communication and transportation are the main obstacles to taking modern medication. Similarly, one participant said,

> "*People (like us) who live in the remote site of the forest do not have a proper communication and transportation system. We cannot afford modern medication (for distance and cost). We have to rely on ethnomedicine*."
>
> (IDI_N_2, Older Khasi native)

Likewise, educated new generations think that people will use modern medication if they have excessed the modern/allopathic medicine. On the other hand, some participants revealed an opposite angle on this issue. For clarification, the participant illustrates the condition of the headman in this notion.

> "*The headman [Montri] of our villages [punjis] is an educated man. He has a car also. He can take diagnostic treatment if he wants. But he is very much used to or likes to take traditional treatment. If he doesn't get sick badly, he takes ethnomedicine or traditional medicine*."
>
> (IDI_N_4, older Khasi native)

However, our data revealed that the use of ethnomedicine depends on people's viewpoint and willingness. Nearly every person in Khasi villages uses ethnomedicine to heal their illness as primary health care.

Institutional factors

Social forestation through the "clear-felling method"

Field data explored that social forestation is a primary factor that influenced the decreasing use of ethnomedicine among the indigenous Khasi community. Participants claimed that most of their therapeutic plants are extinct because of the social forestation implemented in the study area. One participant mentioned this in an IDI:

> "*Our fourth generation does not have proper land ownership documents. They thought we lived here, so this is our place, our land. They had classified places or forest areas like one for Betel leaf cultivation, one for medicine, and one for wood.*"
>
> (IDI_N_6, Khasi farmer)

Participant further said that,

> *"In 1930, the government's people came here and said, 'This forest area is occupied by the government.' There was an act implemented by the Government authority to enrich forest resources. Without any kind of agreement, discussion, or concern, they took our land…*
>
> *At that time, our ancestors understood that the importance of a piece of paper was much more important than us and our existence…*
>
> *After losing our maximum land, ancestors made a communal document for us to stay here and some land to feed their child (us.)"*
>
> (IDI_N_6, Khasi farmer).

Participants said this is the story of land occupation in Khasi villages and other forests in Kamalganj Upazila (sub-district). Data claimed that the social forestation method threatened the Khasi people. Participants illustrated social forestation in this manner,

> "*In the name of social forestry, they cut all the big trees, and after cutting the big trees, they set on fire the certain forest area. When they burned the forest, the officer told them that it is a clear-felling method for better outcomes.*"
>
> (KII_5, Khasi headman)

The Khasi headman took seconds and smiled, then firmly replied,

> "*Do you think that after cutting and burning the forest, they can ever regenerate the thick forest? Today, the forest is good only on our land. The land occupied by the government is almost empty now. Government reserve trees only on the roadside and the tourist spot.*"
>
> (KII_5, Khasi headman)

Similarly, during the fieldwork, the Deputy Forest Officer (DFO) was in charge of Moulvibazar, Kamalganj area. He illustrated this factor in an IDI

> *"The land occupied by Khasi people has a deeper forest than the other side of the forest. Due to the lack of human resources, we have limitations in taking good care of the total land area; on the contrary, the Khasi people take good care of their land for their benefit."*
>
> (IDI_N_8, DFO)

The government officer and the native both expressed that the forest area under the Khasi people is in good condition. Participants explained that because of the 'clear-felling method,' all the shrubs are burned to establish social forestation, and the lion's share of therapeutic plants are worn in the shrubs.

Land occupation by the owner of the tea garden

Tea cultivation in this region was started when the British Empire occupied this land. The land occupied by the owners of tea gardens had emerged as a common factor associated with forest, therapeutic plants, and ethnomedicine in Khasi villages and all over the hilly area of the Kamalganj sub-district. The Khasi people expressed that the tea garden owner had good relations with the government and the police maker. In contrast, the natives had hardly any correlation with the mainstream people. They told us when the garden owner came to the burial land of the Khasi people, they (the garden owner) were ruthless. One participant explained this situation in this tune;

> "*First, the government occupied our land for the sake of the country, and then the garden owner grazed our land and therapeutic plants garden. We did not have enough workforce/ documents to protect our land. In the hands of the tea garden owner, we lost more than three-fifths of our land. Now the population is more than double, but the land is still as it was before.*"
>
> (IDI_N_9, Older Khasi farmer).

