Traditional skill of ethnic people of the Eastern Himalayas and North East India in preserving microbiota as dry amylolytic starters

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Preparation of ethnic fermented beverages using dry amylolytic starters is an integral part of socio-cultural practice of different ethnic groups of people residing in the Eastern Himalayan region of Nepal, Bhutan and India including North-East India. Alcoholic beverages are produced by traditional fermentation using specific amylolytic starters, which are prepared in different ways by diverse ethnic groups. This study is aimed at documenting the traditional skill of various ethnic groups of people of North East India and the Eastern Himalayas in preserving microbiota as dry amylolytic starters generally used for preparation of alcoholic beverages.

Keywords: Alcoholic beverage, Amylolytic starter, Ethnic groups, Eastern Himalayas, North East India.

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The geographical extent of Eastern Himalayas comprises eastern Nepal, Indian states of Sikkim, Arunachal Pradesh and Darjeeling hills, and a mountainous country Bhutan. North East India is comprised of the cluster of eight states namely Assam, Nagaland, Sikkim and Tripura. More than 137 different ethnic groups reside in these regions. The consumption of alcoholic beverages, prepared by fermentation using amylolytic starter inocula commonly referred to as amylolytic starter, is a common practice among the people of North East India and the Eastern Himalayas. The amylolytic starter is a round to flattened ball of mixed dough containing various wild and domesticated plant parts and amylolytic and alcohol-producing yeasts, starch degrading moulds and lactic acid bacteria. Varieties of ethnic amylolytic starters are prepared such as marcha of Nepal, Sikkim and the Darjeeling hills in India, pho of Bhutan, emao/humao of Assam; xaaz pitha and modor pitha of Assam, hamei of Manipur, thiat of Meghalaya, chowan of Tripura, kherie/khekhrri of Nagaland, Pee, paa, phut and phab of Arunachal Pradesh, and dawdim of Mizoram (Fig. 1). This paper aims to give extensive information on the indigenous knowledge of preparation process of various amylolytic starters found in different regions of the Eastern Himalayas and North East India.

Locations of documentation and data collection

Documentation work was carried out for a period of 12 months from December 2015 till November 2016. Data collection was done based on structured questionnaire, interviewing the people involved in traditional preparation of amylolytic starters, personally analyzing the preparation procedures, collection of plant samples and their identification from Botanical Survey of India, Sikkim circle, Gangtok. The study was done in Basilakha village of Sikkim; Dharan, Dhankutta and Hiley districts of Eastern Nepal; Napchey village of Dhonakha, Bhutan; Kohima of Nagaland and West Siang and Nirjuli district of Arunachal Pradesh. The interviewees were local people of the villages visited and had proper knowledge of preparation of the starter cultures.

Results and discussion

Traditional preparation process of amylolytic starters

Marcha

Marcha is a dry flat creamy white solid ball-like starter of different size and shape traditionally prepared in Sikkim and the Darjeeling hills in India (Fig. 1A), Bhutan (Fig. 1B) and Nepal (Fig. 1C),
which is used to ferment starchy material into various ethnic fermented beverages and alcoholic drinks. In the South and eastern parts of Bhutan, *marcha* is predominantly prepared and used by the ethnic Nepali of Bhutan. The preparation process of *marcha* in these regions is almost same.

**Indigenous knowledge of preparation of marcha**

Glutinous rice (*Oryza sativa*) is soaked in water for 8-10 h (overnight) at an ambient temperature. After soaking rice is crushed in a foot driven heavy wooden mortar pestle. Wild herbs such as roots of *guliyo jara* or *chitu* (*Plumbago zeylanica*) leaves of *bheemsen paate* (*Buddleja asiatica*), flower of *sengreknna* (*Vernonia cinerea*), ginger and red dry chili (2-3 pieces) are crushed and added to the powdered rice. Mixtures are then mixed with water to make a thick paste or dough, from which dough balls of different sizes are made. These balls are then dusted with the old *marcha* which are used as an inoculum. The freshly prepared flattened balls are kept on the leaves of fern *Glaphylopteriolopsis erubescens* (commonly known as *pirey uneu*) and covered with the ferns and fermented at room temperature for 24 h. After fermentation, ferns are removed and balls are collected and dried in the sun or kept at room temperature for about 5 days (Fig. 2). The dried *marcha* balls are then sold in the market.

