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RESEARCH ARTICLE

TRADITIONAL TECHNIQUES FOR PROCESSING BAMBOO SHOOTS IN NORTHEAST INDIA AS FOOD RESOURCE

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ABSTRACT

Northeastern region is endowed with rich diversity of edible bamboos. Preparation of food from bamboo shoots is traditional knowledge confined to the tribal communities of the region. Bamboo as food provides ethnic delicacy to the communities thus it is very popular there. Edible fresh bamboo shoot is available only during June to October. Therefore, the processing of bamboo shoots for preservation becomes important to make product available for whole year. Popular traditional products of Nagaland are Rhuchak, Voyen, Chutney, shoots with King Chili, Rhuchu, Ruchan and Rhuyen. There is need to sustainably manage the bamboo resource of Nagaland as per the requirement of communities for value addition of edible species of bamboo.

INTRODUCTION

Bamboos belong to the grass family Poaceae under the sub-family of Bambusoideae. Bamboo is not only used as building material but as agricultural implements, furniture, musical instrument, handicrafts, chopsticks production, raw materials, pulping materials and the edible nature of tender shoots of some species enhanced the importance of bamboo globally. The most important bamboos used as vegetables are chiefly the species from genera *Bambusa, Dendrocalamus* and *Phyllostachys*. Bamboo shoots are available in abundance in whole of North- Eastern states. Bamboos are an integral part of the Indian culture, particularly in the whole of North-East India, which accounts for nearly 50 per cent of the total bamboo resource of the country (Naithani, 2011). With regards to distribution bamboo occupies predominantly large parts of Dimapur, Peren, Mon, Wokha and Mokokchung districts. In all other districts of Nagaland bamboo is found as an admixture to other forest species. About 5 per cent of the growing stock of bamboo in the country is in Nagaland covering nearly 4,50,000 hectares. The dominant species diversity of bamboo in Nagaland are Kako (*Dendrocalamus hamilitonii* Nees), Dolo (*Schizostachyum dulloa* (Gamble) Majumdar, Giant bamboo (*Dendrocalamus giganteus* Munro), Tsisant (*Bambusa pallida* Munro) and Jadi (*Bambusa tulda* Roxb.). Bamboo shoots are considered as a delicacy in Nagaland and eaten regularly round the year. Bamboo shoots are traditionally consumed more often as vegetables during the season of availability. The average consumption of bamboo shoot in the North Eastern States of India is 1979 tones, 2188 tones, 442 tones, 433 tones, 442 tones and 201 tones in Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland and Tripura, respectively (Sarangthem and Singh, 2003). June to October months of the year are the moderate sale months while January to May have low sale as there is decline in the production of bamboo shoots during the period. Since bamboo shoots are highly perishable, therefore, the preservation in the season of low availability is needed and done by the tribal communities of the region of present study. Deserving to mention that while selecting an appropriate drying technology, it is important to explore energy, environmental and cost issues. There is need for development of village bamboos in NE India and technologies for value addition of lesser known bamboos (Biswas and Singh 2013 and Biswas 2014). Different technologies may be appropriate at different geographical locations depending on local socio-cultural conditions (Choudhury *et al*., 2012). High moisture content of bamboo shoots makes them easily perishable giving space for the growth of undesirable microorganisms like bacteria molds and yeasts. Canning has been observed to be effective in abating rancidity and preventing the growth of micro-organisms in bamboo shoots (Fu *et al.,* 2002). Canned bamboo shoots can

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be satisfactorily preserved and preferred along with various other food items such as pickle condiments. There is a growing demand for processed and packaged bamboo shoots in the national and international markets. Shelf life of freshly harvested bamboo shoots is 9 and 23 days in water and brine respectively (Anonymous 2009). During storage, a bitter taste develops in the bamboo shoots if stored for a longer period of time or exposed to sunlight. It has been reported that bamboo shoots preserved in plastic bags have a risk of contamination by the materials present in the plastic bags (Chiangthong and Chayawat 2009). The consumption pattern of bamboo shoots in most of the countries is traditional, non-standardized, seasonal and region-specific with little value addition. Therefore, there exists a great opportunity, especially for the organized food processing sectors to take up the processing of bamboo shoot-based food products in an organized manner (Choudhury *et al.,* 2012). Information on the ethnic fermented vegetable and bamboo shoot products of Northeast India is sparse outside the region (Tamang *et al.,* 2009). An attempt is made to document processing of bamboo shoots in Nagaland state of North-eastern region of India.