Participants expressed that after the tea garden owners occupied the land, the Khasi people lost their right to "this" forest area. Eventually, the participants commonly reported that;

> "*We could not go there where we played in our childhood, and we could not go there to collect wood or vegetables. We had no right to collect or take care of our therapeutic plants. The owner admits it as a "punishable crime." We were treated as criminals in our land!*"
>
> (IDI_N_10, Older Khasi native)

Our data revealed that although the landlord did not use most of the land, they made it 'forbidden' for the Khasi people, and the state land could be occupied only for this tea, causing the Khasi people to lose their maximum therapeutic plants. The Khasi people mention that the land grabbing by the tea garden owner affected their economy, medicine, and daily life.

Social factors

Cosmological belief and cultural norms

Cosmological beliefs and cultural norms influence every step of life in indigenous communities. The Khasi belief system was based on their religion of nature worship.

However, when they converted to Christianity, they had to believe in the cosmological knowledge of the newly adopted religion and the cultural practice, which reshaped their norms and values with the basis of the converted religion. The impact was not about religious conversion but new cosmological beliefs that influenced native knowledge about forests, cosmology, food habits, and healthcare.
One of our key informants, a native healer, explained about this religious conversion's effect on belief in an interview;

> "*Before the religious conversion, Khasi had been nature worshippers. They had faith in their nature and the plants. The healer was a respected person in the Khasi Community. Nowadays, they do not have enough faith in their plants and in the healer.*"
>
> (KII_3, Native healer)

Our analysis suggested that a change in cosmological belief influences not only medication or plants but also forests and every event and element of the forest in the study area. Khasi people's cultural beliefs, practices, myths, taboos, and other activities are closely connected with their religion. They state that when one changes religion, one must be devoted to a new belief and culture.

Medical accuracy and trustworthy viewpoints

Medical accuracy and trustworthy viewpoints are expressed as an ongoing influential factor in the use of ethnomedicine. By the flow of Khasi people, if anyone eats grass in faith, it may work. But if he doesn't believe it, the chance of a cure is like a dew drop. But there is a contradictory statement also. One participant stated that:

> "*Our bone dislocation (or break) treatment is good. It heals our pain and attaches the dislocated bones. But it is not 100% accurate. The healer does it under predictions.*"
>
> (IDI_N_11, Native Khasi)

Moreover, data revealed that the Khasi people abandoned their past beliefs. Nowadays, many natives depend on modern medicine.

Our findings showed that many people have diverted into modern medical treatment from ethnomedicine, decreasing their trust in ethnomedicine and its efficacy. On the other hand, the effect of ethnomedicine is slow. Nowadays, people want rapid health improvement. Ethnomedicine specialist Professor IDI_N_12 said,

> "*Ethnomedicine is very good for health. The side effects of ethnomedicine are very minimal. But today, people want visual change. Using modern treatment is less time-consuming and affects more quickly than ethnomedicine. It is also a big reason for the poor situation of ethnomedicine.*"
>
> (IDI_N_12 Ethnomedicine specialist)

The time-consuming statement arises as a very influential criterion for decreasing the use of ethnomedicine.

Individual Factors

Education

Participants commonly express education as a factor that influences the use of ethnomedicine. Education and ethnomedicine have a close relationship. Our data revealed that most educated people in the Khasi community are not interested in ethnomedicine. On the contrary, they depend on modern medical systems. Such notions were explained by an ethnomedicine specialist who is a professor of forestry and environmental science and conducted his PhD in the Khasi community, expressed in the following quote in an IDI,

> "*Ethnomedicine is used by the older people and the women who stay in the house. The educated people have fragile faith in ethnomedicine. They are much more used to modern diagnosis than traditional medicine.*"
>
> (IDI_N_12, Ethnomedicine Specialist)

The headman of Lawyachora village said,

> "*The educated mother of the village encourages their children to use modern medication rather than the traditional therapeutic plants*."

Participant IDI_N_12, an Ethnomedicine Specialist, agreed with the statement and expressed that mainstream education influences mainstream medicine and educated guardians encourage their children to take allopathic medicine.

