Cultural significance and diversities of ethnic foods of Northeast India

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Received 30 August 2006; revised 23 October 2006

The traditional foods processed and prepared by women of Northeastern region are intimately connected to their socio-cultural, ecological, spiritual life and health. The processing and preparation of ethnic foods not only demonstrate the creativity and treasure of food heritage of tribal women but also their incremental learning to sustain the life and ecosystem as a whole. Looking to the diversities in ethnic foods, an attempt has been made to explore the ethnic foods made of local soybean, bamboo shoot, tree bean, *lai patta* (leafy mustard) and *rai* (*Brassica juncea* (Linn.) Czern. & Coss.) from different selected tribes of Northeast India.

Tribal women of Northeastern region have a wide range of variability in the ethnic foods made of soybean, bamboo shoot, *lai patta*, tree bean and *rai*. In each state, the processing method of these foods is somewhat different based on the culture, variability in the materials used in the food, climate and overall knowledge of the processing and preparation. The foods used in the dietary system were found to be nutritionally rich and culturally important in various festivals and ceremonies. Ethnic foods prepared and consumed by women cannot be seen in the isolated mode, instead it is a complex dynamics in which nutrition, health, food security, culture, ethics, subsistence economy and ecological sustainability are integral components. A policy framework with clear directives on recognition of traditional foods and associated knowledge systems is urgently needed.

**Keywords:** Cultural significance, Ethnic food, Traditional food, Fermentation, Indigenous knowledge, Tribal women, Women empowerment, Northeast India, Adi, Galo, Apatani, Sherdukpen, Ao, Sema, Mizo, Khasi, Bhutia, Gurung, Meitei, Barman

**IPC Int. Cl.**: A61K36/00, A01G1/00, A01G17/00, A47G19/00, A23L1/00, A23L1/06, A23L2/02, A61P1/04, A61P15/00, A61P15/06, A61P15/14, A61P25/00

Northeastern India is one of the richest floras in India, where people depend on shifting cultivation systems and forest based food products for their sustainable survival. This region, which lies under eastern Himalayan ecosystem, is not only rich in plants diversity but also have a great treasure of cultural, social and linguistic variability, conserved by tribal people. The region is a treasure of indigenous knowledge systems pertaining to agriculture, food, medicine, and natural resources management. People are habituated to live and survive with the forest and *Jhum* cultivation culture, which ensure a range of ethnic foods rich in nutrition and compatible to culture and ethnicity of tribes¹. Since time immemorial, rural women of this region have selected many wild plants and non-vegetarian foods through trial and error². Women have conserved many local crops, ethnic vegetables and indigenous fruits used in local diet for food and nutritional security. Most of these indigenous materials are collected by women folk either from the forest areas, conserved in shifting land or indigenous kitchen gardens³-⁵. These ethnobotanical resources used in traditional foods are based on the location specific demand, culture, economy, ethnicity, food habit and overall needs³.⁴-⁶. Different fermented and non-fermented foods are used in various combinations with traditional vegetables to meet the food and nutritional security⁶. Mainly the different tribal women share these traditional foods at community level in various cultural occasions (like *Etar*, *Solung* and *Aran* festival in *Adi* tribe), which ensure the equitable food

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availability and balanced nutrient supply to all the members of village.

The traditional foods consumed by tribes of Northeastern region are intimately connected to virtually all aspects of their socio-cultural, spiritual life and health. The new generation in the same community has undergone a rapid change in their diets over the past 30 yrs due to intervention of modern crop varieties, materialistic life and current trend towards increasing use of commercial processed foods. For tribal people, traditional food use transformation has been radical, as people have moved from a diet in which the majority of nutrients drawn from local food, to more generic diet of store-bought food, most of which are produced and processed far away from locality. People have affinity for sweet-tasting things, and these sweeteners were added to many fruits, vegetables, and even cereals & pulses based flours, which are having harmful effects. Changing cropping pattern, types of farming systems and fast foods through globalization process, accompanied by decrease in the use of traditional vegetables, fruits and fermented ethnic foods of local tribes of northeastern region has resulted in many diseases most notably, heart disease, stroke, diabetes and other ailments.

There is an urgent need to explore, analyze and document the ethnic foods (fermented and non-fermented) consumed by tribal communities of Northeast India and its associated dynamics to understand, food consumption pattern and availability, nutritional and medicinal values and associated cultural and social aspects of ethnic foods. The present study was carried out in the seven states of Northeast India to explore the diversities and types of ethnic foods made of soybean, bamboo shoot, tree bean, lai saag (leafy mustard) and rai (Brassica juncea).

Methodology

Explanatory research design was followed to carry out the research work. For studying the socio-cultural and ecological dynamics of traditional foods, the qualitative approach was adopted. A multistage sampling procedure has been applied to select the final sample of study. To fulfill the objectives, study has been conducted in those areas where people are still dependent on the indigenous resources for their survival. The seven sister states of Northeastern region, i.e. Arunachal Pradesh, Mizoram, Manipur, Nagaland, Tripura, Meghalaya and Sikkim were selected, where still rural tribal women are dependent on the varieties of traditional foods.

Based on the degree of traditionalism, ethnicity, ethno-ecology, extent of forest cover and availability of traditional foods, Adi, Galo, Apatani and Sherdukpen tribes (Arunachal Pradesh), Ao and Sema tribes (Nagaland), Mizo tribe (Mizoram), Khensi tribe (Khasi hills, Meghalaya), Bhutia and Gurung (Sikkim), Meitei community (Manipur) and Barman community (Tripura) were selected (Table 1) for the study. Four remote villages from various locations, dominated by the concerned community were selected randomly. Thus, total village sample was 28 from which, with the help of Gaon Burha (GB) and Anchal Samiti Member (ASM, Panchayay body), 5 old aged (more than 60 yrs in age) rural women were selected randomly (total 140) for the interview and focus group discussions.

