Indigenous medicinal plant knowledge of the Santal ethnic group in Rajshahi and Chapainawabganj Districts of Bangladesh

Najmun Naher, Bholanath Mondal, Mritunjoy Mojumder, Shahida Taher

Correspondence

Najmun Naher[1]*, Bholanath Mondal[2], Mritunjoy Mojumder[3], Shahida Taher[4]

[1]Department of Botany, Faculty of Biological and Earth Sciences, National University, Gazipur-1704, Bangladesh.
[2]Department of Plant Protection, Palli-Siksha Bhavana (Institute of Agriculture), Visva-Bharati University, West Bengal, India.
[3]Department of Geography and Environment, Faculty of Biological and Earth Sciences, National University, Gazipur-1704, Bangladesh.
[4]Department of Home Economics, Faculty of Biological and Earth Sciences, National University, Gazipur-1704, Bangladesh

*Corresponding Author: najmunsmriti@gmail.com,najmun.nahar@nu.ac.bd

Ethnobotany Research and Applications 34:35 (2026) - http://dx.doi.org/10.32859/era.34.35.1-17
Manuscript received: 30/03/2026 - Revised manuscript received: 05/05/2026 - Published: 07/05/2026

Research

Abstract

Background: The Santal community is one of the largest indigenous groups in Bangladesh and has a long history of using plants to treat different illnesses. The main objective of the study was to record the medicinal plants used by the Santal people of the Rajshahi and Chapainawabganj districts of Bangladesh. Systemic documentation aims to preserve indigenous knowledge and support health promotion and disease prevention.

Methods: Information was collected through interviews with local healers and community members.

Results: In total, 61 plant species from 39 families were identified to cure 49 diseases. Leaves were found to be most frequently used part owing to 54.38%, followed by roots, barks, stems, fruits, and flowers. These plants are used to treat common problems like diarrhea dysentery, stomach pain, jaundice, cold and cough, skin infections, and women's health issues. The study shows that the Santal people have valuable knowledge about local plants.

Conclusions: However, this traditional knowledge is slowly disappearing because of modern lifestyle changes and a lack of interest among younger people. This research highlights the importance of protecting both the plants and the traditional knowledge for future generations.

Keywords: Santal community, ethnomedicinal plants, traditional knowledge, Rajshahi, Chapainawabganj

Background

Medicinal plants have been an essential component of healthcare systems for indigenous communities worldwide, serving as primary remedies for various ailments and embodying rich cultural heritage (Balick & Cox 1996, Fabricant & Farnsworth 2001). In Bangladesh, the Santal community is one of the largest indigenous groups, primarily residing in the northwestern

districts such as Rajshahi and Chapainawabganj. Due to limited access to modern medical facilities, Santals heavily rely on traditional medicinal plants for treating common diseases, including fever, gastrointestinal disorders, respiratory infections, skin conditions, and wounds (Chowdhury *et al.* 2013, Hossain *et al.* 2020).

Traditional healers within the Santal community, often called "Ojha" or "Bodhi," possess specialized knowledge about local flora and their therapeutic applications, which has been transmitted orally through generations (Saha & Rahman 2016, Khan *et al.* 2017, Das & Roy 2016). The use of ethnomedicinal plants plays a critical role not only in healthcare but also in preserving the community's cultural identity and relationship with the natural environment (Islam & Hossain 2016, Das & Bhowmik 2017).

Despite their significance, Santal ethnomedicinal practices face increasing threats from deforestation, environmental degradation, and socio-economic changes such as urbanization and modernization, which lead to habitat loss and the erosion of traditional knowledge among younger generations (Rahman *et al.* 2015, Nath *et al.* 2014). Moreover, insufficient documentation of these practices further risks their disappearance.

Conservation of both the biological diversity of medicinal plants and the cultural knowledge of their use is vital. Integrating ethnomedicine with modern healthcare could enhance treatment accessibility, affordability, and cultural appropriateness in rural areas (Sarker *et al.* 2019, Paul & Biswas 2018). Therefore, systematic documentation and analysis of the Santal community's medicinal plant use are essential steps toward safeguarding this invaluable indigenous heritage. The objective of this study is to document and analyze the medicinal plants used by the Santal community in the Rajshahi and Chapainawabganj districts of Bangladesh, with a focus on their traditional knowledge, preparation methods, and therapeutic applications.

Materials and Methods

Study area

The research was conducted in the Rajshahi and Chapainawabganj districts of northwestern Bangladesh, where the Santal community is predominantly settled. This area is geographically located at approximately 24°07'N to 24°40'N and 88°15'E to 88°40'E, with elevations ranging from about 15 m to 35 m asl. It has a tropical monsoon climate, hot summers (32–36 °C), cool winters (10–16 °C), moderate rainfall, alluvial Barind clay soils, and an agro-riverine environment dominated by agriculture. These districts feature a rural landscape with limited access to formal healthcare services, making traditional medicine vital for the local population (Fig. 1).

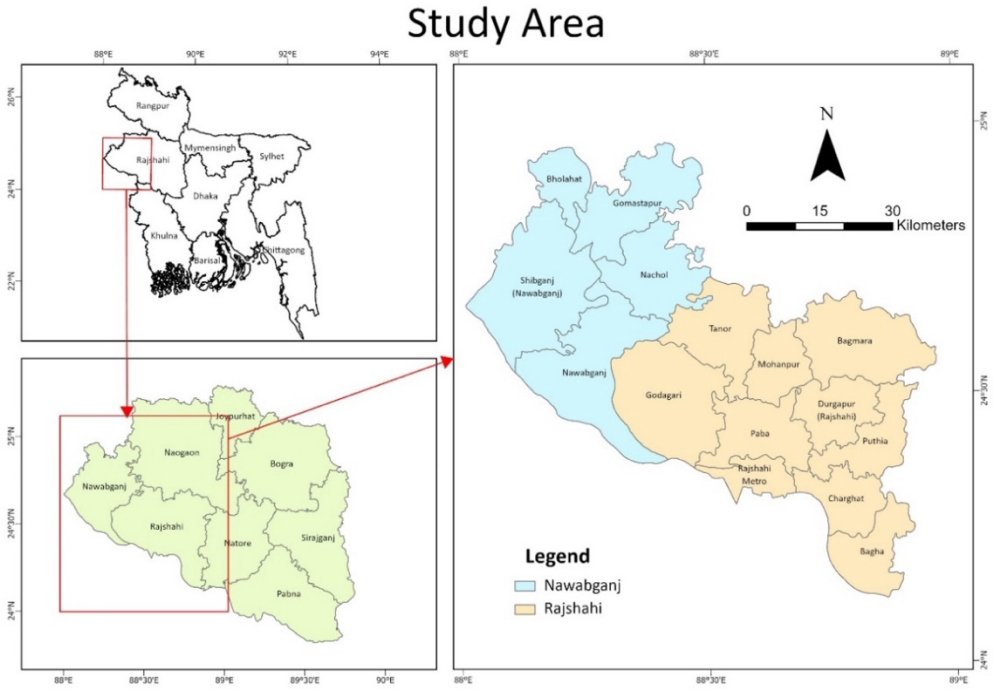

Figure 1. Study area of the Santal Ethnic Group in Rajshahi and Chapainawabganj Districts of Bangladesh

Sampling and Data Collection

Ethnobotanical data were collected through field surveys and direct interviews with knowledgeable informants from the Santal community. A purposive sampling method was adopted to identify knowledgeable individuals, including traditional healers (Ojhas), elderly community members, and herbal practitioners. A total of 150 respondents were interviewed. Participants were selected based on their experience in using or preparing medicinal plants for treating various ailments. Semi-structured questionnaires and guided field walks were employed to gather information on medicinal plants, including local names, parts used, preparation methods, and ailments treated. Plant specimens mentioned by informants were collected for identification.