Limitation of Khasi traditional healer (Nong Sumar)

Our participant illustrated that not everyone in the Indigenous communities is good at processing and using ethnomedicine. Some people have good experience and knowledge in ethnomedicine; they are called Nong Sumar (Khasi healer). The Khasi healer achieved the qualities and skills through hard work and blessing of older people. Our data explore the healer's rule in ethnomedicine as a bridge among plants, knowledge of plants, and their use and healing. However, data show that the importance of healers is diminishing daily, and the healers are not interested in this profession. One of the Khasi healers said,

> "*I am a traditional Khasi healer. It is our fourth generation's profession. But now, I do not want my son to be a traditional Khasi healer. He is a college boy. I think he will settle in the town (city) and do a better job from which he can earn enough, and most importantly, my son is not interested in ethnomedicine.*"
>
> (KII_2, Native healer)

Participants agreed that the traditional Khasi healer is a living storage of knowledge about plants and their use. With the decreasing numbers of healers, Khasi people worry that the knowledge of plants and ethnomedicine will become extinct. Our data revealed that the more they are attached to education, the less they are involved in traditional knowledge.

Environmental factors

New disease

Khasi people expressed that they do not know how to face novel diseases such as COVID-19 with their fragile medical system. One of our informant (IDI_N_12, Ethnomedicine Specialist) said that,

> "*Day by day, the significance of therapeutic plants and their use are decreasing. The major cause of the decrease is the shortage of research and inventions. We have hardly found any new use of therapeutic plants in several research studies in different geographical areas of Bangladesh. On the contrary, due to adverse climate and environmental pollution, new diseases are spreading worldwide. The native healer doesn't have enough knowledge and materials to provide the remedy of arisen diseases.*"
>
> (IDI_N_12, Ethnomedicine Specialist)

The key informants express that, to invent new remedies, it is necessary to continue scientific research on therapeutic plants. They also said that to increase people's interest in ethnomedicine, we can conduct social awareness about the benefits of ethnomedicine.

Losing plants

Khasi people expressed that they do not know how to face those novel diseases with their fragile medical system and poor storage of therapeutic plants. The Khasi healer explained that,

> "*Once, we had hundreds of therapeutic plants. We had a self-reliant medical system. But nowadays, our ethno-medication is in a fragile situation. For global warming, land occupation, and the greed of humans, we lose many plants.*"
>
> (KII_4, Native healer)

Participants expressed that they could not treat previous or known diseases because of the shortage of plants and how they could cure new diseases. Our data revealed that this factor influences people's trust in ethnomedicine.

Discussion

This study underscores that the Khasi people are dependent on forests for their daily lives. They live in the forest, and most of their daily necessities are fulfilled by forest resources. In the age of modernization and hybrid culture, they are faithful and depend on the forest for drinking water and medicine. Everyone in the villages [*punjis*] depends on ethnomedicine for at least their first aid. Ethnomedicine is the primary medication for all. However, the scenario is changing nowadays. Our analysis revealed a broad spectrum of factors that influenced Khasis ethnomedical practice, which led to ethnomedicine as a suboptimal health care system. Our data showed that these factors are interrelated and interconnected. Social forestation, land occupation by the tea garden owner, cosmological belief and cultural norms, medical

accuracy, trustworthiness, education, and scarcity of healers were the key reported factors that influenced Khasi's ethnomedicine.

In 1927, the British Indian government published a forest act restricting indigenous people's longstanding rights. For the indigenous people, the forest was their sanctuary. Forest supported them with economic, social, and religious nourishment. The activities in the forest were restricted in the forest area, and the Indigenous forest people lost their forest, which also impacted the flora and fauna of this region (Mukherjee, 2016). Restriction and prohibition in the forest area are prominent causes of the loss of plants and medicinal plant gardens by the indigenous people, especially the northeastern Khasi people. It was noted that the authority conducted a clear-felling method to establish social forestry. In this method, the shrubs are burned, and the plants are planted in the dry land. For this clear-felling method, most therapeutic plants and gardens of therapeutic plants were burned.

Therapeutic plants are the raw material of ethnomedicine. Any condition that causes the scarcity of therapeutic plants is also responsible for the decrease in the use of ethnomedicine. When people do not find appropriate medicine due to a shortage of therapeutic plants, they naturally move on to another source of medication. In this section, land occupation by the tea garden owner in Kamalganj, mainly the Khasis living place, plays a harsh role. Though the tea garden was established in Bangladesh in 1840 and commercially in 1857 (Cortesi, 2018), the tea estate owner still craves Khasi land. The Daily Star (2015), a prominent newspaper in Bangladesh, reported that the Khasi people of Jhimai village were guarding their houses and fearing eviction by a local tea garden authority. Because of the land occupation of the tea garden owner, the Khasi people lost their organized garden of therapeutic plants, as expressed by the study people.