MATERIAL AND METHODS

Nagaland is located in the extreme North-Eastern region of India consisting of 11 districts. Present study was undertaken in Wokha district of Nagaland. The mentioned district is located in the western region of the state of Nagaland. It lies close to the plains of Sibsagar in the state of Assam. The total geographical area of Wokha district is 1,628 sq km with a population 166, 34316 as per 2011 census. Hilly district Wokha is located at an altitude of 1313 m ASL and lies between 26°06′ N and 94°16′ E latitude. Region experiences maximum and minimum temperature of 30^0 C and 10^0 C, respectively. The rainfall ranges from 1500-2000 mm annually. The villages selected for present study are Changsu (N-26.19142` E-094.28142`), Wokha (N-26.11011` E-094.252441`), Yikhum (N-26.16628` E-098.24587`) and Riphyum (N-26.17996` E-094.26400`). These four villages were chosen because the people of these villages are extremely dependent on the bamboo for domestic consumption. A complete list of farmers in each selected villages was taken from the concerned officials. The four villages comprise of 1504 households with a total population of 12,667. Considering 10% sample total of 150 households were randomly selected and surveyed for collection of information. The methods employed in this study were designed with the purpose of producing base line information for the edible use of bamboo shoots in the local systems, its different traditional products and processing techniques.

RESULTS

It is observed that 6 species of bamboo are largely used for preparation of edible product in Nagaland. Bamboo shoots are ground and fried before using them in preparation of certain dishes. The fermentation is a chemical change produced through the breakdown of carbohydrates and proteins by yeast, bacteria or molds. It is a process used in order to make and preserve such kinds of foods while keeping intact nutrient values and enhancing flavor. The unique micro flora in each fermented food increases the protein, vitamin, and fatty acid levels. The principle of bamboo shoot fermentation and the indigenous traditional techniques for the processing of fermented bamboo shoot products is similar among the tribal communities of the state.

The methods used for the process of bamboo shoot products employed in Nagaland are as follows:

Rhuchak

Rhuchak is the crushed fermented bamboo shoot product. Well-preserved crushed fermented bamboo shoot can be used throughout the year until the next harvesting is done. It is only possible due to natural fermentation process, as no preservatives agent is used. The process of Rhuchak preparation is carried out during the month of June to October when the new shoots are formed. A particular species of bamboo i.e. *Dendrocalamus giganteus* Munro, also known as "*enung*" is used for making the Rhuchak. The young and tender bamboo shoots are collected and the sheaths removed. Shoots are cleaned and washed thoroughly. Cleaned shoots are thinly sliced and transferred in a wooden mortar and pound with a pestle. After the fresh bamboo shoots crushed, it is collected and packed in an airtight container and kept for 2-3 months for fermentation in anaerobic condition to consume.

Voyen

It is a sliced bamboo shoot product. Bamboo species used for *voyen* preparation are *Dendrocalamus hamiltonii* and *Dendrocalamus giganteus*. The freshly harvested bamboo shoots are collected and the tough fibrous portion at the base of the shoot is cut off and the outer hard leaf sheaths are removed. The tender leaf sheaths inside and near the tip of the shoot are left attached being tender and full of flavour. Later top of shoots are cleaned and washed 4 to 5 times and sliced into tiny pieces. These pieces are soaked in the water overnight (10-11 hrs) to remove any acidic elements left. Then the water is drained off and the shoots boiled in a large container for 45 minutes. If there is no bitterness present, shoots can be consumed by frying with various ingredients. If bitterness is left then sliced shoots are needed to be boiled until the bitterness goes off. This bamboo shoot product is also sold as roasted whole shoot in the market places, wrapping with banana leaf but it cannot be preserved for more than 2-3 days.

Pickle

In Nagaland three types of bamboo shoot pickle is prepared, i.e. i) pickle using traditional method: bamboo shoots with King Chili locally known as *Kedi Chusi* and *Chudi,* an interspecific hybrid between *Capsicum frutescens* Linn. and *C chinense* Jacq., ii) pickle with non-traditional method: bamboo shoots with King Chili, iii) chutney with dry fruits. Studies find that the preparation of pickle from bamboo shoot is done in Wokha village only.