**Mana/Manapu**

*Mana* is a black colored amylolytic starter of Nepal. *Newari* community of Nepal specifically prepares this amylolytic starter to ferment alcoholic distilled liquor, *ayela*, which is very popular alcoholic drinks and is used in special occasions and rituals in
Nepal. Owing to a much easier process of preparation, the use and preparation of marcha is replacing the use of mana in Nepal, due to which the practice of making mana has almost come to an extinction point.

Indigenous knowledge of preparation of mana

During preparation of mana, wheat grains are soaked in water over night, boiled for 30 min, drained off excess water, cooled, added dried leaves of harrah plant, old mana powder and ground in a traditional mortar and pestle. Dough mixture is made into small balls, placed on paddy straw spread on a clean floor, and again covered by paddy straw or straw mat, and fermented for 6-7 days till green moulds appear on the ball. It is dried in the sun to get a black-coloured mana and stored for future use.

Pho

Pho or phab (Fig. 1D) is a flat dark brown colored cake prepared from powdered maize. This amylolytic starter is prepared indigenously by Drukpa community of Bhutan residing in the North Western side of Bhutan. Pho is used in preparing the fermented alcoholic drink Aru, which is popularly used during the festive seasons in Bhutan.

Indigenous knowledge of preparation of pho

The main ingredient used for preparing pho is a flower of bhagham plant. This flower blooms during October and is white in color and almost 8 inches long (20 cm). The flowers of this plant are sun dried and powdered. During the preparation, powdered maize, rice husks and dried powdered flowers of bhagham are taken in a specific ratio of 2:4:3, respectively. Previously prepared pho is used as inoculum by back-sloping method and added to the mixtures (Fig. 3). Pho stored for more than one year is usually not preferred to be used as a starter culture.

Emao/humao

Emao (Fig. 1E) is amylolytic starter prepared by Bodo community of Assam. Dimasa, another ethnic community in Assam calls it humao. Emao is a ball like starter used to ferment glutinous rice to prepare alcoholic beverages of Assam like zujou/judima.

Indigenous knowledge of preparation of emao

Glutinous rice (Oryza sativa) is soaked in water for about 2-3 h and mixed with plants like leaves of banana, lwkwna, dong-phang-rakhep (Scoparia dulcis) and dry barks of Albizia myriophylla. These ingredients are then ground together in a wooden mortar pestle (this set of apparatus is locally called gaihen and ual). The powder is then sieved in a sandri (traditional sieve made of bamboo) to which little amount of water is added to make thick paste or dough. Different sizes of small round cakes are made from this dough which are then dusted with the old emao, basically used as an inoculum, covered with rice straw and fermented for 2-3 days. After the incubation balls are sundried.

Xaaz pitha

Xaaz pitha (Fig. 1F) is an amylolytic starter produced by Ahom community of Assam. Xaaz pitha is a ball like starter used to ferment glutinous rice into fermented beverages. Unlike addition of fresh leaves of wild plants during preparation of emao, dried leaves are added in preparation of xaaz pitha.

Indigenous knowledge of preparation of xaaz pitha

Xaaz pitha is traditionally prepared mixed amylolytic dough inocula used as a starter for the preparation of various ethnic alcoholic beverages. Local rice is soaked for 10-12 h and dried leaves and stems of wild herbs are added to the soaked rice. The mixture is then grounded together in an wooden mortar by a pestle. A thick dough is prepared by adding water to the above powdered mixture, from this fresh oval–shaped balls are made and placed on fern leaves (Fig. 4). The freshly prepared xaaz pitha is
then dried either in the sun or over the fireplace. After a period of about five days they become hard and ready for use.

**Modor pitha**

Modor pitha (Fig. 1G) is also a starter prepared by Kachari community of Assam to ferment rice into alcoholic beverages such as *xaaz pani*.

**Indigenous knowledge of preparation of modor pitha**

Glutinous rice (*Oryza sativa*) is soaked in water for about 2-3 h and mixed with the dried leaves, stem and roots of different types of plants. The above mixture is crushed together in a foot driven wooden mortar pestle (this set of apparatus is locally called *dekhi*). A little amount of water is added to make thick paste, made into small round cakes, dusted with powdered old *modor pitha*, placed on rice straw and then covered with ferns, and fermented for 2-5 days. Once the fermentation process is completed *modor pitha* ball starts to swell. Finally, it becomes hard and is ready to be used as starters for alcoholic beverages.

