Jyoti Prakash Tamang *Editor*

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ISBN 978-981-15-1485-2 ISBN 978-981-15-1486-9 (eBook)
https://doi.org/10.1007/978-981-15-1486-9

This Springer imprint is published by the registered company Springer Nature Singapore Pte Ltd.
The registered company address is: 152 Beach Road, #21-01/04 Gateway East, Singapore 189721, Singapore

Preface

India has one of the oldest civilizations in the world with vast history, food culture, bio-resources, and diverse ethnicity. India is administratively divided into 28 states and 9 union territories and is the world's second largest populated country with >120 billion people speaking more than 1652 languages, 216 dialects, and 23 official languages. Ethnic food has a cultural connotation in India and linked to diverse ethnicity which represents the traits of wisdom and knowledge of ancient Indian people on culinary and also on the right choice of "bio-actively enriched balance diets" since *Rig Vedic* period around 1500 BCE to 1000 BCE. Gastronomy of Indian ethic foods is based on *Vedic* food habits with adoption of some Mughal and English cuisines, the present-day Indian foods of more than 2000 diverse ethnic groups of people are unparalleled and unique to each other. It is remarkable to note that unlike many countries India has more than 350 diverse types of major or common and minor or region-specific ethnic fermented foods and beverages (234 fermented foods, 84 alcoholic beverages, and 32 traditionally prepared amylolytic starters) which are traditionally prepared and consumed by ethnic people of India for 5000 years. Indian gastronomy and culinary with huge diversity of ethnic foods are always pride of our rich dietary culture and heritage.

This book has 23 chapters covering different types of ethnic fermented foods and alcoholic beverages of all states of India. I am grateful to all contributing authors and co-authors who accepted our invitation to write this book. I could bring all of them in the same platform who have been working on various aspects of Indian fermented foods and beverages. I am also grateful to Springer Nature for publishing this comprehensive book on Indian ethnic foods. We hope this book will be read by researchers, students, teachers, nutritionists, dieticians, food entrepreneurs, agriculturalist, government policy makers, ethnologists, sociologists, and electronic media persons who keep interest on the health benefits of fermented foods and beverages. This book *Ethnic Fermented Foods and Beverages of India: Science History and Culture* is the first of this kind on compilation of various ethnic fermented foods and alcoholic beverages of India.

I dedicate this book to our ancestors who invented the technology, knowledge, wisdom, and skill of food fermentation and created the platform of "ethno-microbiology" for research to study in depth of metagenomics and determination of bioactive molecules in ethnic fermented foods and beverages contributing health benefits to the consumers.

Gangtok, India Jyoti Prakash Tamang

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Editor and Contributors

About the Editor

Jyoti Prakash Tamang is one of the pioneer microbiologists working on the interpretation of "ethno-microbiology" to molecular food microbiology associated with age-old ethnic fermented foods and beverages of India, Nepal, and Bhutan, a field he has investigated for the past 33 years using a range of metagenomics/omics and bioinformatics tools. He has also sparked significant interest in ethnic fermented foods by establishing knowledge-based resources and promoting academic interest in India. He has more than 154 publications to his credit, including several books with international publishers—*Himalayan Fermented Foods: Microbiology, Nutrition, and Ethnic Values* (CRC Press, New York 2010), *Fermented Foods and Beverages of the World* (CRC Press, 2010), *Health Benefits of Fermented Foods and Beverages* (CRC Press, 2015), and *Ethnic Fermented Foods and Alcoholic Beverages of Asia* (Springer Nature, New Delhi 2016). He has received several national and international awards and is currently the senior-most Professor in Microbiology and Dean of Sikkim Central University, Gangtok, India. Prof. Tamang is the International Centre for Integrated Mountain Development (ICIMOD) Mountain Chair for the year 2019–21 and also Visiting Professor of National Institute of Industrial Science and Technology, Japan.