Bamboo shoots with King Chili (Traditional)

The bamboo species used for preparation of bamboo shoot with King Chili are *Dendrocalamus giganteus* (enung), *Dendrocalamus hamilitonii* (vapvu) and *Bambusa pallida*

(tsisant). The fresh bamboo shoots are collected and their sheaths removed, cleaned and washed thoroughly in normal water. Shoots are sliced into small pieces after cleaning before mixing before mixing the ingredients. The ingredients used for pickle preparation are King Chili's preserved paste, mustard oil, and salt. Measure of all the ingredients is given in Table 1. After mixing of ingredients oil is heated in a pan at low flame, the mixture put in a pan and is removed from the flame. The pickle thus prepared is ready to use or preserved.

Table 1. Ingredients used for preparation of Pickle: bamboo shoot with King Chili (traditional)

S No	Ingredient	Quantity
1	Preserved bamboo shoot	1 ½ kg
2	King Chili paste (preserved)	100-150 g
3	Mustard oil	300 ml
4	Salt	As per taste

Table 2. Ingredients used for preparation of Pickle: bamboo shoot with King Chili (non-traditional)

S No	Ingredient	Quantity
1	Preserved bamboo shoot	1 ½ kg
2	King Chili preserved paste	½ Kg
3	Mustard powder(black)	150 g
4	Mustard powder(white)	100g
5	Cumin seeds	50g
6	Carom seeds	50g
7	Mustard oil	½ liter
8	Acetic acid (mixed with 200ml water)	30 ml
9	Salt	As per taste

Table 3. Ingredients used for preparation of Pickle: Bamboo shoot chutney with dry fruits

S No	Ingredient	Quantity
1	Bamboo shoot	1 kg
2	Sugar	1 kg
3	Salt	50 g
4	Cardamom	20 g
5	Cinnamon	20 g
6	Clove	20 g
7	Cumin seed	10 g
8	Red chili Powder	15 g
9	Onion (thinly chopped)	15 g
10	Garlic (thinly chopped)	15 g
11	Vinegar	50 ml
12	Dry fruits	100gms

Figure 1. Bamboo shoots sliced for preparation of pickle

Figure 2. Rhuchu (Juice from Bamboo shoot) extraction technique using conical bamboo basket. Wooden mortar in picture is used to pound sliced bamboo shoot with pestle

Bamboo shoots with King Chili (Non-traditional)

The freshly harvested bamboo shoots are removed of their sheaths, cleaned and washed in normal water. Nearly 10 kg of the upper part of bamboo shoot is taken and cut it into thin round shape. The sliced bamboo shoots are dipped in water for 20- 40 minutes and drained. The ingredients used for pickle preparation are King Chili, mustard oil, cumin (*Cuminum cyminum* Linn.) seeds, carom (*Trachyspermum ammi* Sprague) seeds, white mustard (*Sinapis alba* Linn.) seed powder, acetic acid, citric acid and salt. Measure of the ingredients is provided in Table 3. The thin round slices of bamboo shoot is kept in a big bowl separately. Quantity of water just enough to boil is taken, citric acid added and boiled for five minutes. Heat the oil in a pan, when it is heated add the Bamboo shoot mixed with mustard powder, salt, carom and cumin seeds, King Chili and acetic acid fried in oil under low flame. Mixing of all the ingredients is done in such a way that oil must float after needed frying has been done. It is later allowed to cool and serve. Bamboo pickle is packed in a glass jar or in plastic container tightly and kept under room temperature.

Bamboo shoot chutney with dry fruits

Bamboo species used for making chutney with dry fruits are *Dendrocalamus giganteus* (enung), *Dendrocalamus hamiltonii* (vapvu) and *Bambusa tulda* (tsisant). To make chutney with dry fruits, fresh bamboo shoots are collected, sheaths removed, cleaned and washed. The shoot is sliced into small pieces with the help of a Dao/ knife. The sliced bamboo shoot is boiled in

a pan in order to remove the bitterness. It is boiled for 2-3 times and drained each time so that the bitterness is thoroughly removed. The boiled sliced bamboo shoot is ready for making chutney. Measure of all the ingredients in making bamboo shoot chutney with dry fruits is given in Table 2. Sugar and salt are duly mixed with water in a stainless steel pan. It is then heated till the sugar and salt are dissolved properly. Along with it, chopped onion and garlic are added. Dry fruits are chopped into small pieces. The cloves are smashed and kept separately. Cardamom, cumin seed, cinnamon bark and red chili powder are mixed well in a big bowl. The chopped onion, garlic and the smashed clove kept separately are mixed with other spices thoroughly and subsequently mixed. The admixture is then cooked till it becomes softer. Lastly ingredients is mixed with vinegar and heated to get desired consistency. After having cooled the prepared item it is stored in a glass or plastic jar and kept in room temperature.