To collect the data, recipe contests were organized (Fig. 1) in few of the selected villages (only in Arunachal Pradesh) to see the total varieties of traditional foods from local soybean, bamboo shoot, lai patta, and rai. The recipe contests were chosen as one of the tools of learning and data collection about the traditional foods from the rural women as well as to create awareness about the importance of ethnic foods among rural women and newer generation. In the recipe contest, the women of villages were informed 3 days in advance with the help of Gaon Burha to prepare the different traditional foods from soybean, bamboo shoot, lai patta and rai seeds. On a

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<tr>
<th>State</th>
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<th>Altitude (meters amsl)</th>
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<td>Adi, Nepali</td>
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Results and discussion

Soybean based ethnic foods

Mizo tribe

The soybean based fermented food is called bekang by the Mizo tribe. The seeds of bekang (soybean) are crushed and boiled in water for about half an hour and taken out. Boiled seeds are kept in plates (made of bamboo) to drain out the water. After some time, the lukewarm seeds are wrapped in leaves of belphuar tree. Only the leaves of belphuar tree are used for wrapping the bekang as it is considered good in maintaining the temperature during fermentation. The wrapped bundle is placed over the shelf (made of bamboo) near the fireplace in kitchen and the fermentation is completed within 3 days. It is served after adding desired quantity of local chilli, ginger or consumed directly. It is the integral part of all the leafy vegetable-based boiled foods. In Mizoram, the tribal women of some other villages do the processing differently by mixing ash with boiled seeds and then wrapping in the leaves of belphuar tree. For longer storage life, fermented soybean seeds are spread in the sieve and dried in sun; dried seeds are packed in the bamboo container and closed. After 10-12 days, it is taken out, made into paste and stored in the belphuar tree leaves. The women of Mizo tribe market this product through formal network of MHIP (Mizo Hmeichhe Insuithkhawm Pawl).

Galo tribe

The Galo tribe women of Basar, Arunachal Pradesh are well acquainted with preparation of soybean based fermented food called Aagya. Desired quantity of soybean seeds are boiled in an aluminum container for about 30 min. Boiled seeds are kept in Oko leaves (Phrynium pubenerve Blume, family Maranphaceae) to drain out the water. Then the seeds tightly packed in the Oko leaves are kept in rapkho (bamboo made shelf) above the fireplace in kitchen for 12-14 days. After this, it is taken out and stored in Udu (a basket made of bamboo). The Aagya, now ready for use is mixed with varieties of local vegetables, chutney and boiled foods.

Adi tribe

The Adi women of East Siang district prepare a fermented product called peron namsing, from soybean seeds. Soybean seeds are cleaned to remove the chaff and washed. The cleaned seeds are boiled in water for about 30-40 minutes till they become very soft. They are cooled by spreading over Epo (bamboo
The seeds are transferred into the ekkam leaves (Phrynium pubenerve, family, Maranphaceae) and packet is made with bamboo or cane rope and hung near the kitchen (in the bamboo made shelf called peron) for fermentation. When the fermentation process is completed after 10-12 days (in summer) or 25-30 days (in winter), the seeds are taken out. These fermented seeds, called peron namsing (Fig. 4) are mixed with several boiled vegetables along with local chilli, fermented bamboo shoots and salt. Based on the quantity, some women process it further to make the paste (Fig. 5) and keep in the ekkam leaves after making in cake or ball shape near the fire place in kitchen. In Pasighat market, double processed peron namsing is sold by Adi women. The chutney (Fig. 6) made of peron namsing is prepared rarely. It is prepared by making the paste of fermented soybean seeds mixing with the paste of local tomato, chilli (sibol variety), ginger (local variety) and salt.

**Apatani tribe**

The Apatani plateau dominated by Apatani tribe in Lower Subansiri district is world known for its ecofriendly and sustainable technologies of rice-fish based farming systems and related food web. They also consume a wide range of diversified ethnic foods made up of agricultural and forest products. Soybean based fermented product, called yanni perung is quite popular. To process it, seeds are cleaned, washed and boiled in water for about 30 min. The lukewarm seeds are placed in the kulu leaves (wild banana, Musa balbisiana Colla), packed airtight and kept over fireplace for smoking. The seeds get fermented within 3-4 days during summer while in winter it may take 10-12 days. The fermented seeds are taken out and made into chutney with tomato, chilli, ginger, garlic and salt. It can be preserved for over several months after drying and making its paste with red chilli and dried ginger.

**Sherdukpen tribe**

The Sherdukpen tribal women of Shergaon (1981 m above MSL) area of West Kameng district, Arunachal Pradesh make soybean-based food called chukchoro. The seeds of soybean are soaked in water to remove the damaged seeds and husk. Then it is boiled in water for 1-2 hrs till the seeds become very soft. The water is drained out and lukewarm seeds are kept in the banana leaves and covered with warm cotton cloth. This packet is kept near the fireplace in the bamboo made shelf for 15-30 days during winter. During summer, the fermentation is completed within 10-12 days. When the seeds begin to emit flavour it is considered fermented and is taken out from the basket. It can be consumed directly after mixing with varieties of local vegetables. For longer preservation, it is made into paste and stored in banana leaves. It is used in making chutney with local chilli (solu), tomato, yak cheese and salt. Women sell this product in the local market after making in ball or square shape and wrapping in the banana leaves.

**Bhutia tribe**

**Bari**

The Bhutia tribal women of Sikkim prepare the ethnic food called Bari, from soybean (Fig. 7). Soybean seeds are washed and boiled in water for about one hour. When it becomes soft, water is drained out; seeds are crushed and wrapped tightly in leaves of Nebera (Ficus sp.). The packets are kept above the chulha (oven) for 4-5 days for fermentation. It is used for making chutney and curry. The chutney is made with coriander, tomato, garlic, chilli and salt while curry is made with potato and tomato.