Plant Identification

Collected plant samples were identified using standard botanical references and verified at the Bangladesh National Herbarium. Voucher specimens were prepared and deposited for future reference.

Data Analysis

Qualitative data on plant usage were categorized according to ailments treated and methods of preparation. Quantitative analysis included calculating the frequency of use and consensus among informants regarding particular plants.

Results

Medicinal plants use by Santal tribe of Bangladesh

The medicinal plant parts used by the Santal community of Bangladesh are summarized (Tables 1). The plant samples used by the Santal tribe were collected and identified by following relevant literature according to families, genera, and species. Santal local medicinal practitioners did not disclose everything, such as the preparation of medicine and dosage of administration. Common Santal people share their ethnomedicinal knowledge in open group discussions and their daily needs based on medication collected from nearby forests or household medicinal plants.

Medicinal plants recorded and their distribution into families

Ethnobotanical survey was conducted in the Rajshahi and Chapainawabganj districts of Bangladesh during July 2023 to December 2023 (Fig. 2). The present field survey has recorded a total of 61 ethnomedicinal plants belonging to 60 genera and 39 families (Fig. 3, Table 1) used by the Santal tribal healers and other Santal men and women in Bangladesh. The distribution of plants within families shows variation. The family Fabaceae is represented by the highest number of species (6 species), followed by Euphorbiaceae (4 species), Amaranthaceae, Apocynaceae, Cucurbitaceae, Rutaceae, Solanaceae (3 species each), Acanthaceae, Malvaceae, Verbenaceae, and Zingiberaceae (2 species each), and the rest of the 28 families are represented by single species (Fig. 3).

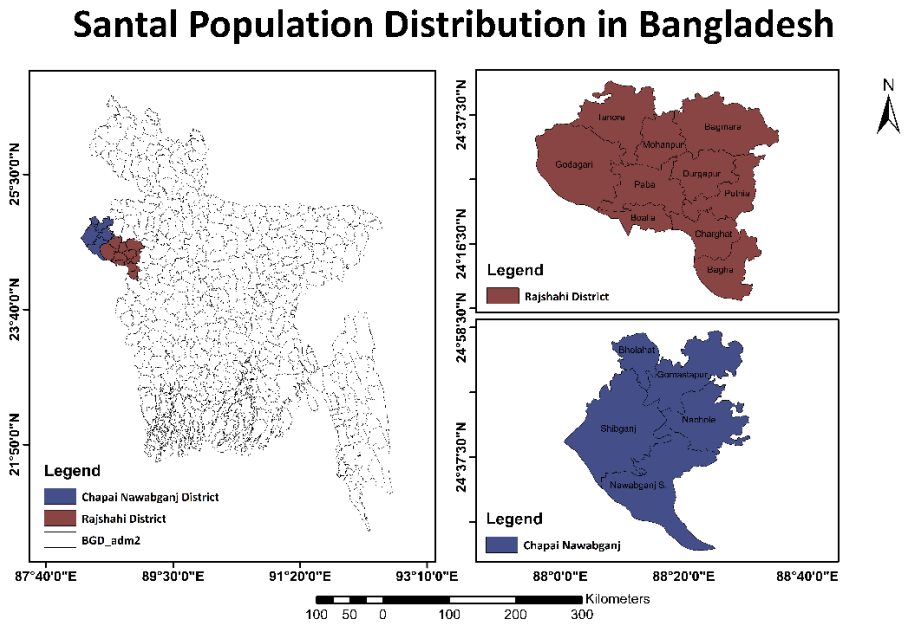

Figure 2. Santal community distribution in Rajshahi and Chapainawabganj districts of northwestern Bangladesh

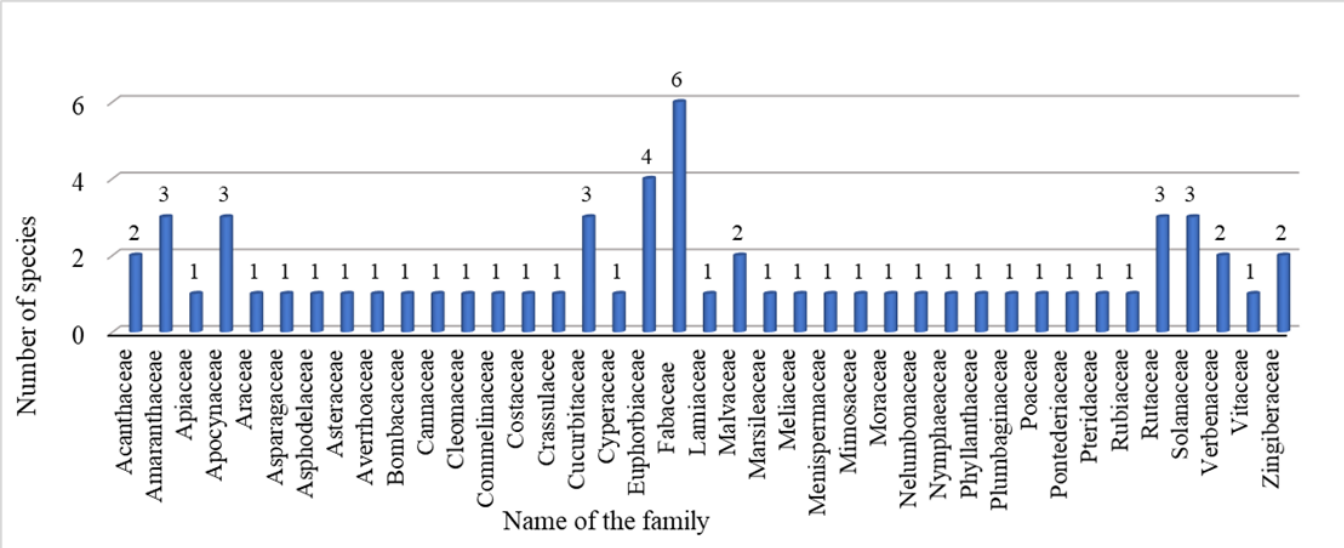

Figure 3. Number of family use for preparation of medicine by Santal tribe of Bangladesh

The Santal people use different types of plants for medicine. Among them, herbs are the most used (43%), followed by shrubs and trees (23% each), and climbers (11%). This shows that herbs are very important in their traditional healing. This distribution indicates a predominant reliance on herbaceous plants for traditional medicinal practices. Santal community collected the plants from natural habitat and their home gardens. Their collection of natural vegetation and cultivation of medicinal plants in their home garden could have indicated their preference for ethnomedicine to treat common physical ailments (Fig. 4).