Pickles are traditionally used in every household and extensively used as a main ingredient in different fish and meat preparations (curry and dry) and also used in some dishes made of meat.

Rhuchu

Rhuchu is bamboo shoot juice. The bamboo species which are used in making the Rhuchu are: *Dendrocalamus hamiltonii* (vapvu), *Dendrocalamus giganteus* (enung) and *Bambusa tulda* (tsintsan). Fresh bamboo shoots collected are removed of sheaths are hand removed, while the hard portions of shoot with the help of knife. It is then cleaned and washed well, sliced into small pieces and put in a wooden mortar and pound with pestle. Crushed shoots are collected in a conical bamboo basket with a hole below. A pointed bamboo stick which is a little longer than the length of the basket is inserted into the hole. The inner wall of the basket is lined with bamboo leaf. The crushed bamboo shoots are then put in the basket which is tied to a post and is covered with banana leaves. Stones are placed above it as weights. The bamboo stick helps in the seepage of the juice, which is twisted and gently turned from time to time in order to allow proper drainage of the juice collected in container drop by drop through bamboo stick. Collected bamboo shoot juice is allowed to ferment in an airtight container for 6-10 days to find Rhuchu ready to consume. It has flavor similar to vinegar. Rhuchu is consumed in little quantity as food additives.

Ruchon

For preparation of Ruchon the bamboo species used are *Dendrocalamus giganteus* (Enung) and *Dendrocalamus hamiltonii* (vapvu). The freshly harvested shoots are removed of hairy outer sheaths and its hard portion. Shoots are cleaned, washed, and put in a wooden mortar and pestle. It is then pounded and the fresh crushed bamboo shoots are collected in a basket. The basket is covered with a banana leaf from all the sides and kept for fermentation for 5-6 days in a dark place. During the fermentation process, the juice of the crushed bamboo shoot is collected in an empty jar or bottle. On the 7th day the semi-fermented crushed shoot is spread over a bamboo-mat and exposed to sun to dry properly in 2-3 days or more. Ruchon thus prepared is then packed in polythene bags and preserved for future use. The ruchon can be stored for about 1-2 years.

Rhuyen

The fresh tender shoots from *Dendrocalamus hamiltonii* (vapvu) are used to prepare Rhuyen (Sliced bamboo shoots). The upper tender part of the bamboo shoot is collected and cleaned by removing the sheaths and washed properly. It is then sliced into desired small pieces with the help of a dao/knife. It is then kept in a basket lined with banana leaf from all the sides for fermentation for 6 days in a dark place. On the 7th day the fermented shoots are spread over bamboo mat and exposed to the sun to dry it completely for 2-3 days. It is then packed in an airtight plastic containers / polythene packs. It is now ready for consumption.

Conclusion

Bamboo shoot forms traditional delicacy in North-Eastern region of India. *Dendrocalamus hamiltonii* and *Dendrocalamus giganteus* are the most used species for preparation of edible products. Bamboo shoots are consumed in canned, boiled, fermented and liquid forms. Though the fresh bamboo shoots are considered nutritionally rich, but their availability is not for round the year. The young shoots after fermentation or drying can be preserved for long. Traditionally there are six products made from bamboo shoots in the state of Nagaland. Three types of pickle are popular in Nagaland in which two prepared with traditional method and one in non-traditional way. According to Farooquee *et al.,* India's size of domestic bamboo economy currently is estimated at 2,000 million Indian rupees (Farooque *et al*., 2007). The market potential of bamboo in India estimated presently as 450 million Indian rupees is expected to increase to 26,000 million Indian rupees by 2015, thus enabling over five million families of artisans and farmers, crossing the poverty line. Despite the enormous production of bamboo shoots in Northeastern India, there is lacuna in knowledge in methodology of processing and packaging of bamboo shoots, only a few units in the region operate on such aspects of bamboo. Hence, documentation of traditional processing techniques along with the value addition in terms of industrial input is a thrust area to be worked out. There is need to document methods of traditional harvesting, processing and preservation techniques, besides promoting local knowledge on recipe and cuisines on edible bamboos as provided in present study.

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