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History and Culture of Indian Ethnic Fermented Foods and Beverages

1

Jyoti Prakash Tamang

Abstract

"भारत" (Bharat) has one of the oldest civilizations in the world with vast history, food culture, bio-resources, ethnicity, and customs. Ethnic food has a cultural connotation in India and is linked to diverse ethnicity which represents the traits of wisdom and knowledge of ancient Indian people on culinary and also on the right choice of "bioactively enriched balance diets" since *Rig Vedic* period. Diversity of Indian fermented foods and beverages is related to diversity of ethnicity with unparalleled food culture of each community. More than 350 types of major and region-specific ethnic fermented foods and alcoholic beverages are produced either naturally or by adding mixed starter cultures using indigenous knowledge of food fermentation in India. Diversity of microorganisms ranges from mycelia fungi to enzyme-producing to alcohol-producing yeasts and Gram-positive and few Gram-negative bacteria with several functional properties. Functional microorganisms play important roles in the traditional fermentation processes by their functional properties enhancing several health-promoting benefits to the consumers such as bio-preservation of perishable foods, bio-enrichment of nutritional value, protective properties, bioavailability of minerals, production of antioxidants, antimicrobial activities, non-production of biogenic amines, and probiotics properties. Microbial diversity in ethnic fermented foods contributes significant genetic resources due to diverse food cultures of the multiethnic groups of people in India. It has been noticed that consumption of few uncommon ethnic foods is declining in many states of India due to change in life style, shifting from cultural food habit to commercial foods and fast foods affecting drastically the traditional culinary practices, and also due to climate change in some places.

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J. P. Tamang (ed.), *Ethnic Fermented Foods and Beverages of India: Science History and Culture*, https://doi.org/10.1007/978-981-15-1486-9_1

Keywords
Food culture · Indian ethnic foods · Fermented foods · History of foods

1.1 Introduction

"भारत" (Bharat) in Sanskrit, an ancient name for modern India, has one of the oldest civilizations in the world with vast history, bio-resources, ethnicity, rich cultural heritage, culinary, cuisine, and customs. India with a total area of 3,287,263 km^2 is administratively divided into 28 states and 9 union territories and is the world's second largest populated country with >120 billion people speaking more than 1652 languages, 216 dialects, and 23 official languages (www.censusindia.gov.in). More than 2000 diverse ethnic groups of people are living in India (Majumder 2001). The dominant racial communities in India are Indo-Aryan (72%), Dravidian (25%), and Mongoloid and other minority groups (3%) (Sousa 2019). The main racial groups of Indian ethnic people belong to six groups, viz., Negrito, proto-Australoids or Austrics, Mongoloids, Mediterranean or Dravidian, Western Brachycephals, and Nordic Aryans according to Guha (1937). India is divided into six physiographic regions: (1) the Himalayas in north and northeast; (2) Peninsular Plateau with Aravalli, Vindhyachal and Satpura ranges, Eastern Ghats and Western Ghats and plateaus Malwa Plateau, Chhota Nagpur Plateau, Southern Granulite Terrain, Deccan and Kutch Kathiawar; (3) Indo-Gangetic Plain; (4) Thar Desert in West; (5) Coastal Plains: Eastern Ghats folds and Western Ghats folds; and (6) Islands—the Andaman and Nicobar Islands and the Lakshadweep Islands. Agricultural farming of locally available agro-resources, pastoral and animal husbandry, fishery, and agrarian system of traditional agriculture have been traced back to Indus Valley Civilization in India (Fuller 2015). Since then mixed-agriculture farming in all geomorphological areas under different agroclimatic conditions is being practiced by farmers in the field of animal husbandry, forestry, fishery, etc. to supplement daily food resources in local diets.