**Hamei**

Hamei (Fig. 1H) is a dry, round to flatten, solid ball-like mixed dough inocula used as starter cultures to prepare *atingha*, an alcoholic beverage in Manipur.

**Indigenous knowledge of preparation of hamei**

Hamei is prepared from local varieties of rice which is either soaked in water or used directly without soaking. The rice is mixed with powdered bark of *yangli* (*Albizia myriophylla* Benth.), 1-2 % of old *hamei*, grinded and dough is prepared by adding a small amount of water. The dough is pressed into flat cakes and kept over paddy husk in a bamboo basket, covered by sack clothes and fermented for 2-3 days at room temperature, and then sun dried for 2-3 days (Fig. 5), and is sold in local markets.

**Thiat**

Thiat (Fig. 1I) is an amylolytic starter culture used for the preparation of fermented alcoholic beverages in Meghalaya.

**Indigenous knowledge of preparation of thiat**

Glutinous rice is used as a substrate for the preparation of *thiat*. Rice is soaked in water overnight after which it is sun dried for a short period of time to drain off the excess water. Dried leaves and roots of herbs *khaw-iang* (*Amomum aromaticum*) are added to the soaked rice and, and then mixture is made into thick dough by adding water. Flat to round balls are made from the dough and fermented for 1-3 days (Fig. 6). The freshly prepared *thiat* balls are sun dried for 3-5 days.

**Chowan**

Chowan/(*chowan beleb*) (Fig. 1J) is a traditionally prepared starter culture of different ethnic tribes in
Tripura, and is used for production of local alcoholic beverage *gora bwtwk* and distilled alcoholic drinks *chuwak*.

**Indigenous knowledge of preparation of chowan**

During *chowan* preparation, soaked glutinous rice is mixed with roots, barks and leaves of locally available herbs and powdered old *chowan*. Use of wild herbs during preparation of *chowan* varies from one tribe to other. The mixture is then made into paste by adding water and kneaded into flat and oval cakes of varying sizes and shapes, and fermented for 2-3 days over earthen oven in kitchen (Fig. 7). These freshly prepared *chowan* cakes are then sun dried for 3-7 days and used.

**Khrie/Khekhrii**

*Khrie/khekhrii* (Fig. 1K) is an amylolytic starter culture prepared by germinated sprouted rice grains in Nagaland. This is the only amylolytic starter in North-East India which is not prepared by using the old starter through back-sloping method, rather it is prepared by fermenting germinated sprouted-rice grains and then sun-dried to use as dry starters to prepare the local alcoholic drink called *zutho*.

Glutinous rice soaked in water overnight

↓

Drained off excess water, air-dried for 3-4 h

↓

Mixed with leaves, barks and roots of wild herbs

↓

Grinded in a wooden motor by pestle

↓— Added old *chowan*,

Mixed with water, made dough, shaped into flat to oval cakes

↓

Fermented for 2-3 d

↓

Sun dried for 3-7 d

↓

*Chowan/chowan beleb*

**Indigenous knowledge of preparation of khrie/khekhrii**

Unhulled glutinous rice (*dhan*) is washed with water two to three times and then soaked into water for 2-5 days. It is then kept and covered with *khreihenyii* leaves and allowed to germinate for 2-3 days in summer and 4-5 days in winter. After germination when the rice sprout is about half an inch in length, the sprouted rice is sun dried and powdered (Fig. 8).

**Phab**

*Phab* (Fig. 1O) is a flat white colored cake, which is prepared using rice flour. *Tagin* community of Arunachal Pradesh prepares this amylolytic starter traditionally. *Apatani* community and *Nyshing* community of Arunachal Pradesh also prepare similar starter cultures called *pee* (Fig. 1L) and *paa* (Fig. 1N), respectively.