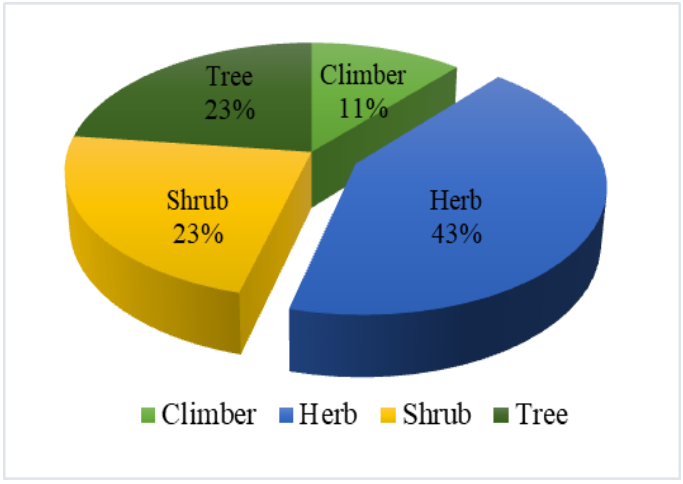

Figure 4. Habit analyses of used plant species in the study area in India Bangladesh

Plant parts used by Santal community in Bangladesh

Various plant parts (Fig. 5, Table. 1) are utilized by the Santals in the preparation of medicine. Leaves (54.38%) are common and frequently used in preparation of medicine, found to be the dominant plant parts used followed by roots (22.8%), fruits (14.03%), bark (12.28 %), and stems (8.7%). The use of whole plants and rhizomes was 5.26%, while seed, wood and pods were utilized by 1.75%.

Table1. Medicinal Plants used by Santal tribe in Bangladesh

Vernacular Name	Scientific Name	Family	Habit	Plant Parts used	Ethnomedicinal uses	Voucher No.
Holud	*Curcuma longa* L.	Zingiberaceae	Herb	Rhizome	**Skin diseases**: Macerated rhizomes are applied on infected areas for treatment of scabies, eczema. **Cough and cold**: Fresh rhizome juice mixed with honey is taken for cold. **Injury**: rhizome paste is applied on injured areas externally **Chicken pox**: Rhizomes of *Curcuma longa* and leaves of *Azadirachta indica* is crushed and made a paste then applied over the whole body, kept for 10 minutes followed by taking a bath.	NUBLS-01
Ada	*Zingiber officinale* Rosc.	Zingiberaceae	Herb	Rhizome	**Cold and Cough**: Rhizome juice is mixed with leaf juice of *Ocimum sanctum* and honey is taken orally to cure cough and cold. **Catarrhal fever**: Decoction of dried ginger is used to cure catarrhal fever. **Paralysis, rheumatic pain**: Leaves of *Vanda tessellata* are mixed with ginger slices (rhizomes of Zinger) is crusaded together and applied to affected areas. **Parasitic worm**: Leaves juice of *Adhatoda vasica* is mixed with rhizome extract is taken orally early in the morning.	NUBLS-02
Gulancho	*Tinospora cordifolia* (Willd.) Hook. f. & Thoms.	Menispermaceae	Climber	Stem, Leaf	**Gonorrhea**: 10 ml of juice obtained from fresh stem is mixed with boiled cow milk or with cold water and taken in the 3 times a day. **Leucorrhea**: Juice obtained from leaves and young stems of *Tinospora cordifolia* is mixed with a little powdered turmeric and taken in the morning on an empty stomach. **Asthma**: Juice is made from fresh stems of *Tinospora cordifolia* is mixed with juice obtained from leaves of *Justicia adhatoda* L. and *Ocimum tenuiflorum* L. is taken orally.	NUBLS-03
Kolaboti	*Canna indica* L.	Cannaceae	Shrub	Leaf, flower	**Diabetes**: Combination of leaf and flower extract is orally taken. ii) **Conjunctivitis**: Leaf and flower juice is applied to treat eye disease.	NUBLS-04
Datura	*Datura metel* L.	Solanaceae	Shrub	Root. Leaf	**Dog bite**: Roots are taken with raw milk every morning after breakfast for 3 days. **Asthma**: leaves and roots of *Datura metel* are mixed and boiled. Inhaled the smoke while the parts are boiling. **Arthritis**: Leaves extract mixed with mustard oil and slightly hit then apply it painful areas. **Pain**: For any type of pain, warm leaves are applied to painful areas to obtain instant relief.	NUBLS-05
Croton	*Croton bonplandianum* Baill.	Euphorbiaceae	Herb	Leaf	**Cold and Cough**: Juice obtained from leaves isused in cough. **Bleeding**: Leaf paste is used for stop bleeding.	NUBLS-06
Rokto	*Iresine herbstii*	Amaranthaceae	Herb	Leaf	**Cuts and wounds**: Leaves extract is applied the infected area	NUBLS-07

pata/Lalbadshah	Hook.				**Skin diseases**: Leaves extract is applied the infected area	
Apang	*Achyranthes Aspera* L.	Amaranthaceae	Herb	Leaf, Whole plant	**Cut and bleeding**: leaves paste applied to the cut area to stop bleeding. **Leucorrhea**: whole plant and black pepper are pasted together and consumed on an empty stomach in the morning. **Diarrhea**: Leaves ground along with 12 seeds of *Piper nigrum* and a spoonful of honey. A spoonful of this paste mixed with a glass of hot water and take it every one hour for one day. **Jaundice**: whole plant and black pepper are pasted together and take it orally. **Dysentery**: 8 cm tap root with its fibrous branches are crushed with two and a half black pepper (*Piper longum*) and is made into small tablets. One tablet is given every morning for treating dysentery till it is cured.	NUBLS-08
Kalmegh	*Andrographis paniculata* (Burm. f.) Wall ex Nees.	Acanthaceae	Herb	Leaf	**Weakness**: Juice extracted from leaves is taken orally before meal at night once daily for 15 next days. **Fever**: 25 ml juice extracted from crushed leaf is taken orally daily before meals for 5 days. **Parasitic worm**: Leaves extract is taken in the morning before meal. **Diarrhea, dysentery**: Taken whole plants juice mixed with salt and water. **Diabetics**: Leaves are made into paste, pill is made from it and one pill is taken orally once a day.	NUBLS-09
Telakucha	*Coccinia grandis* L.Voigt.	Cucurbitaceae	Climber	Leaf	**Diabetics**: 100 ml of juice extracted from crushed leaves is taken orally once daily before meal in the morning. **Bone fracture**: Leaf extract applies on affected areas at daily twice for 15 days. **Skin disease**: Paste of leaf is topically applied on affected areas. **Joint pain**: Juice extracted from crushed leaves is taken apply daily on infected areas. **Muscle reluctant**: Juice extracted from crushed leaves is taken apply daily on legs in the morning for 15 next days. **Heart disease**: About 250g leaves are cooked and eaten with meal twice daily in the afternoon and evening for 1 month. **Fever**: Crushed leaves juice mixed with honey are taken orally for fever.	NUBLS-10
					Mental depression: Leaves are boiled and the decoction taken orally.	NUBLS-11
Jambura	*Citrus maxima* (Brum.) Merr.	Rutaceae	Tree	Fruit peel, Leaf, Fruit	**Dandruff**: Peel of fruits is dried and mixed with mustard oil and apply the scalp **Cough and cold**: Fruit is eaten raw **Headache**: Fruit is eaten as raw.	NUBLS-12
Durba	*Cynodon dactylon* (L.) Pers.	Poaceae	Herb	Leaf	**Bleeding:** leaves are made into paste is applied to the cut area to stop bleeding.	NUBLS-13