1.2 History of Indian Food Culture

Ethnic food has a cultural connotation in India and is linked to diverse ethnicity which represents the traits of wisdom and knowledge of ancient Indian people on culinary and also on the right choice of "bioactively enriched balance diets" since Rig Vedic period around 1500 BCE to 1000 BCE (Jamison and Brereton 2014) to present-day edibles. The genesis of Indian food culture goes back to Indus Valley Civilization also known as Harappan Civilization around 8000 years ago (Sarkar et al. 2016), where cultivation of cereal crops such as wheat and barley as staple diets as well as domestication of cattle for milk and meat is represented by pastoral and farming communities (Possehl 2002). Archaeological evidence suggests that the Harappan people might have invented baking of roasted wheat seeds on griddle to

prepare *chapati* (baked wheat-based bread) as staple diet (Achaya 1994). Ancient Indian dish called *pulao/pallao* which is prepared by cooking together rice and meat (Achaya 1994) has been mentioned in *Yajnavalkya Smriti*, one of the texts of Hinduism composed in Sanskrit during 300–500 BCE (Olivelle 2006). The origin of Indian agriculture systems was mentioned in *Rig Veda* (Sanskrit hymns) with cultivations of vegetables, fruits, spice, etc. (Vishnu-Mittren 1978) which supplemented the local diets in ancient India. One of the oldest Hindu sacred texts in Sanskrit is the *Bhagavad Gita* which was written 5000 years ago. In Chap. 17, text (*sloka*) 8–10 of the *Bhagavad Gita* says that "every human being is born with innate faith," which can be of three kinds—*sāttvic* "सात्वकि" (mode of goodness), *rājasic* "राजसकि" (mode of passion), or *tāmasic* "तामसकि" (mode of ignorance). S*ā*ttvic food denotes food for longevity, prosperity, intelligence, strength, health, and happiness, which includes fruits, vegetables, legumes, cereals, and sweets. *Rājasic* food signifies activity, passion, and restlessness, which include hot, sour, spicy, alliaceous plants *including onions* and *garlic* and salty foods. *Tāmasic* food is intoxicating and unhealthy, which generally causes dullness and passivity (Tamang and Samuel 2010). The influence of religions effected the Indian dietary culture toward vegetarianism due to the advent of Buddhism during 600 BCE (Harvey 2013) and also Jainism during 700 BCE (Dundas 2002) and also due to favorable agroclimatic conditions where a variety of fruits, vegetables, and grains could easily be grown throughout the year. Influence of *ayurdeva aahar* (Kulkarni 2002) comprising mostly milk and milk products, cereals as *chapati* or cooked rice "चावल", lentils/legumes "दाल", fruits and vegetables has been observed in Indian diets.

India has a long history of invasion from foreigners which has not only changed the traditional demography and culture but also drastically influenced the ancient Indian food cultures too, sometimes by accepting or sharing the foods of different communities due to acceptability or preferences of foods. Mughal Empire which ruled India from 1526 to 1857 Richards (1995) has introduced foods including many nonvegetarian dishes such as *biriyani*, *mughlai paratha*, *murgh musallam*, *kebabs*, *malai kofta*, *rezala*, etc. into Indian cuisine. East India Company ruled India for 100 years (1757–1858), and the British Crown ruled India for 89 years (1858–1947). British influenced the ethnic Indian dietary cultures and supplemented many English foods known as Anglo-Indian foods and culinary into Indian cuisine during the 189 years of British rule such as breads/loaves, soup, salad, fried/poached eggs, butter, potatoes, tomato, sweet potatoes, peanuts, squash, cabbage, cheese, porridge, puddings, sausages, hams, tea, and alcoholic beverages such as whisky, brandy, rum, and wine. The 189 years of British rule in India also influenced and changed the feeding practices by using cutlery, which was initially adopted by the affluent and educated Indians and now extensively and commonly adopted by new generations in modern India, ignoring the age-old practice of feeding by hands. The Portuguese ruled Goa for 451 years from 1510 to 1961 (Mitragotri 1992) and influenced the food habits of original Goans. Today the non-fermented Indian cuisine is the blend of ancient *Ayurveda aadhar* and Mughlai and Anglo-Indian foods. However ethnic fermented foods and beverages have not been influenced by Mughal or British cuisine,

which has maintained its originality as ancient and heritage foods of India prepared and consumed by diverse ethnic communities.