Not every factor comes from outside intervention. Some are also generated from their own; one individual factor is their cultural beliefs and norms. Data showed that Khasi were mostly nature worshipers, but after the conversion of Khasi people to Christianity, they gravitated to Christian ideology from nature worshipers. They tried to practice their new religious aspect when devoted to Christian ideology. The belief in nature and love of nature stay on the back foot because ethnomedicine's magico-spiritual and spiritual elements greatly impacted its use (Anyinam, 1995). Like many other indigenous communities, the Khasi people believed in nature and the spiritual sacredness of plants when they were nature worshipers (Anyinam, 1995). According to the findings, when the Khasi people converted to Christianity, they lost their faith in nature and, in many aspects, ethnomedicine. For that reason, the importance of plants and ethnomedicine diminishes daily.

In the route march of decreased ethnomedicine, the extinction of therapeutic plants may play another notable role. Scientists are concerned that world forests and therapeutic plants are declining. The Food and Agriculture Organization (FAO) and United Nations Environment Programme (UNEP) (2020) stated that between 2015 and 2020, deforestation was estimated at 10 million hectares per year. On the other hand, 80 million hectares of forest decreased in 1990. With the world's rhythm, Bangladesh also joins the race of deforestation. According to the FAO and UNEP (2020), between 1990 and 2010, Bangladesh lost 2,600 hectares or 0.17% per year. From 1990 to 2010, Bangladesh lost 3.5% of its forest, 52,000 hectares (DownToEarth, 2020). This deforestation of forests and endemic process of therapeutic plants create a scarcity of ethnomedicine and limit its multiverse options, which work as a push factor to demoralize ethnomedicine. Its accuracy is another potential factor influencing the Khasi people and others in the study region to avoid ethnomedicine. Though human civilization is developing every second, on the contrary, the knowledge, practice, and innovation of ethnomedicine still

belong to Khasi's ancestors. The accuracy of ethnomedicine is unsatisfactory for the natives. This also discourages people from being used to ethnomedicine, and their religious conversion fuels their discouragement.

Khasi's ancestors were nature worshipers. They lived in nature by the gift of nature. But when the missionary people come, they advise them to convert to Christianity. When they convert to Christianity, they have to believe in Christian ideology. Their increasing socioeconomic and cultural transformation led to a decrease in the ability of indigenous resources, which ultimately resulted in the reduction of native knowledge (Kunwar et al., 2016). Cultural beliefs, practices, myths, taboos, and other activities are closely connected with their religion, which helped protect and conserve their forest area, therapeutic plants, and use (Pramanik, 2018). When one changes religion, they are also devoted to a new belief and culture. In the dimension of traditional healing of illness, the spiritual component is essential (Krippner, 2008; Morley & Wallis, 1978).

The mode of education reshapes a person's knowledge, attitude, and practice. Nowadays, Khasi people are educated by the mainstream Western education system. Their belief is also in Western medical science and is diverted from the traditional medication system. These findings are consistent with a study conducted in the Bolivian Amazon, which demonstrated that the partial adoption of Western medicine and stigmatization of traditional diets was attributed to the erosion of ethno-medicinal knowledge among young Tsimane' men in Bolivia (Reyes-García et al., 2014). Moreover, the younger and educated populace is unused to traditional medicine and no longer has value in it. This is happening in Bangladesh and other countries like the Mien (Yao) in northern Thailand (Srithi et al., 2009) and Kenya (Bruyere et al., 2016), which are also experiencing this situation. In Lençóis, Bahia, Brazil, the younger generation is knowledgeable about the historical uses of plants. Still, they do not actively apply this knowledge and are doubtful they will do so in the future (Voeks & Leony, 2004). Several studies have discovered consistent evidence indicating a negative correlation between traditional ecological knowledge or utilization of therapeutic plants and formal education (Srithi et al., 2009; Voeks & Leony, 2004; Wyndham, 2010). This factor threatens the future of ethnomedicine in the Khasi community of Bangladesh and other countries.