**Kinema**

It is one of the important components of the diverse food culture of the ethnic communities in the hills of Sikkim. Kinema (Fig. 8) is a fermented food from whole-soybean seeds. It is gray tan in colour, has a sticky texture, and is flavourful. For the preparation of kinema, small-sized (up to 6 mm) yellow seeds of local cultivars of soybean are soaked overnight in spring water and cooked by boiling until they can be pressed easily. Excess water is drained out and the seeds are spitted lightly using a wooden pestle (muslo) in a wooden mortar (okhli), probably to accelerate fermentation and increase the surface area for aerobic spore-forming bacteria. Grits are placed in a bamboo basket lined with locally grown fresh fern fronds [Glaphylopteriopsis erubescens (Well ex. Hook.) Ching], covered with a jute bag and left to ferment naturally at ambient temperatures (25° - 40°C) for two to three days above an earthen-kitchen oven. In some villages, about 1 % of fresh firewood ash is added to the cooked soybeans during kinema preparation. Some women use dark-brown seeds of soybean in making kinema. Instead of fern leaves, Ficus and banana leaves are also used as wrapping materials. Other steps remain the same. Completion of fermentation is indicated by the appearance of a white viscous liquid having a typical
kinema flavour with a slight ammonia-like odour. The self-life of fresh kinema is two to three days during summer and a maximum of one week in winter without refrigeration. Sun-dried kinema is stored for several months at room temperature. The preparation of kinema varies from place to place and is still restricted to household level.

**Kinema dishes**

Kinema is eaten as a side-dish curry with cooked rice. The delicacy of kinema can be perceived from its appealing flavour and sticky texture. To prepare kinema curry (Fig. 9), vegetable oil is heated in a frying pan, chopped onion is added and fried until tender. Tomatoes and turmeric powder are added and fried for 2 min. Fresh kinema, salt and sliced green chilies are added and fried for 3-5 min. Little water is poured to make a thick curry, and cooked for 5-7 min. Kinema curry is served with boiled rice. Sun dried kinema is sometimes mixed with leafy vegetables to make mixed curry as a side dish. Kinema preparation is an income generator for some families. It is sold in all local periodical markets (haats) by rural women. Usually, it is sold by volume measured in a small silver mug containing 150-200 gm of kinema, and packed in the leaves of Ficus hooker Miq., and then tied loosely with straw. Though there is a good market for kinema, and some rural women are involved in it for income generation, but processing is still restricted to the individual household; there is no organized processing unit or factory.

**Meitei community**

**Hawaizaar**

The women of Meitei community of Manipur prepare Hawaizaar, from soybean seeds by fermentation. Desired quantities of soybean seeds are taken and after washing, they are properly cleaned. The seeds are then boiled in water for about 2-3 hrs till become soft, and excess water is drained out and is used for curing the cough. The lukewarm seeds are wrapped in the cotton cloth and tied airtight with the banana leaves. It is kept inside the bamboo basket (thumok) and again covered with rice husk and pressed with stone. The thumok is kept over the fireplace for fermentation, which takes about 4-5 days in summer and 7-10 days in winter. Some women again process it for longer preservation (3-4 days). After fermentation, hawaizaar is dried in sunlight for 10-15 min and paste is made after crushing it. The inside of earthen pot (saphu) is smeared with mustard oil and paste of hawaizaar is kept inside it. The mouth of saphu is closed airtight with banana leaves to preserve longer and avoid further fermentation.

This fermented soybean is used for preparing the ethnic food called Cheigem Pomba. To prepare it, local dry fish, prawn, rice, forest vegetables (leafy), mustard leaves, pea leaves, local onion leaves, turmeric, ginger and few wild spicy plants are used. First, rice along with hawaizaar is boiled with water and kept separate. Chilli, onion, garlic and leafy vegetables with dry fish are fried in mustard oil. When all the materials become light maroon in colour, then boiled rice and hawaizaar are added, mixed properly and boiled with little water. Cheigem Pomba is now ready to eat. The hawaizaar is used in preparing varieties of chutney and consumed with salad and fermented fish (ngari). This food is most often used in the festival Gobardhan puja, Surap (ritual ceremony after 13 days of death of a man) and Asti (ritual ceremony after 6 days of death of a man). Rural women do not give the hawaizaar to the women after child delivery. The hawaizaar is very popular in local market.

**Mao-Naga community**

In Manipur state, Mao Naga women have their unique culture and food habits, which are compatible with the nature and health. They prepare a fermented food from soybean, called Hakhu mata/akhuni. Chaff and inert matter are removed from soybean seeds by putting in water. The seeds are properly dried in partial shade and boiled in water for about half an hour. When the seeds become soft, water is drained out using the bamboo made sieve. Then seeds are spread on the cotton cloth in partial shade for cooling and drying. The dried seeds are wrapped in banana leaves and packet is made with bamboo rope and hung above the fireplace in kitchen in completely dark condition to initiate fermentation. Fermentation takes place in about 15-20 days in winter and 5-7 days in summer. When the leaf of banana becomes completely wrinkled, it indicates that fermentation of soybean seeds is complete. The seeds are taken out from leaves and roasted with salt without any oil. These seeds are again packed in fresh banana leaves and stacked over the shelf near smoke in kitchen. After 3-5 days this is ready to eat and sale.

**Ao tribe**

The Ao tribe of Mokokchung district of Nagaland prepares indigenous foods made from soybean.
During the night on a full moon day, the seeds of soybean are selected and boiled till it become very soft. When the water is evaporated, seeds are covered with the banana or taro (Colocasia esculenta (Linn.) Schott) leaves, kept over fire for more than 30 min till it gives pungent smell. On the other hand, the boiled soybean kept for over 3-4 days and mixed with suitable fish and dried over fire, then kept in the container and eaten as needed. This ethnic food is taken mostly with the tea, which is considered nutritious.

**Sema tribe**

The fermented soybean food, *axoni* is quite popular among the different tribes of Nagaland. It is prepared by women of all the 10 tribes of Nagaland and is known by various names like Kheuha, sabrocha and sadocha. *Sema* tribal women wash & boil soybean seeds in water till becomes soft; spread the seeds over the bamboo mat to drain out water. The seeds are wrapped in the banana leaves and kept over the fireplace in kitchen in the bamboo made shelf for activating fermentation. When seeds start emitting flavour, they are taken out from the leaves and ground with the banana or *ekkam* leaves. The ground paste is packed in a banana leaf and a small packet is made. The packet is exposed to sunlight or placed near the fireplace in kitchen and left for one to two weeks. After this, when it gives a peculiar smell then women recognize that *axoni* is ready to eat. In *Sema* community, the women believes that if the men touch it, then the unique smell of *axoni* shall be lost forever & food will be spoiled, only prepare this ethnic food.