**Indigenous knowledge of preparation of phab**

During *phab* preparation soaked rice is dried and mixed with leaves of some plants *nakail* (*Cinnamomum glanduliferum* Mesissn.), *ctuepatti* (*Cissampelos pareira* L.), *khanoba* (*Clerodendron viscosum* Vent.), 5-7 balls of old *phab* are added, made into fine powder, added water and mixed...
thoroughly. The mixture is made into a paste and then small round cakes, wrapped in rice leaves and placed in bamboo strips over the fireplace and fermented for 1-2 days. Cakes are sun dried for 5-10 days and store up to 6 months (Fig. 9). The preparation process of phab, pee and paa is almost same except for paa where rice is boiled without soaking. No herbs are added during the preparation of pee.

**Phut**

Phut (Fig. 1M) is a flat cake prepared by glutinous rice flour. Mongpa community of Arunachal Pradesh prepares phut traditionally.

**Indigenous knowledge of preparation of phut**

During phut preparation soaked rice is dried and crushed into a fine powder using wooden mortar and pestle. Handful leaves of plant along with cakes of old phut are made into fine powder, added to rice flour and mixed thoroughly. The mixture paste is made into small round cakes, wrapped in straw and fermented for 1-2 days. Cakes are sun dried for 3-7 days.

**Dawdim**

Dawdim (Fig. 1P) is a traditionally prepared amylolytic starter of Mizoram used in preparation of local alcoholic beverages.

**Indigenous knowledge of preparation of dawdim**

During preparation, soaked local varieties of rice are crushed to make fine rice flour, mixed with local leaves of herbs with addition of 2% old dawdim. The mixture is then made into paste by adding water and kneaded into flat and oval cakes of varying sizes and shapes, wrapped in fern leaves in bamboo-made baskets, and then covered by jute bags and kept for fermentation above the earthen kitchen oven for 1-3 days. These freshly prepared cakes are sun dried for 3-5 days (Fig. 10).

**Socioeconomic importance**

The present documentation focuses on the preparation of amylolytic starters, which are used to make fermented beverages. It was observed that the substrate (rice) used for making the amylolytic starters is almost same among the different ethnic groups, except for the Drukpa community of Bhutan who used maize instead of rice as the starchy substrate. Amylolytic starters are not just prepared at household level but also at a commercial scale in small villages of North-East states of India and the Eastern Himalayan regions of Nepal and Bhutan. From these small villages the starter cultures are supplied to the local markets and sold at various places.
prices. Some ethnic groups of people are economically dependent on the preparation of these amylolytic starter cultures. The mountain women have been storing and culturing the functional microorganisms for alcoholic fermentation in the form of dry starter cultures for more than 1000 of years\(^1\). The producers earn about 60-70 % profit by selling these starters and are one of the major sources of income in the village areas contributing to local economy.

The consortium of microorganisms consisting of filamentous moulds, amylolytic and alcohol producing yeasts and species of lactic acid acid is preserved in cereals as starchy bases, as a source of starch, together with the use of glucose-rich wild herbs to supplement the carbon sources for growing microorganisms\(^1\). Starter culture-making technology reflects the traditional method of sub-culturing desirable inocula from previous batch to new culture using rice as base substrates. This technique preserves the microbial diversity for beverages production. Saccharifying activities are mostly shown by filamentous moulds *Rhizopus* spp. and *Mucor* spp., and yeast *Saccharomyces fibuligera* whereas liquefying activities are shown by *Saccharomyces fibuligera* and *Saccharomyces cerevisiae*\(^5\). *Rhizopus* spp. and *Sm. fibuligera* degrade cereal starch and produce glucose, and then alcohol-producing yeasts species of *Saccharomyces* and *Pichia* rapidly convert glucose into ethanol\(^5\). Lactic acid bacteria present in amylolytic starters impart flavor, antagonism and acidification of the substrates\(^6\). Fermented beverages produced by using amylolytic starters are generally mild-alcoholic (4-5 %), sweet taste with several health benefits to the local consumers as high source of calories, some vitamins and minerals\(^1\)*.

**Conclusion**

It has been noticed that majority of the young generations do not know ethnic foods, their culinary practices and processing method. Native microorganisms with vast biological genetic resources, which are associated with ethnic fermented foods, are forced to disappear. These fermented food and beverages have the potential to grow in a small medium sized industry if proper scientific and technical support is extended to the existing indigenous practices of home based fermentation.

**References**