					Blood dysentery: 5 g leaves of *Cynodon dactylon* and 2 leaves of *Syzygium cumini* is mixed together and made the leaves juice, then heat it a little, mix it with milk and take it orally twice a day. **Headache**: Leaf paste is used to cure headache.	
Mutha	*Cyperus rotundus* L.	Cyperaceae	Herb	Leaf	**Stomachache**: Leaf juice is taken orally. **Bloating**: Leaves juice is taken orally.	NUBLS-14
Chal kumra	*Benincasa hispida* (Thunb.) Cogn.	Cucurbitaceae	Climber	Fruit, Seed	**Enlarged heart conditions**: Ripe fruits are cooked with goat milk and taken for enlarged heart conditions. **Parasitic worms**: Seeds are crushed with water and taken the extract an empty stomach for helminthiasis. **Stomachache**: Pulp of seeds is dried and burnt and taken with warm water for stomach pain.	NUBLS-15
Lau	*Lagenaria siceraria.* (Molina) Standl.	Cucurbitaceae	Climber	Fruit	**Dry cough**: Pulp of the fruit is taken orally for dry cough. **Inflammation and ear infection**: 1-2 drops of leaf juice is applied to the ears daily 1-2 times.	NUBLS-16
Bon Chakunda	*Senna alata* (L.) Roxb.	Fabaceae	Shrub	Leaf	**Itching**: Leaf extract is used externally **Skin disease**: Leaf paste is use externally. **Constipation**: pour 1 cup of boiling water over one teaspoon of powdered dry leaves, and leave it to infuse for 10 minutes. Filter and drink before going to bed.	NUBLS-17
Kanta notey	*Amaranthus spinosus* L.	Amaranthace	Herb	Root	**Blood dysentery-** Roots and black pepper extract are taken to cure blood dysentery. **Menstrual pain**: Roots and black pepper extract are taken to relief pain. **Diarrhoea**: Juice extracted from crushed roots taken orally twice before meal in the morning and evening for 5 next days.	NUBLS-18
Patharkuchi	*Bryophyllum pinnatum* Salisb	Crassulacee	Herb	Leaf	**Diarrhoea:** leaves extract mixed with 3gms of cumin seeds and ghee is taken **Piles:** leaf extract with black pepper givesrelief from piles.	NUBLS-19
Sisu	*Dalbergia sissoo* Roxb.	Fabaceae	Tree	Root	**Diarrhoea, dysentery:** Take root extract and one spoonful of honey to cure diarrhoea and dysentery.	NUBLS-20
Jaba full	*Hibiscusrosa sinensis* L.	Malvaceae	Shrub	Leaf, Flower	**Hair fall**: flowers are heated with coconut oil applied on the head for hair growth. **Leucorrhea:** One flower is soaked in water and then rubbed inside the hand. The juice that emerges is taken orally twice daily in the morning and night.	NUBLS-21
Shapla	*Nymphaea nouchali* Burm.f.	Nymphaeaceae	Herb	Flower	**Menstrual problem**: One flower is mixed with 75g of raisins and made into a paste. Pills prepared from the paste are taken for 15 days.	NUBLS-22
Poddo	*Nelumbo nucifera* Gaertn.	Nelumbonaceae	Herb	Flower	**Cold, Cough, and Fever**: Decoction of flowers is used incough and fever.	NUBLS-23
Korobi	*Nerium indicum* Mill.	Apocynaceae	Tree	Root, Bark	**Skin diseases**: Roots are lightly fried in sesame oil or coconut oil and then applied to affected parts of the skin.	NUBLS-24

					Fever: A little amount of bark is extract and mixed with honey is taken orally during high fever. **Abortifacient**: 1g powdered root is mixed with cold water is taken orally to induce abortion.	
Sheuli	*Nyctanthes arbor-tristis* L.	Verbenaceae	Tree	Leaf	**Fever:** Leaves juice mixed honey is used in chronic fever of children. **Bilious fever**: Leaves juice mixed with water and zinger juice is used in bilious fever. **Rheumatism**: 15-20 leaves are boiled in water and drink the boiled water for rheumatic pain and any others pain.	NUBLS-25
Genda phul	*Tagetes erecta* L.	Asteraceae	Herb	Leaf, stem	**Cut and Wound**: Leaves is crushed and apply it externally. **Bleeding**: Leaves paste is applied to stop bleeding.	NUBLS-26
					Rheumatism: Infusion of the plant is used against rheumatism.	NUBLS-27
Kamini	*Murraya paniculata* (L.) Jack	Rutaceae	Shrub	Root	**Rheumatism**: Decoctions of roots are taken orally to treat rheumatism.	NUBLS-28
Shimul	*Bombax ceiba* L.	Bombacaceae	Tree	Root, Bark	**Rheumatism**: Grinding decoction of roots and bark is taken orally to cure rheumatism.	NUBLS-29
Kochuripana	*Eichhornia crassipes* (Mart.) Sol.	Pontederiaceae	Herb	Whole plant	**Asthma**: Juice of the plant is used in treatment of asthma.	NUBLS-30
Rokto chita	*Plumbago indica* L.	Plumbaginaceae	Herb	Root bark, Leaf	**Abortion**: Crushed bark of roots is applied to the opening of the vagina to induce abortion **Paralysis**: Roots paste is mixed with mustard oil and applied to paralyzed area twice daily. **Skin disease**: Leaves paste is used externally. **Diarrhoea**: Root powder is used in treatment of diarrhea. **Lowering cholesterol level**: Leaves extract is taken orally. **Diabetics**: Leaves extract is taken orally.	NUBLS-31
Shusuni shak	*Marsilea quadrifolia* L.	Marsileaceae	Herb	Leaf	**High blood pressure**: Leaves are cooked and take it as vegetable **Sleeping Problem**: Leaves are cooked and take it as vegetable	NUBLS-32
Satamuli	*Asparagus racemosus* Willd.	Asparagaceae	Climber	Root	**Asthma**: The roots (50 gm each) of A. racemosus and S. zeylanica are made into paste along with the seeds of N. sativa, C. cyminum (1/2 teaspoon), M. fragrans (1/2), fruits (1/2 teaspoon) of P. cubeba, P. longum, flower buds (7) of S. aromaticum and the stem bark (5 gm) C. verum. Finally, pills are prepared from it **Back pain**: Root decoration is used for back pain.	NUBLS-33
Thankuni	*Centella asiatica* L.	Apiaceae	Herb	Whole Plant	**Stomach pain:** four whole plants with roots, a small amount of mango bark, one pineapple leaf, and raw turmeric juiced and consumed on an empty stomach cure stomach pain. **Dysentery:** take 5-6 leaves every morning to cure dysentery.	NUBLS-34