**Bamboo based ethnic foods**

**Arunachal Pradesh: Apatani tribe**

*Apatani* women of different villages of Ziro district prepare varieties of fermented food products, viz. *Hikhu, Hiring* and *Hithyi* from the indigenous bamboo shoots.

**Hikhu:** The bamboo shoots are collected by women from the forest and properly washed before peeling and chopping down. They are made into small pieces and transferred into the bamboo basket after putting the *ekkam* or banana leaves inside the basket. The basket is covered tightly with the banana leaves and left for over 6-8 days for fermentation. These fermented bamboo shoots are called *Hikhu*.

**Hiring:** After making small slices, the bamboo shoot pieces are kept in a bamboo cylinder and made airtight with the *ekkam* leaves. The cylinder full of bamboo shoots is left for about one week for fermentation and is then ready to use. The taste of fermented bamboo shoot made by this method is better than the previous method.

**Hithyi:** The sliced bamboo shoots are dried in sun and stored in the bamboo made basket. This product is called Hithyi.

**Adi tribe**

A wide range of diversity exists in fermentation process of bamboo shoots, traditionally evolved by *Adi* women through the informal experimentation at different altitudes of East Siang district and Rayang, Bolung, Jiya and model villages of Roing in Dibang valley district. The *Adi* women of different villages (Balek, Napit, Renging, Mirbuk, Mirku, Yabgo, Jarku, Anini and Roing) prepare the bamboo shoots into three major forms. First one, called *ekung* is fermented by various methods, second one is dried shoots, called *Eyup* and third one is used fresh, called *Eting*, which is used directly after boiling with several indigenous leafy vegetables.

**Ekung (Fermented bamboo shoot):**

Women collect required quantities of bamboo shoots from the forest areas and after peeling, small slices are made. Inside the bamboo made basket called *papur, ekkam* leaves are placed at bottom, on which slices are kept in layers and pressed. On the top, slices are covered properly with *ekkam* leaves to make the basket airtight. The basket is left for 5-6 days in summer and 8-10 days in winter for complete fermentation. The fermented bamboo shoot thus prepared is called *ekung* (Fig. 10).

In the second processing method, the required quantity of bamboo shoots are collected and put in the *edung* [cylinder (open from one side) made from local variety of bamboo *Eye*]. The slices are properly pressed and made airtight with the *ekkam* leaves. The *edung* is left for over 4-5 days for fermentation and shoots are ready to use. The fermentation process in this method is faster than the previous method irrespective of whether it is winter or summer. Up to 1980s, there was a unique tradition of processing the bamboo fermentation to reduce the cyanide percentage. Cyanide causes several diseases/disorders related to nervous system, miscarriage, abnormal childbirth and goiter problems[13]. Due to this, still old aged women advise the pregnant women not to eat any bamboo based food product unless it is rigorously
Processed. For reducing the cyanide percentage at the time of processing the bamboo shoots, 2-3 small size holes were made inside the edung. During the period of fermentation, these edungs are kept near the water stream or river bank in such a manner so that water touches to the bottom of edung. Thus, the toxic compounds are leached out. It also helps to maintain the temperature inside edung. With the passage of time, this traditional wisdom has been eroded at an alarming rate among the young generation. The bamboo shoots processed by this method were quite tasty and have good keeping quality than other methods.

Processing using stones in water stream

The Adi women (Padam sub-tribe) of Roing collect bamboo shoots from the forest, peel and make into small slices using Dao (a small sword like agricultural tool). These slices are processed in bamboo basket using ekkam leaves. The small packets of already semi-fermented shoots are wrapped in ekkam leaves and made airtight using cane or bamboo rope. These packets are then pressed under the stones near the water stream coming from top of the hills, for several months (3-4 months) to reduce the bitterness. This also significantly helps in reducing the cyanogenic glycoside content due to the activity of yeast and bacteria such as Lactobacillus lactis, which causes major diseases related to nervous system, goiter and miscarriage.

Mixing with a large number of local vegetables and ethnozoological recipes fermented bamboo shoots are used. Small fishes break easily into small pieces, which is a major problem during cooking. To minimise it and improve the taste, Adi women add eukung. Eukung is the part and parcel of diet of Adi tribe and is mixed not only in large number of leafy vegetables, but also in pork, miithun meat (Bos frontalis Gaur), etc. Eukung is used in many cultural occasions and festivals like Solung, Etar and Aran. Fresh raw bamboo shoots after making into small pieces are also added with different forest leafy vegetables, insects and ethnozoological foods. For example, dried bamboo shoots (tenga) mixed with a caterpillar surviving on the green leaves of Bengi tree (Cassia siamea Lam.) are boiled (Fig. 11) and eaten. It is preferred for quick recovery of the weak person. The Galo tribe living in the same locality prepares this food in a different way. The rice grains are crushed and the caterpillar called talo, is cooked along with coarse rice powder and eaten after adding salt and chilli. This food is called ammin. In case of surplus, the caterpillars are wrapped in ekkam leaves and roasted in the wooden fire. Then it is dried by keeping over the fireplace and called pamnam. To prepare the chutney, the dried caterpillars are crushed and mixed with the paste of local ginger, chilli and salt.

Fresh bamboo shoots (tenga) are mixed with marsang (Spilanthes acmella Murro) leaves along with sibol chilli (an indigenous variety) and dilap (indigenous onion) and boiled for eating (Fig. 12). Similarly, bamboo tenga is mixed with koppir (Solamun sp.), ginger and chilli (a local variety sibol) for making the chutney (Fig. 13). The same leafy vegetables as well as lai saag (leafy mustard), tapioca leaves and sweet potato leaves are mixed with dried bamboo tenga and boiled together for consumption (Fig. 14). The preparation of ethnic foods using dried bamboo shoot varies according to the season and is mostly used during winter.