Preparations and consumption of some ancient foods have been restricted due to religions and customary beliefs through food laws and taboos (Kwon and Tamang 2015). Hinduism practices the concept of purity and pollution, which determines interpersonal and intercaste relationships (Kilara and Iya 1992). Kitchens of the Brahmin Hindu produce two types of meals, *kaccha* "कच्चा," which means raw or uncooked, and *pakka* "पक्का" meaning ripe and cooked. *Kaccha* foods are regarded as inferior foods and are likely to be contaminated; hence to make it edible, there are strict codes of cooking, serving, and eating at kitchen. *Pakka* food is fried in traditionally prepared clarified butter called *ghee* so it is high-quality and nutritious foods. Hindus are traditionally vegetarians, but many non-Brahmins are nonvegetarians. Cow is a sacred animal for Hindus. Brahmin Hindus do not eat onion and garlic since these alliaceous plants are religiously classified as *tāmasic* or intoxicants. In the culinary history of India, *thali*, traditional platter used for serving all ingredients of foods, has been recorded in Indus Valley Civilization around 3500 BCE to 2500 BCE (INTACH 2016 www.intach.org). Historically, during Vedic period, *thali* was a ritual cooking in a pot to boil rice as *pakka* food (Achaya 2009). Later on, use of *thali* system with varieties of dishes serve in a round metal platter has become a part of Indian food culture. *Ahara* is a food that has been considered as a balanced nutritious diet in Ayurveda and is also defined as a substance which is swallowed through the throat after eating (Sawhney and Versha 2018). After the advent of Islam in India, consumption of foods is governed by Islamic dietary laws for Muslim as per Quran, the holy book of Muslim (Hussaini 1993). Islamic dietary laws forbid the consumption of meats of pig and dead animals, blood in any form, food previously offered to Gods, and alcohol and any intoxicant substances (Achaya 1998). As per the Islamic dietary laws, slaughtering of animals involves killing through a cut to the jugular vein in the neck which is known as *halal*, meaning lawful as defined in Quran (Twaigery and Spillman 1989). Traditionally Buddhists avoid eating meat and fish out of respect for life (Hinnells 1997). Varieties of spices are used in India along with the addition of desirable amount of salt. Diverse Indian communities in modern India from Vedic period have developed different methods of culinary practices to make presentable ethnic foods and beverages with ancient touch in history of dietary culture.

Traditional feeding practice by hands is an ancient dietary practice since Vedic periods for the last 6000 years ago in India (Prakash 1987; Hegde et al. 2018). Sitting on the floor cross-legged while eating by hands has been practiced since *Vedic* India and remains a unique food culture of Indian communities. Sitting on the floor cross-legged while having food as practiced traditionally in India is a yogic posture called *sukhasan* which is said to massage the abdominal muscles, to activate blood circulation in the lower part of the body, and to increase pliability (Sinha 1996).

Gastronomy of Indian ethnic foods is based on *Vedic* food habits with adoption of some Mughal and English cuisines; the present-day Indian foods of more than 2000 diverse ethnic groups of people (Kulkarni 2002) are unparalleled and unique to each other. Due to varied agroclimatic conditions, geographical locations, and availability of agro-produces, cooked rice "चावल" is a staple diet followed by lentil thick soup

called dal "दाल" in East India and Northeast India; rice-legume-based fermented food (*idli*, *dosa*) is a staple diet along with cooked rice in South India, whereas wheat-based baked flat *chapati* is a staple diet along with *dal* in North, West, and Central India (Fig. 1.1). These diets are supplemented with many fermented and non-fermented food items including vegetable, milk products, pickle/*acchar*, *papad*, etc. in thali system.