Tulsi	*Ocimum sanctum* L.	Lamiaceae	Herb	Leaf	**Cough and cold:** 50 ml of juice extracted from crushed leaves is taken with honey is taken orally twice before meal in the morning and evening for 5 next days. **Cut and wounds:** Apply leave paste on the cutting areas. **Asthma**: Leaves juice is taken orally. D**ysentery**: 50 ml of juice extracted from crushed leaves is taken orally twice before meal in the morning and evening for 5 next days.	NUBLS-35
Neem	*Azadirachta indica* A. Juss.	Meliaceae	Tree	Leaf, Stem, Bark	**Skin diseases**: Leaves paste is mixed with turmeric is beneficial for skin disease. **Dental caries**: Stem used as a toothbrush to prevent dental caries. **Dysentery**: take leaves and bark paste with honey to cure dysentery. **Malarial fever**: Bark is used in malarial fever. **Diabetics**: Leaf extract is taken orally.	NUBLS-36
Sada Verenda	*Jatropha curcas* L.	Euphorbiaceae	Shrub	Latex	**Toothache**: Latex is used in toothache. **White dysentery**: presence of mucus in stools gum is taken with salt.	NUBLS-37
Laal-vendar	*Jatropha gossypifolia* L.	Euphorbiaceae	Shrub	Leaf	**Dysentery**: Leaf juice is taken in the morning on an empty stomach.	NUBLS-38
Venna/Reri	*Ricinus communis* L.	Euphorbiaceae	Shrub	Leaf	**Rheumatism**: Seed oil is externally used in rheumatism.	NUBLS-39
Shaora	*Streblus asper* Lour.	Moraceae	Tree	Bark, Root, Stem	**Dysentery**: Roots are crashed and boiled and 3 teaspoonful juice of macerated bark is mixed together, is taken thrice daily for dysentery. **Toothache**: Stem is for toothache.	NUBLS-40
Olkachu	*Amorphophallus campanulatus* (Dennst.)Nicolson	Araceae	Herb	Tuber	**Asthma**: Curry is made from tuber is used in asthma. **Dysentery**: Curry is made from tuber is used in dysentery. **Anemia**: Curry is made from tuber is used in anemia.	NUBLS-41
Shim	*Lablab purpureus* (L.) Sweet	Fabaceae	Climber	Leaf	**Tonsillitis:** Crushed leaves paste is applied around the throat.	NUBLS-42
Bon okra	*Urena lobata* L.	Malvaceae	Shrub	Whole plant	**Scrotum pain**: Juice is made from crushed whole plant is taken.	NUBLS-43
Akand	*Calotropis procera* (Ait.) R. Br.	Apocynaceae	Shrub	Leaf Latex	**Stomach pain**: Applying mustard oil on the leaves, heating it slightly then placed it on the stomach. **Bleeding**: Leaf gum of white latex and is used for stop bleeding.	NUBLS-44
Bashak	*Adhatoda vasica* L.	Acanthaceae	Shrub	Leaf, Bark	**Cold, Cough, Bronchitis**: fresh leaves extract with honey is taken orally **Asthma:** juice obtained from fresh stems of *Tinospora cordifolia* is mixed with juice obtained from leaves of *Adhatoda vasica* L. and *Ocimum tenuiflorum* L. and taken.	NUBLS-45
Bel	*Aegle marmelos* (L.) Corrêa	Rutaceae	Tree	Fruit, Root	**Diarrhoea**: Unripe fruit juice is taken orally. **Dysentery**: Roots extract mixed with cow milk and sugar is taken. **Heart disease**: Juice of root mixed with water is used in heartdisease.	NUBLS-46
Harjora	*Cissus quadrangularis* L.	Vitaceae	Climber	Tendril	**Bon-fracture**: Tendril of harjora and roots of *vitis adanata* are grind together, make a paste to apply like a plaster on the fractured bone for healing.	NUBLS-47

					Body ache or any pain: Stem is crushed and mixed with 25gm mustard oil/ghee and tied around the place to treat body ache or any pain. **Nerve problems**: Whole stem is crushed and boiled with ghee and then messaged all over the body to treat nerve problems	
Babla	*Acacia nilotica* Dellile.	Mimosaceae	Tree	Pod	**Dysentery**: Pod is used to treat dysentery. **Indigestion, Acidity**: Pod extract is used.	NUBLS-48
Chhatim	*Alstonia scholaris* (L.) R. Br.	Apocynaceae	Tree	Bark	**Rheumatism**: Paste made from dry bark is used externally in treatment of rheumatism.	NUBLS-49
Amla	*Phyllanthus emblica* L.	Phyllanthaceae	Tree	Fruit, Leaf,	**High cholesterol**: Fruit juice is taken orally to reduce cholesterol level **Diarrhoea**: Infusion of the leaves with fenugreek seed is given for chronic diarrhea. **Dysentery**: Fruit decoction is mixed with yogurt and given in cases of dysentery. **Diabetics**: Decoctions of the leaves and seeds are used in the treatment of diabetes mellitus **Hair fall problem**: The fruit, cut into pieces, is dried, preferably in shade and then boiled in coconut oil.	NUBLS-50
Kamranga	*Averrhoa carambola* L.	Averrhoaceae	Tree	Fruit, Leaf	**Influenza fever**: Decoction of leaves and fruits is taken to cure influenza fever. **Cold**: Raw fruit is eaten. **Diarrhoea**: Fruits juice is taken orally to cure the diarrhea. **Hemorrhoids**: Fruits are dried and make it powder then mixed with water and make pills, everyday take one pill with water.	NUBLS-51
Rokta chandan	*Pterocarpus santalinus* L.	Fabaceae	Tree	Leaf, Wood	**Bleeding from gums**: 6- 7 leaves are boiled in water and the water is used for gargling. **Headache**: The paste of the wood is applied onto the forehead for treating headache. **Skin disease**: Wood paste is applied externally to treat skin disease. **Conjunctivitis**: kohl (local term: kajol) is made from wood is applied to eyes.	NUBLS-52
Bock phool	*Sesbania grandiflora* (L.)	Fabaceae	Tree	Leaf, Flower	**Epilepsy**: 4 teaspoonful of juice obtained from fresh leaves is taken with powdered black peppers twice daily for 15- 20 days. **Dry coughs**: 2-3 flowers are fried in ghee and taken orally.	NUBLS-53
Nisinda	*Vitex negundo* L.	Verbenaceae	Shrub	Leaf	**Fever**: A decoction of the leaves along with long pepper is given in catarrhal fever.	NUBLS-54
Aswa gandha	*Withania somnifera* (L.) Dunal.	Solanaceae	Shrub	Root	**Asthma**: Decoction of root is used for asthma.	NUBLS-55
Tit begun	*Solanum nigrum* L.	Solanaceae	Herb	Fruit	**Fever:** Fruit extract is used in fever.	NUBLS-56
Bidda pata	*Adiantum caudatum* L.	Pteridaceae	Herb	Whole plant	**Cold and Cough**: Juice obtained from crushed whole plant is taken orally twice daily in the morning and evening before meals for 5 days. **Fever**: Juice extracted from crushed whole plant is taken orally twice daily in	NUBLS-57

					the morning and evening before meals for 5 days. **Skin diseases**: Plant extract is used externally	
Madana	*Spermacoce hispida* L.	Rubiaceae	Herb	Leaf, Root, Flower	**Spleen disorders**: Juice obtained from leaves is taken orally before meal at night. **Urinary infection**: Root juice of the plant is used for the treatment of urinary infection. **Malarial fever**: Root juice of the plant is used for the treatment of malarial fever. **Skin disease**: Flowers paste is applied externally in boils treatment.	NUBLS-57
Kustha	*Costus speciosus* (Koen) Sm.	Costaceae	Herb	Leaf, Rhizome, Root	**Diabetics**: Leaves juice is taken orally. **Asthma**: Rhizome juice is taken orally twice daily before meals for 5 days. **Pneumonia**: Rhizome juice is taken orally twice daily before meals for 5 days. **Fever**: Rhizome juice extracted is taken orally twice daily before meals for 5 days. **Skin disease**: Root paste is used to improved skin complexion and rash. **Small pox**: Root paste is used to improved skin complexion and rash.	NUBLS-58
Alovera	*Aloe vera* (L.) Burm.f.	Asphodelaceae	Herb	Leaf	**Cold**: Leaves extract is applied on chest externally.	NUBLS-59
Hurhure	*Cleome viscosa* L.	Cleomaceae	Herb	Leaf	**Headache**: Leaves paste is applied on forehead.	NUBLS-60
Shalpani	*Desmodium gangeticum (L.) DC.*	Fabaceae	Shrub	Root	**Rheumatism:** Root paste mixed with salt then apply the paste externally	NUBLS-61
Kanduly	*Murdannia nudiflora (L.) Brenan*	Commelinaceae	Herb	Whole plant	**Skin disease**: Whole plant paste is mixed with common salt is applied to affected areas in leprosy. **Asthma**: Root paste is mixed with goat milk and take it orally to cure asthma.	NUBLS-62