Manipur: Meitei community

The women collect the young emerging bamboo shoots; peel is removed and after making into small pieces, it is dried in sunlight for about 10-15 min. Washing the bamboo shoots in water is avoided otherwise natural flavour and taste will be lost as perceived by these women. The dried bamboo shoot pieces are kept in the earthen pot made of black clay soil after adding small amount of water and salt (thum). This pot is made airtight and left for over 2-3 months. After fermentation due to the anaerobic condition, bamboo shoots are taken out and dried in sunlight to about 50% moisture level. Then it is mixed with small amount of thum and thuntak (basket made of cane/bamboo) and dried completely by keeping in the vessels. During old days, women were also adding the turmeric powder. This fermented shoot is now ready to serve. In the same area some women do fermentation following somewhat different ways, like before putting in the earthen pot, the shoots are properly squeezed and extract is thrown away. This process is adopted with an intention to avoid bitterness and minimize diseases occurring due to cyanogenic glucosides.

In hilly areas, some tribal women ferment the bamboo shoot in the large size bamboo made container called Cot, which is of about 2.13 m height. Since for fermentation of bamboo shoots certain amount of water is needed that’s why the big size bamboo container is necessary. The green leaves of banana are put inside the container over which
bamboo shoots are quite popular among fermented shoots. Several local dishes made of ready to eat. Pickles are also prepared from these days in summer for fermentation. After this, it is left for over 15-20 days in winter and 7-10 days in a basket or jar, some amount of water is added to it. The shoots are used for fermentation when the shoots are to be stored for a longer period. After putting the shoots either in a basket or jar, some amount of water is added to it. The shoots are left for over 15-20 days in winter and 7-10 days in summer for fermentation. After this, it is ready to eat. Pickles are also prepared from these fermented shoots. Several local dishes made of bamboo shoots are quite popular among Khasi tribe. Tungtep (small dry fish) and Ktungmluh (big dry fish) are added to fermented bamboo shoots to make the curry.

**Meghalaya: Khasi tribe**
The fermented ethnic food prepared from *Bambusa nutans* wall. Ex Murro by Khasi women is called lungseij. Bamboo shoots are collected from forest, peeled, washed properly and cut into small pieces. The pieces are then transferred either into glass bottle or traditional bamboo made basket. Banana leaves are laid inside the basket. The fermentation is done in the bamboo made basket when the fermented shoots are to be consumed within a short period, whereas jars are used for fermentation when the shoots are to be stored for a longer period. After putting the shoots either in basket or jar, some amount of water is added to it. The shoots are left for over 15-20 days in winter and 7-10 days in summer for fermentation. After this, it is ready to eat. Pickles are also prepared from these fermented shoots. Several local dishes made of bamboo shoots are quite popular among Khasi tribe. Tungtep (small dry fish) and Ktungmluh (big dry fish) are added to fermented bamboo shoots to make the curry.

**Tripura: Barman community**
Bamboo based fermented food products are not much popular among the tribes of Tripura compared to other Northeastern region tribes. The women of Barman community prepare traditional food called Godhak, from bamboo shoot. Fresh bamboo shoots (borak variety) are collected from forest, peeled and made into small pieces. Simultaneously, the pseudostem of banana is collected and after peeling the epidermic layers, small pieces are made. These two materials are mixed together and boiled in hot water till becomes soft. After 10-15 min, the dry fishes, salt, chilli, pieces of onion and garlic are added to it to improve the taste. Godhak is ready to serve after this.

**Leafy mustard (lai saag) based ethnic foods**

**Nepali community of Mebo**
The Nepali women living among the Adi community in Mebo, East Siang district, Arunachal Pradesh, have also developed the empirical wisdom to process some leafy vegetables into fermented product for long-term use and preservation. In this regard, gundruk, fermented food from *lai saag* is most popular (Fig. 1). For preparing it, desired quantity of *Lai saag* (Tulang and Tuka varieties) is taken, washed, crushed thoroughly and transferred into Doko (container made of bamboo) having holes at bottom and is pressed with the stones. This is kept for 5-6 days and allowed for fermentation. Then the fermented leaves are taken out, again crushed and spread over the Dhari (mat made of bamboo) and dried under sunlight for 2-3 days. After complete drying, it is called Gundruk and is served as chutney or with curry. Chutney is made of Gundruk, tomato, dried chilli, ginger, garlic and salt, while curry is made with potato. Gundruk is most often used in breakfast by mixing with Dhedo (wheat or maize flour is baked in low flame in a pan and water is added slowly. Baking and addition of water with continuous stirring is done for 30-40 minutes. The end product is called Dhedo).

**Bhutia tribe of Sikkim**
The women of Bhutia tribe of Sikkim ferment the *lai saag* by different methods for making an ethnic food called Gundruk. To prepare Gundruk, the leaves of *lai saag* are washed properly, crushed and squeezed to take out the water. The fermentation can be done by adopting two methods.

(i) Fermentation in pit and soil
A pit of certain size according to the quantity of *lai saag* to be fermented is dug and the crushed green leaves of *lai saag* are put in a tin box. Banana leaves are laid at the bottom of box. After putting crushed green leaves of *lai saag*, it is pressed to make airtight and covered with banana leaves. The tin container is kept in the pit, covered with soil and left for one
month for fermentation. After this, the tin container is taken out, banana leaves are removed, and the fermented lai saag is separated from the tin container and spread on the Nanglo (bamboo plate) and dried in sun. The dried gundruk can be preserved for two years.

(ii) Fermentation in cow dung
In this process, the fermentation rate is faster compared to the above method. After crushing the green leaves of lai saag, it is placed between the two sheets of polythene sheets and made airtight with thread. This packet is kept inside the cow dung and left for over 20 days for fermentation. After this period, polythene sheet packet is taken out from the cow dung and properly washed. Gundruk is taken out and spread on the nanglo and dried in sun. The Bhuatia women use its soup and give to the breast-feeding mother for improving milk efficiency. This fermented ethnic food is considered as a tonic for the old age person. It is also used for preparation of chutney, curry, etc.

Rai (Brassica juncea) seeds based ethnic food
The Bhuatia tribal women of Sikkim also ferment the rai seeds (Fig. 16). Desired quantity of rai seeds are taken, washed properly and boiled in water. The lukewarm seeds are kept in earthen pot and pressed with stone to pack airtight. The pot is left for 2-3 months for fermentation of seeds inside. The fermented seeds used with many food helps in curing stomach pain, gas trouble and significantly improve digestion.