In the conversion of the circumstances of ethnomedicine, climate change plays a vital role. The current environmental emergency facing the globe is co-related with therapeutic plants and ethnomedicine (Hazra & Hussain, 2009). Of this increasing global warming, plant species reflect the response by decreasing species diversity because of the change in plants' functional group or shifting their habitats (Körner, 1998; Krajick, 2004; Parmesan & Yohe, 2003; Watson et al., 1997). The declining availability of therapeutic plants contributes to a raw material crisis in ethnomedicine. Moreover, the rise of new diseases is also a significant factor in reducing the use of ethnomedicine, particularly in Bangladesh. In the world context, China, India, Africa, and some European countries use ethnomedicine to prevent and control the COVID-19 pandemic (Li et al., 2020). Still, there is no specific ethnomedicine for the SARS-COV-2 pandemic in the Khasi community, as well as other regions of Bangladesh. When the consumers of ethnomedicine are not treated with ethnomedicine, they will be moved on. Like supply chain management, when the raw material and consumer decrease, the production and the workers also decrease. For that reason, indigenous healers/physicians are shifting from these professions daily.

One of the major concerns is that most indigenous knowledge, including their knowledge of ethnomedicine, is unwritten (Aprilio & Wilar, 2021; Pramanik, 2018). It is transmitted from one generation to another generation by oral medium. This dropout of healers will play a

devastating role in their ethnomedicine and the overall traditional knowledge of the Khasi people.

In the Khasi community, most people use ethnomedicine because it is cheaper and accessible to collect. However, due to rapid industrialization and urbanization, ethnomedicine faces the threat of being displaced by Western medicine, leaving many people uncertain about health care (Hazra & Hussain, 2009). Ethnomedicine can play a vital role in ensuring the health security of mass people. There is a great chance to discover new drugs from the therapeutic plants traditionally used worldwide (Cox et al., 1989; Lewis, 1992; Moerman, 1991; Phillipson & Anderson, 1989; Schultes & Raffauf, 1990; Turner & Hebda, 1990). In this process, the first step is to conserve and regenerate the therapeutic plants. However, it is fundamental to make proper documentation to conserve and regenerate therapeutic plants and ethnomedicine. Frequently, there is insufficient scientific documentation of the indigenous knowledge of therapeutic plants in Bangladesh and other countries. A study conducted among the Red-headed Yao in China found that out of 110 species of herbs used for therapeutic baths, only 5% had previously been recognized for their medical characteristics.

Additionally, 79% of the species were newly discovered to have medicinal benefits when used in baths (Li et al., 2006). A deep understanding of how local communities utilize medicinal plants can be a valuable foundation for conducting phytochemical, pharmacological, and clinical research (Srithi et al., 2009). This research is crucial in ensuring the sustainable and sensible utilization of these plants as a valuable resource. The findings of this research will help policymakers who want to regenerate and conserve therapeutic plants by enlightening them on the factors associated with therapeutic plants and ethnomedicine. However, the influence of these factors on the utilization of ethnomedicine can vary among different communities. Therefore, examining the depth of these impacts on a community-specific level is necessary to identify the most effective approaches for promoting ethnomedicine and preserving medicinal plants in a specific region.

The major limitation of this study is to get excess in every household because of the SARS-CoV-2 pandemic. We conducted our data collection during the pandemic. The entry of outsiders into some households was forbidden because of the SARS-CoV-2 pandemic and the phobia of infection.

Conclusion

Traditional medicines and healing systems have been essential for indigenous communities living in remote areas of the country, who have largely been excluded from the modern healthcare system. This study identified several factors contributing to the decreasing use of ethnomedicine, including a younger generation's lack of appreciation for traditional medicine and the unreliability of traditional medical knowledge. It is crucial to thoroughly record and publicize medicinal plant knowledge among the young Khasi generation. This will help increase their understanding and respect for their traditional values and promote the conservation and sustainable use of these medicinal plants. Additionally, it will ensure that the traditional medical knowledge within their community remains alive. This study shows that the indigenous Khasi people still rely on traditional medicine and therapeutic plants. However, the use and significance of therapeutic plants are decreasing gradually. Ethnomedicine could be a vital source of remedies for novel diseases. The result also shows that it is urgent to document ethnopharmacological data to preserve therapeutic plants and

save them from vanishing. The clinical test of the traditional use of therapeutic plants is needed to bring trust in ethnomedicine.

Further research can encourage the continued use of medicinal plants. Incorporating ethnomedicine into national health strategies can enhance healthcare by combining traditional and modern practices. This integration can improve health outcomes, ensure quality care for all, and support the achievement of SDG 3. The Ministry of Fisheries and Livestock of Bangladesh can persuade indigenous people to use ethnomedicine and encourage the conservation of therapeutic plants, creating a chance to conserve these plants and continue traditional medication practices.

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