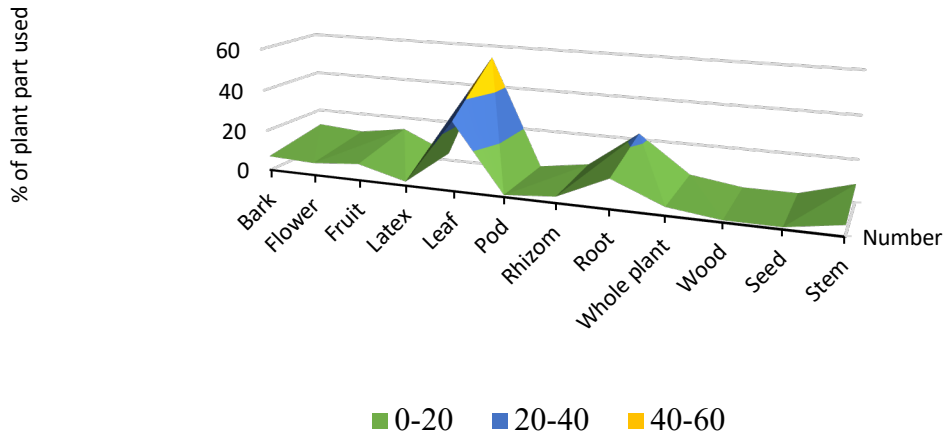

Fig. 5 Recorded plant parts used in different diseases in Bangladesh

Mood of preparation

Mode of preparation of the medicine encompasses juice (23.17%) followed by extract (27.80%), paste (17.21%), decoction (11.92%), raw eaten (7.94%), cooked (4.63%), and boil (3.97%) all the time fresh plant parts were used for medicine preparation (Fig. 6).

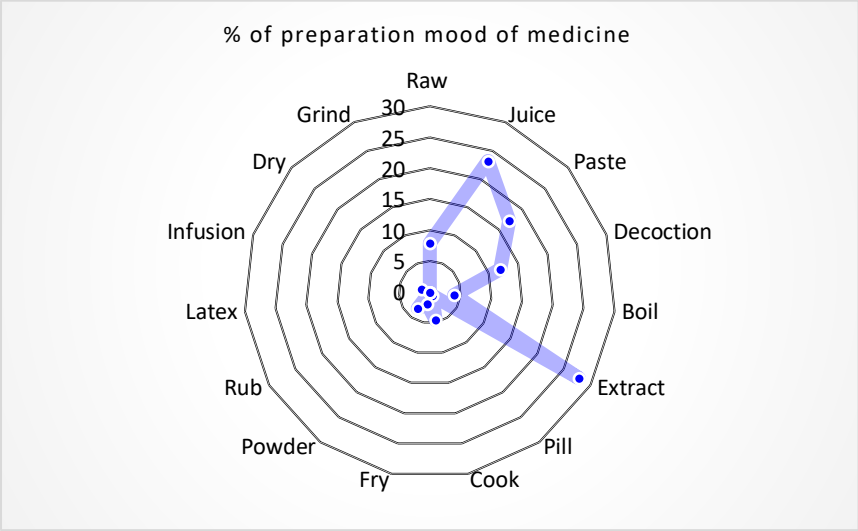

Fig. 7. Percentage of preparation mode of medicine by Santal tribe of Bangladesh

Diseases treated

Altogether 38 types of physical problems (Fig. 7) were found to be treated by the use of the documented medicinal plants. Most of the herbal preparations are found to be used by the Santals to treat dysentery (15 species, 26.78%), followed by skin diseases (11 species, 19.64%), Fever and cough and cold (10 species, 17.85% each), diarrhoea (9 apecies, 16.07%), diabetes (7 species, 12.50%), Dental caries, Headache, Heart disease, Leucorrhea, and Pin worm (3 species, 5.35% each), Abortifacient, Bone fracture, Chicken pox, Cholesterol, Conjunctivitis, Hair fall, Malarial fever, Menstrual pain, Paralysis (2 species, 3.57% each) and other several diseases treated by different single genera.

Demographic and Ethnomedicinal Profile of the Santal Community

A total of 150 individuals from the Santal community were interviewed during the ethnobotanical survey conducted in the Rajshahi and Chapainawabganj districts of Bangladesh. Among the respondents, 53.3% were male (n=80) and 46.6% were female (n=70), indicating active participation from both genders. The age distribution of participants showed that the largest group (31.6%) belonged to the 31-45 years age range, followed by 28.4% aged 46-60 years, 23.2% between 18–30 years, and 16.8% aged 61 years and above.

Educational background revealed that 40.8% had no formal education, while 34.4% had completed primary education, and 16.4% reached secondary level. Only 8.4% had studied beyond the secondary level. The majority of respondents (52.4%) were engaged in farming, with 18.8% working as day laborers, 20.4% identified as housewives, and 8.4% recognized as traditional healers or Ojha, who play a key role in maintaining and practicing traditional medicinal knowledge.