Radish based ethnic food
The Gurung tribe of Sikkim ferment mula (radish) to prepare an ethnic food called sinki (Fig. 18). Radish are washed, cut into small pieces and dried under sunlight in naaglo (local utensil made of bamboo for winnowing the grains) for 3-4 days. The dried pieces are packed in polythene and placed inside a pit. The pit is covered with cow dung and soil paste and left undisturbed for over 15 days for fermentation. The fermented root pieces are called sinki and are used for making soup. It is found to be very effective in curing diarrhoea, stomach pain and consumed mostly during the lean period.

Tree bean based ethnic foods
Meitei community
The Meitei community living in the hilly ecosystems of Manipur has gained a long experience in preparing the ethnic food made of tree bean (Yongchak, Parkia roxburghii G. Don). The tender pods of tree bean are used for making chutney, which is useful in curing the intestinal disorders. Iromba is one of the favorite delicious ethnic foods of Meitei community. There are several types of Iromba depending upon the materials used. The most popular is the Yongchak Iromba, which is seasonal and made from tree bean, available in winter to spring season. It is a compulsory item in any feast and in the festivals like Nugol Chakouba, Chhinaoba, etc. This is also popular among the Christian community of the hill tribes. The major ingredients, which are added in Yongchak Iromba are Yongchak, Ngari (dry fish of Puntus breed, Phutunis or Eromus dandricus), red skinned potato, Pullei (Alpini nigra (Gaertn.) Bentt), chilli, salt and coriander. All the vegetables are put in a container after adding water to a level and boiled till cooked. Nagari is soaked or Maroi Nakupi (Allium odorum Linn.) is fried (for vegetarian) and paste is made with chilli and salt is added to it. The green skin of tree bean pod is removed by scrapping with Yoingkhot (an iron utensil). After removing the peel of potato and tree bean pod, they are mixed properly with coriander and other ready materials. This dish is considered as an appetizer and is well known to the old age women of Meitei community, which signifies their ethnicity.

The observations from the seven states revealed that increasing facilities of communication and road approachability have enlarged the social mobility in the different tribal communities. In most of the town now establishment of shop and enterprises have significantly increased its demand. This has mobilized the transportation of foods among community from one corner to another corner of town. It has also helped in transferring the learning about processing of ethnic foods based on soybean, bamboo shoot and lai patta. These types of inter-and-intra communal interaction of collecting and purchasing the ethnic foods could succeed in developing a type of knowledge network where reciprocal learning takes place. This knowledge network existed more among the middle-aged group people living nearby the town. Remarkable erosion in the ethnic foods consumption could be observed in all the communities among the young age group, since they are now more attracted towards market based fast and fried foods. In many parts of the world, conservation and domestication of culturally important plant species used in foods and...
medicines have been enormously sustained by the women with their painstaking effort and adaptive learning\textsuperscript{14}. It could be learned that the women living in the high altitude (Table 2) were having very high level of ethics to continue consumption of their traditional foods, which are significantly associated with many festivals (Solung, Etar and Aran in Adi tribe of Arunachal Pradesh), marriages and cultural occasions. The Sherdukpen women of West Kameng district of Arunachal Pradesh decide the areas to be sown under soybean. The community based approach is followed among the Adi tribe in conservation of cultural landscape associated with bamboo groves and tree bean (Fig. 19).

Selective and seasonal harvesting, diversifying the harvest (forest and non forest products), and maintaining and enhancing the ability of resources to renew themselves through vegetative propagation, seed dispersal, domestication and habitat modifications, such as controlled burning\textsuperscript{15} are some of the location specific indigenous practices followed by tribal women to sustain the ethnobotanicals used in ethnic foods. For culturally important species used for foods, tribal women have developed a variety of conservation and sustainable harvesting practices, including adaptive management methods. The traditional knowledge related to processing and preparation of ethnic foods is transferred from one generation to another by various mode of communication among the different tribal communities of Northeast India (Table 3). The weekly markets were the frequent and potential interaction points on ethnic foods among the different tribes & subtribes, and were found to be the first important mode of communication. Personal contact was the second important means for intergenerational transfer of traditional knowledge about ethnic foods. In the barter systems, during the time of exchanging the foods with other goods, women also learn the traditional knowledge codified in the local dialects. This way of learning about the traditional foods was found to be strong at high altitudes and more diversified in cultural and ecological edges of Northeast India. Friends and neighbours are also the sources of learning about ethnic foods in those communities of Northeast India where degree of ethnicity and dependency on natural resources are more. Native knowledge (rank I) and personality attributes [(rank II) (degree of interacting with nature, other members of society, inter-and-intra communal interaction)] of a woman are important factor in deciding the diversities of processing the ethnic foods (Table 5). In the remote villages, where tribal women are much dependent on the local foods, were found to be more knowledgeable in processing of the foods, invariably in all the age groups.

<table>
<thead>
<tr>
<th>Varying altitude (m above ms1)</th>
<th>Mode of conservation</th>
<th>Cultural dimension</th>
<th>Ethics level</th>
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<tbody>
<tr>
<td>152-456</td>
<td>Kitchen gardens and plain sloppy agricultural fields</td>
<td>Festivals, marriage party, spiritual and cultural functions</td>
<td>Low</td>
</tr>
<tr>
<td>456-915</td>
<td>Kitchen gardens and plain sloppy agricultural fields</td>
<td>Festivals, marriage party, spiritual and cultural functions</td>
<td>Moderate</td>
</tr>
<tr>
<td>1066-1981</td>
<td>Shifting land and home gardens</td>
<td>Festivals, marriage party, spiritual and cultural functions</td>
<td>High</td>
</tr>
<tr>
<td>1981-2286</td>
<td>Shifting land and home gardens</td>
<td>Festivals, marriage party, spiritual and cultural functions</td>
<td>Very high</td>
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### Table 3—Mode of communication and intergenerational transfer of traditional knowledge related to ethnic foods (n=140)

<table>
<thead>
<tr>
<th>Mode of communication</th>
<th>Arunachal Pradesh</th>
<th>Manipur</th>
<th>Nagaland</th>
<th>Tripura</th>
<th>Mizoram</th>
<th>Meghalaya</th>
<th>Sikkim</th>
<th>Mean score</th>
<th>Ranks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Folk songs</td>
<td>30.00</td>
<td>20.00</td>
<td>24.57</td>
<td>32.47</td>
<td>17.75</td>
<td>35.75</td>
<td>28.53</td>
<td>27.01</td>
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</tr>
<tr>
<td>Proverbs</td>
<td>45.50</td>
<td>30.40</td>
<td>28.45</td>
<td>13.32</td>
<td>12.58</td>
<td>27.63</td>
<td>19.68</td>
<td>25.36</td>
<td>V</td>
</tr>
<tr>
<td>Folk tales</td>
<td>32.34</td>
<td>22.32</td>
<td>15.65</td>
<td>19.36</td>
<td>10.60</td>
<td>15.43</td>
<td>21.32</td>
<td>19.57</td>
<td>VII</td>
</tr>
<tr>
<td>Folk story</td>
<td>25.47</td>
<td>15.67</td>
<td>22.43</td>
<td>27.86</td>
<td>12.59</td>
<td>15.94</td>
<td>18.40</td>
<td>19.76</td>
<td>VI</td>
</tr>
<tr>
<td>Mouth of words</td>
<td>70.34</td>
<td>65.87</td>
<td>68.90</td>
<td>67.75</td>
<td>75.63</td>
<td>72.65</td>
<td>65.43</td>
<td>69.51</td>
<td>II</td>
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<tr>
<td>Weekly markets</td>
<td>65.70</td>
<td>73.76</td>
<td>75.31</td>
<td>62.60</td>
<td>60.97</td>
<td>62.75</td>
<td>60.56</td>
<td>65.95</td>
<td>I</td>
</tr>
<tr>
<td>Informal rural, social &amp; cultural institutions</td>
<td>48.97</td>
<td>53.23</td>
<td>37.69</td>
<td>39.47</td>
<td>32.49</td>
<td>45.62</td>
<td>34.98</td>
<td>41.77</td>
<td>III</td>
</tr>
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</table>

*Note: Figures indicate mean percentage*

### Table 4—Sources of learning about ethnic foods (n=140)

<table>
<thead>
<tr>
<th>Sources of traditional knowledge learning</th>
<th>Arunachal Pradesh</th>
<th>Manipur</th>
<th>Nagaland</th>
<th>Tripura</th>
<th>Mizoram</th>
<th>Meghalaya</th>
<th>Sikkim</th>
<th>Mean score</th>
<th>Ranks</th>
</tr>
</thead>
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<tr>
<td>Parents</td>
<td>68.90</td>
<td>60.89</td>
<td>68.65</td>
<td>58.56</td>
<td>65.68</td>
<td>70.89</td>
<td>59.90</td>
<td>64.78</td>
<td>I</td>
</tr>
<tr>
<td>Grand parents</td>
<td>60.78</td>
<td>63.66</td>
<td>55.55</td>
<td>69.89</td>
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<td>68.33</td>
<td>60.76</td>
<td>59.22</td>
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<tr>
<td>Neighbours</td>
<td>12.09</td>
<td>15.94</td>
<td>10.78</td>
<td>15.55</td>
<td>09.08</td>
<td>16.77</td>
<td>10.45</td>
<td>12.95</td>
<td>VI</td>
</tr>
<tr>
<td>Relatives</td>
<td>09.56</td>
<td>12.86</td>
<td>08.45</td>
<td>10.67</td>
<td>15.32</td>
<td>07.88</td>
<td>17.56</td>
<td>11.75</td>
<td>VII</td>
</tr>
<tr>
<td>Friends</td>
<td>07.67</td>
<td>10.46</td>
<td>16.77</td>
<td>21.22</td>
<td>17.77</td>
<td>12.22</td>
<td>29.90</td>
<td>16.57</td>
<td>V</td>
</tr>
<tr>
<td>Elders of society</td>
<td>23.67</td>
<td>18.90</td>
<td>28.99</td>
<td>27.88</td>
<td>10.68</td>
<td>30.56</td>
<td>35.67</td>
<td>25.19</td>
<td>IV</td>
</tr>
<tr>
<td>Inter and intra communal learning</td>
<td>20.65</td>
<td>23.63</td>
<td>30.90</td>
<td>34.22</td>
<td>29.34</td>
<td>27.60</td>
<td>30.59</td>
<td>28.13</td>
<td>III</td>
</tr>
<tr>
<td>Self imaginative learning</td>
<td>09.78</td>
<td>04.89</td>
<td>12.34</td>
<td>05.57</td>
<td>10.10</td>
<td>08.89</td>
<td>06.66</td>
<td>8.31</td>
<td>VIII</td>
</tr>
</tbody>
</table>

*Note: Figures indicate mean percentage*

### Table 5—Factors responsible for diversities in the ethnic foods and their methods of processing (n=140)

<table>
<thead>
<tr>
<th>Sources of traditional knowledge learning</th>
<th>Arunachal Pradesh</th>
<th>Manipur</th>
<th>Nagaland</th>
<th>Tripura</th>
<th>Mizoram</th>
<th>Meghalaya</th>
<th>Sikkim</th>
<th>Mean score</th>
<th>Ranks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personality attributes</td>
<td>68.90</td>
<td>60.56</td>
<td>53.74</td>
<td>50.78</td>
<td>55.44</td>
<td>65.66</td>
<td>45.77</td>
<td>57.26</td>
<td>II</td>
</tr>
<tr>
<td>Native knowledge</td>
<td>58.56</td>
<td>50.56</td>
<td>60.78</td>
<td>65.89</td>
<td>60.66</td>
<td>59.09</td>
<td>48.90</td>
<td>57.77</td>
<td>I</td>
</tr>
<tr>
<td>Knowledge gained in husband’s house</td>
<td>15.68</td>
<td>19.99</td>
<td>38.92</td>
<td>26.85</td>
<td>25.67</td>
<td>09.09</td>
<td>55.89</td>
<td>27.44</td>
<td>VI</td>
</tr>
<tr>
<td>Personal taste</td>
<td>23.98</td>
<td>25.47</td>
<td>32.87</td>
<td>40.40</td>
<td>37.88</td>
<td>28.67</td>
<td>32.65</td>
<td>31.70</td>
<td>IV</td>
</tr>
<tr>
<td>Taste of other family members</td>
<td>25.34</td>
<td>22.59</td>
<td>15.67</td>
<td>30.32</td>
<td>14.55</td>
<td>12.78</td>
<td>38.69</td>
<td>22.85</td>
<td>VII</td>
</tr>
<tr>
<td>Types of resources and their availability</td>
<td>50.35</td>
<td>45.43</td>
<td>55.59</td>
<td>46.71</td>
<td>40.85</td>
<td>48.80</td>
<td>40.76</td>
<td>46.92</td>
<td>III</td>
</tr>
<tr>
<td>Cultural and spiritual norms</td>
<td>48.98</td>
<td>40.89</td>
<td>28.56</td>
<td>37.31</td>
<td>30.63</td>
<td>16.66</td>
<td>08.12</td>
<td>30.16</td>
<td>V</td>
</tr>
</tbody>
</table>