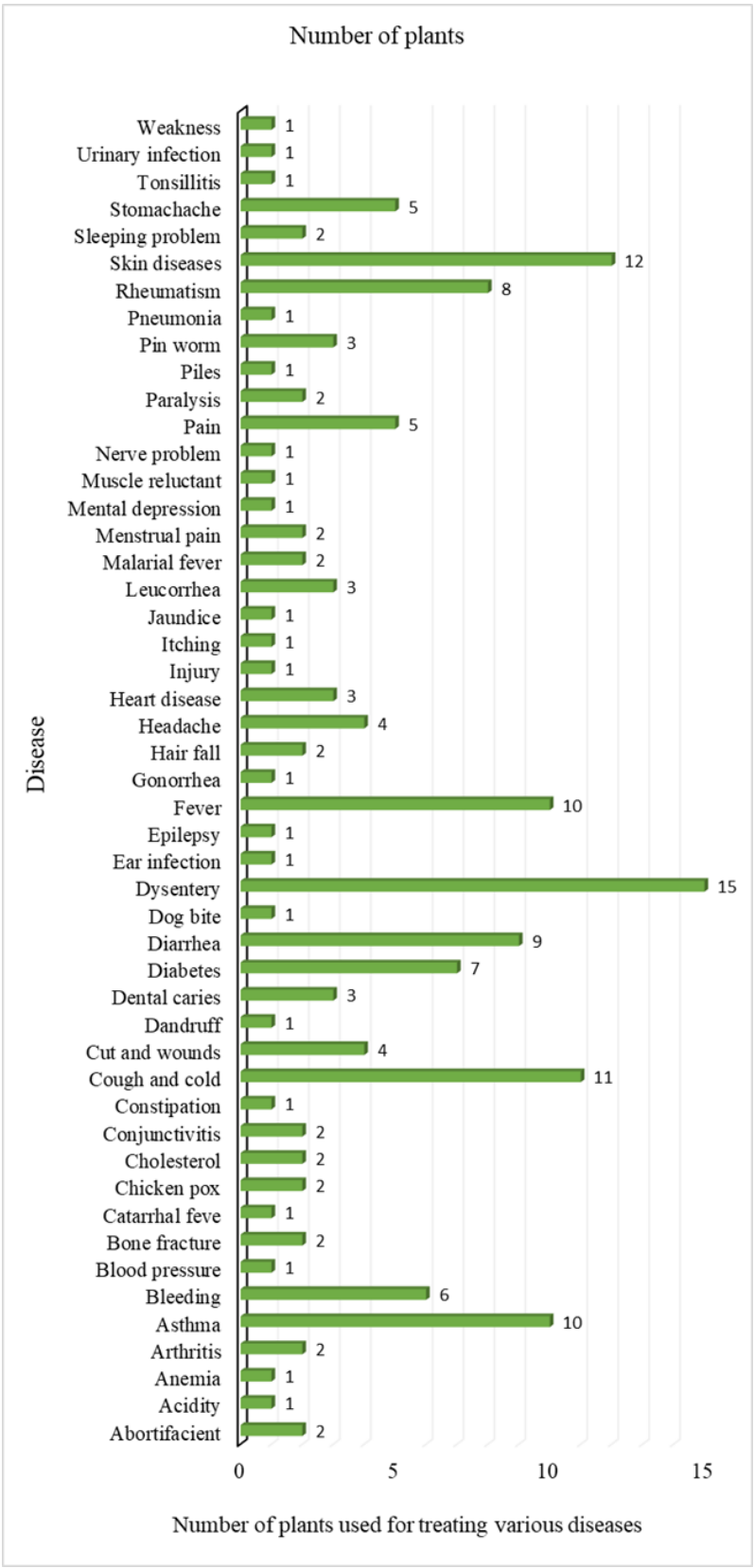

Figure 7. Number of plants used for treatment of various diseases

Importantly, 29.2% of respondents (n=73) were directly involved in the practice or transmission of ethnomedicinal knowledge, either as traditional healers or as knowledgeable household members. Most practitioners were from older age groups, particularly between 46 and 60 years, underscoring the oral nature of knowledge transmission and the risk of cultural erosion if younger generations are not engaged. Despite the limited formal education among many Santals, their understanding and application of medicinal plant use remain extensive and deeply embedded in their cultural heritage (Table 2).

Table 2. Demographic Characteristics of Santal Respondents (N=250)

Demographic Category	Sub-category	Number of Respondents	Percentage (%)/ Number
Gender	Male	80	53.3
	Female	70	46.6
Age Group (years)	18–30	58	23.2
	31–45	79	31.6
	46–60	71	28.4
	61 and above	42	16.8
Education Level	No formal education	102	40.8
	Primary (1–5 class)	86	34.4
	Secondary (6–10 class)	41	16.4
Occupation	Higher Secondary and above	21	8.4
	Farmer	131	52.4
	Day laborer	47	18.8
	Housewife	51	20.4
	Traditional healer (Ojha)	21	8.4
Involved in Ethnomedicinal Practice	Yes	73	29.2
	No	177	70.8

Table 3. Chi-square test of demographic categories and ethnomedicinal involvement

Category	χ^2	p - value	Level of Significance
Gender	0.667	0.414	Not Significant
Age Group	12.58	0.005	Significant
Education	68.25	0.000	Highly significant
Occupation	109.20	0.000	Highly significant
Involved in ethnomedicinal practice	43.62	0.000	Highly significant

The Chi-square results showed no significant difference in gender distribution among respondents ($\chi^2 = 0.667$, $p = 0.414$). However, significant variation was found across age groups ($\chi^2 = 12.58$, $p = 0.005$), education levels ($\chi^2 = 68.25$, $p < 0.001$), and occupations ($\chi^2 = 109.20$, $p < 0.001$). Involvements in ethnomedicinal practice also differed significantly between respondents ($\chi^2 = 43.62$, $p < 0.001$).

Comparative Ethnomedicinal Knowledge of Santal Communities

The comparative study of ethnomedicinal practices between the Santal communities of Rajshahi and Chapainawabganj districts reveals both shared traditions and notable regional differences. A total of 55 plant species were documented in Rajshahi, while 42 species were reported in Chapainawabganj, suggesting slightly greater biodiversity use in Rajshahi. Both communities commonly used most of the species. The mode of preparation of herbal remedies was similar across regions, primarily involving decoctions, pastes, and juices. Common ailments treated included digestive disorders, fever, wounds, cough, and jaundice. In Rajshahi, traditional healers (Ojhas) played a more active role, and a higher percentage of respondents relied on herbal remedies as the first line of treatment. In contrast, in Chapainawabganj, modern allopathic medicine is increasingly preferred, especially by the younger population, and fewer practicing Ojhas were reported.

Knowledge transmission in both regions is primarily oral, passed from elders to younger generations, though Rajshahi demonstrated stronger continuity. In Chapainawabganj district, there is a faster decline in traditional knowledge, with many young Santals showing limited interest in ancestral healing practices. Overall, while both regions reflect a rich tradition of

plant-based healing, Rajshahi shows greater knowledge retention and healer activity, whereas Chapainawabganj reflects greater transition toward modern healthcare**.**

Table 4. Comparative Ethnomedicinal Knowledge of Santal Communities in Rajshahi and chapainababganj district

Criteria	**Rajshahi District**	**Chapainawabganj District**
Total participants	75	75
Number of medicinal plant species used	55	42
Most common plant families	Fabaceae, Apocynaceae, Euphorbiaceae	Fabaceae, Cucurbitaceae
Commonly treated diseases	Fever, dysentry, wound healing, skin disease	Cough, diarrhea, jaundice, Fever
Preparation methods	Decoction, paste, juice	Decoction, Paste, juice, direct consumption
Knowledge transmission method	Mainly oral from Ojhas (Professional practitioner) and elders	Oral, Ojha (Professional practitioner), with increasing reliance on modern medicine
Use of modern medicine	Moderate; 45% prefer herbal first	Higher; 61% prefer allopathic medicine first
Healer activity (Ojha)	More active and influential	Present, but fewer practicing healers
Loss of knowledge in younger group	Evident, but slower	More prominent and rapid

Discussion

The Santal community, one of the largest indigenous groups in Bangladesh and neighboring regions, has a rich tradition of using medicinal plants for healthcare. Their ethnomedicinal knowledge is deeply intertwined with their cultural identity and environment, particularly in rural settings where modern healthcare access is limited (Chowdhury *et al.* 2013, 2020; Islam & Hossain 2016). Santals use diverse native plants to treat ailments such as fever, respiratory conditions, gastrointestinal disorders, skin infections, and wounds. The community's traditional healers, known as "Ojha" or "Bodhi," hold specialized knowledge on plant species, preparation methods, and dosages, which is orally transmitted through generations (Hossain *et al.* 2020, Khan *et al.* 2017, 2029).

Among commonly utilized plants, *Azadirachta indica* (Neem) is highly regarded for its antiseptic and anti-inflammatory properties; *Ocimum sanctum* (Tulsi) for respiratory and digestive health; *Aegle marmelos* (Bael) for digestive ailments; *Terminalia arjuna* for cardiovascular health; and *Curcuma longa* (Turmeric) for wound healing and anti-inflammatory effects (Sarker *et al.* 2019, Paul & Biswas 2018, Islam & Rahman 2018).Ethnobotanical surveys in the Rajshahi and Chapainawabganj districts of Bangladesh have documented over sixty one plant species used medicinally by the Santals, highlighting the community's vast botanical knowledge and the importance of conserving both this knowledge and plant biodiversity (Hossain *et al.* 2020, Rahman *et al.* 2015, Rahman *et al.* 2017, Roy *et al.* 2018). Similar studies in the neighboring Indian states, where the Santal population also resides, affirm the widespread and culturally embedded use of medicinal plants within the tribe (Nath *et al.* 2014, Uddin *et al.* 2021).