*Note: Figures indicate mean percentage*
Types of resource materials used in the soybean, bamboo shoots and lai patta based food preparation and individual taste (rank III and IV) were next important factors, which decide the diversities of processing the foods. All varieties of soybean, bamboo shoot and lai patta are not considered ideal for fermentation. In all studied communities of Northeast India, women do not prefer the improved or exotic varieties/species of soybean, bamboo and lai patta. For example, among the Adi community, women prefer local variety of soybean (peron), bamboo (ayom variety) and lai patta (Tulang variety) for preparing the ethnic foods. Cultural and spiritual diversities of knowledge holders of different tribal communities also affect processing diversities (rank V). For example, in Nagaland, while fermenting the soybean based food axoni, it is the common belief of the women that this food should not be touched or processed by men, otherwise axoni will be shying and real flavour will go away after fermentation. Therefore, axoni is prepared only by women. Learning about diversities of ethnic foods made of soybean, bamboo shoot and lai patta takes place in the husband’s house after marriage due to different taste of foods of other family members (rank VI and VII) coupled with native knowledge gained in mother’s house. These diversities open a scope for setting small scale processing industries.

The focus group discussions and personal interviews held among different age group of various tribal communities indicate that erosion of traditional knowledge relating to not only ethnic foods but also other areas like human health, animal’s health, agriculture, handicraft, making armaments, environment and ecosystem management have increased at an alarming rate among the younger generation. This is caused by various factors like disintegration of joint family system to nuclear family system, sociopolitical changes in the rural communities, modern lifestyle and high social mobility from rural areas to city and towns for education and other amenities, and increased expansion of fast and fried foods. Hence, it is the need of the day to have an integrated approach for preserving the roots and institutions of traditional knowledge systems related to ethnic foods. For this, an awareness campaign, brain storming, various educative programmes like workshops and interaction with school children and college students are the need of the hour. These educative programmes will not only make the young generation aware and transfer the knowledge systems from one generation to another, but also will open up the avenues for research and development. During the recipe contests and traditional food festival, the community leaders, both men and women are to be encouraged to participate effectively during the discussion (Figs. 17 & 20). The concept of Village Traditional Knowledge Bank (VTKB) can be developed at the village level to make entries and document not only the ethnic food based knowledge systems but also the other traditional knowledge systems. Education, collaboration, and agreement on principles of sustainability are important. Harvesting of bioresources used for foods should be co-coordinated, monitored, and controlled to reduce the risks of cumulative harvesting impacts. Intellectual property rights of local women must be acknowledged and protected. All values (ecological and cultural) of ethnic foods should be considered, not just monetary values, thus maintaining the holistic, interdisciplinary
approaches to selection, harvesting, and marketing of ethnic foods, which will be a sustainable approach for women’s empowerment (Fig. 21).

**Conclusion**

Traditional knowledge of tribal women and their practices of ethnic foods preparation has much relevance to the sustainable food and nutritional security of hilly societies and ecosystems. Every tribal community of Northeast India have their own food habits based on the location specific diversities on crops and forest resources, culture, ecological edges and seasonal variability. The fermented foods prepared from soybean, bamboo shoots, rai and lai patta were found to be compatible with the nutritional security and subsistence economy of tribal women. The wisdom of using plant materials for fermenting and processing were found to be unique and scientific in nature (subjectively) to ensure the good health of tribal women of Northeastern region. The processing of these foods and associated dynamics are transmitted from generation to generation and exchanged within and between communities. Selectivity, harvesting techniques and preservation methods of food based planting materials indicate the holistic sustainable view of tribal women. Across the culture and bioregional domain, knowledge related to ethnic foods and their consumption patterns vary on account of the women’s native knowledge, personal taste and demand of family members. These knowledge systems are basically governed and managed by the elder of society and communicated through the traditional ways of communication. Culturally and nutritionally important soybean and bamboo based foods have become centralized among the old age people and younger generation is no longer interested in learning about these foods systems, thus threatening the traditional foods and eco-culture of tribal societies.

Many elements need to come together for positive changes to prevail such as skilled teacher, who hold the traditional knowledge, wisdom and values; interested learners who have the opportunity and desire to become skilled and access to intact, productive environmental or environment capitals on which to build and practise. If any one of these significant element is missing, the ecosystem and sociocultural dynamics associated with foodweb of Northeastern region cannot be sustaining. The women’s knowledge of bioresources used in preparation of ethnic foods and its dynamics with eco-cultural aspects reminds us to acknowledge the context of diversities of social capital of Northeastern region and their role in sustainable use of traditional foods and management of related natural resources. A policy framework that integrates support for farming and rural development can also be supplemented with clear policy directions on recognition of traditional foods and associated knowledge systems.

**Acknowledgement**

Authors acknowledge the technical support and guidance of Prof Nancy J Turner, School of Environmental Sciences, University of Victoria, BC, Canada for conducting the research. Authors are grateful to the tribal women of studied areas for their active support in providing the information about traditional foods. Authors thank and appreciate the contributions made by Gaon Burha and Anchal Samithi Members (ASM) of concerned villages during conducting recipe contests and focus group discussions. Authors also acknowledge and thank the Dean, College of Horticulture and Forestry, Pasighat, Arunachal Pradesh, for his guidance and help during the study.

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