However, these traditional practices face threats from rapid environmental changes, deforestation, agricultural expansion, and cultural assimilation. The erosion of ethnomedicinal knowledge among younger generations due to modernization further jeopardizes the continuity of these practices (Islam & Hossain 2016, Paul & Biswas 2018, Alam *et al.* 2021). Efforts to document and conserve Santal ethnomedicine are crucial, not only to maintain cultural heritage but also to explore potential pharmacological applications. Incorporating indigenous knowledge into formal healthcare systems could enhance accessibility, affordability, and cultural acceptability of treatments in rural and marginalized communities (Chowdhury *et al.* 2013, Khan *et al.* 2017, Sultana & Rahman 2022, Chakraborty & Datta 2019).

Conclusion

The present ethnobotanical survey provides significant insights into the traditional medicinal knowledge of the Santal community residing in the Rajshahi and Chapainawabganj districts of Bangladesh. The documentation of 61 indigenous plant species used to treat a wide array of health ailments reflects the community's deep-rooted dependence on natural resources and their intimate ecological knowledge. This knowledge, passed down orally through generations, forms an essential

component of the Santal cultural heritage and plays a critical role in sustaining primary healthcare in remote rural settings where access to modern medical facilities is limited.

Declarations

List of abbreviations: Not applicable

Ethics approval and consent to participate: The present study involved ethnobotanical interviews with members of the Santal ethnic group in Rajshahi and Chapainawabganj districts of Bangladesh. Formal ethical approval was not required for this study as it involved no invasive procedures and documented traditional knowledge with informed consent, in accordance with institutional guidelines. The research was conducted in accordance with the principles of the Declaration of Helsinki and its subsequent amendments. Informed verbal consent was obtained from all participants prior to data collection, and participation was voluntary

Human Ethics and Consent to Participate: All participants provided informed consent to participate. Anonymity and confidentiality were strictly maintained.

Consent for publication: Consent to publish was obtained from all participants. No identifying personal information is included in this manuscript

Availability of data and materials: All relevant data are included within the article.

Competing interests: The authors have no competing interests

Funding: No funding was received for conducting this study

Author contributions: Najmun Nahar conceived and designed the study, conducted data collection, and prepared the original manuscript. Bholanath Mondal contributed to the research design and assisted in manuscript preparation. Mritunjoy Mojumder was responsible for map preparation, data analysis, and contributed to manuscript revision. Shahida Taher participated in data collection, data preparation, and reviewed the manuscript. All authors read and approved the final version of the manuscript.

Acknowledgements

We are grateful to the Bangladesh Academy of Sciences for their continued encouragement and institutional backing throughout the study. Our deepest appreciation goes to the Santal community members of Rajshahi and Chapainawabganj districts, whose invaluable knowledge, hospitality, and willingness to share traditional medicinal practices made this research possible.

Literature cited

Alam MF, Hossain MS, Rahman MA. 2021. Impact of deforestation on medicinal plants in northern Bangladesh. Environmental Science and Policy 120: 10-18.

Balick MJ, Cox PA. 1996. Plants, people, and culture: The science of ethnobotany. Scientific American Library.

Chakraborty S, Datta S. 2019. Traditional healing practices among the Santal tribe of Bangladesh. Journal of Ethnopharmacology 230:150-158.

Chowdhury MAM, Uddin SB, Mazumder AAM, Howlader MSA. 2013. Ethnobotanical study of medicinal plants used by the Santal community in Rajshahi district, Bangladesh. Journal of Ethnobiology and Ethnomedicine 9:1-45.

Chowdhury MA, Rahman MT, Karim MR. 2020. Ethnobotanical survey of medicinal plants used by indigenous communities in Rajshahi district, Bangladesh. Journal of Medicinal Plants Studies 8:3- 45-52.

Das S, Bhowmik P. 2017. Pharmacological properties of traditional medicinal plants used by ethnic groups. Asian Journal of Herbal Medicine 12:2- 23-30.

Das S, Roy S. 2016. Sustainable use of medicinal plants among indigenous communities in Bangladesh. Environmental Conservation Journal 17:2- 67-75.

Fabricant D S, Farnsworth N R. 2001. The value of plants used in traditional medicine for drug discovery. Environmental Health Perspectives 109:(Suppl 1)- 69–75. doi:10.1289/ehp.01109s169

Hossain MA, Sarker S, Rahman M A. 2020. Documentation of traditional medicinal plants used by the Santal community in Chapainawabganj district, Bangladesh. Bangladesh Journal of Plant Taxonomy 27:2-163–175.

Hossain MR, Sultana S, Islam MT. 2020. Medicinal plant usage among ethnic groups of northwestern Bangladesh. Ethnobotany Research and Applications 18: 1-15.

Islam MS, Hossain MA. 2016. Indigenous knowledge and traditional use of medicinal plants by Santal tribe of northern Bangladesh. American Journal of Ethnomedicine 3:5-34–44.

Islam MS, Ahmed S, Rahman MM. 2018. Phytochemical and ethnopharmacological importance of *Azadirachta indica* and *Ocimum sanctum*. Asian Journal of Medicinal Sciences 9:1-15-22.

Khan MA, Rahman MM, Islam MT. 2017. Ethnomedicinal plants used by the Santal community in Rajshahi district. Asian Journal of Traditional Medicines 12:3-25–35.

Khan MH, Haque ME. 2019. Traditional medicinal plant use by the Santal tribe in Chapainawabganj district, Bangladesh. Bangladesh Journal of Ethnobotany 20:1-28-37.

Nath SK, Saha A, Barbhuiya SK. 2014. Medicinal plants used by the Santal tribes of Assam, India: An ethnobotanical study. International Journal of Herbal Medicine 2:4-30–39.

Paul S, Biswas S. 2018. Ethnomedicinal uses of plants by Santals in West Bengal, India. Journal of Medicinal Plants Studies 6:2-27–34.

Rahman MM, Sarker S, Hossain MA. 2015. Traditional knowledge on medicinal plants used by the Santal tribe in Bangladesh. Bangladesh Journal of Plant Taxonomy 22:2-139–147.

Rahman M, Sarker BC, Hossain MS. 2017. Indigenous medicinal plants and their uses by the Santal community in northern Bangladesh. Ethnobotany Research and Applications 15: 1-10.

Roy S, Das S, Biswas S. 2018. Documentation of medicinal plants used by indigenous communities in Rajshahi. Journal of Herbal Medicine 10:3-123-130.

Saha M, Rahman MM. 2016. Indigenous medicinal plant utilization by the Santal tribe of Rajshahi region. Asian Journal of Pharmaceutical and Clinical Research 9:3-280–286.

Sarker BC, Uddin MN, Karim MA. 2019. Challenges in preserving traditional medicinal knowledge among indigenous communities in Bangladesh. Journal of Indigenous Medicine 11:2- 55-62.

Sarker S, Hossain MA, Rahman M A. 2019. Ethnomedicinal practices of the Santal tribe in northwestern Bangladesh: An ethnobotanical survey. Journal of Medicinal Plants Studies 7:1-1–10.

Sultana N, Rahman MA. 2022. Healthcare accessibility and indigenous medicine: a study among Santals. International Journal of Community Health 6:1-40-48.

Uddin MN, Sarker BC, Islam MR. 2021. Healthcare accessibility and traditional medicine among the Santal tribe in Rajshahi. International Journal of Community Health 5:1- 40-48.