1.3 History of Indian Fermented Foods

Dietary culture of ethnicity predicts the cultural history of ethnic communities (Tamang and Samuel 2010). Delicacy of foods invokes innovation in culinary and diversification of cuisine to supplement taste, flavor, aroma, and palatability of the final edible product. The ancestors of Indian people might have innovated the traditional food fermentation technology to get fermented and alcoholic beverages and for the preservation of perishable plant and animal resources and enhancement of new preferred flavor and taste to increase delicacy in diets. Innovative food fermentation technology, based on wisdom and native skill of the ancestors of Indian people, includes natural fermentation, "back-slopping" fermentation (using previous cultures or inoculum), smoking, drying, salting processes, and alcohol production, which were developed to preserve the foods for consumption and to impart health benefits. The wisdom and native culinary skills of ancestral people of India for the production of fermented and non-fermented foods have been passed from generation to generation through mothers to daughters, fathers to sons, with few modifications and adjustments based on local prevailing conditions and also involvement of self-practice, family tradition, and community knowledge. This symbolizes a remarkable step in the dietary history of Indian societies. Evidence-based and archaeological findings such as fossils, food remnants of fermented foods except

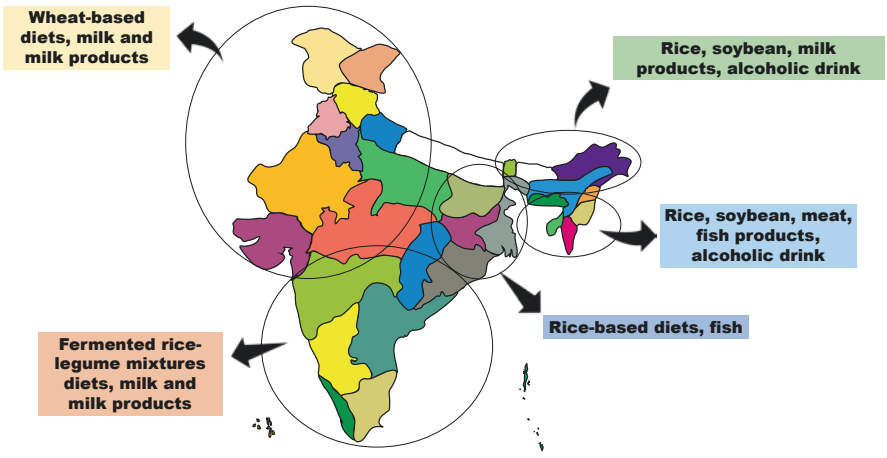

Fig. 1.1 Gastronomical map of India showing geographical distribution of food habits

some in Indus Valley Survey (Sarkar et al. 2016), and detailed historical records and monuments on origins of Indian fermented foods and beverages have not been documented yet. However, some ancient fermented foods and beverages are mentioned in *Rig Veda*, and literatures of Jains, and Buddhism in Sanskrit (Achaya 1994, 2009). We believe that most of the Indian fermented foods belong to *sattvic* category of Hindu philosophy, due to their high nutritive value, functionality, and health-promoting benefits, and some acidic foods such as fermented vegetable and bamboo products are *rajasic* category foods due to the sour taste. Indian fermented foods may not fall under *Vedic* classification of *tamasic* foods since ethnic foods may not cause dullness and passivity to consumers.

Historical evidences on preparation and consumption of some culturally adopted Indian fermented and alcoholic beverages are recorded here. *Dosa* or *dosai*, a traditional fermented mixture of rice and black gram cooked flat, thin, layered pancake-like batter of South India, has been prepared and consumed in Tamil Nadu around the first century CE as mentioned in the Tamil Sangam literature (Achaya 2003). Another popular ethnic food of South India known as *idli* or *idly* or *iddalige*, fermented rice and black lentils consumed as round steamed spongy savory staple food, was first mentioned in Kannada literature known as *Vaddaradhane*, the earliest extant prose work in Kannada written by great Kannada writer Shivakotiacharya in 920 CE (Krishna Jois 1969). *Idli* and *dosa* are the heritage foods of Tamil, Kannada, Telegu, and Malayalam people of Dravidian origins in India, who use these foods in every religious and social occasion. *Jalebi*, a fermented, cereal-based coiled, fried, crispy, sweet food, has been known in India since 1450 CE and is probably of Arabic or Persian origin (Gode 1943). *Dhokla*, a fermented mixture of wheat and Bengal gram of Gujarat, was mentioned in Gujarati literature known as *Varanaka Samuchaya* in 1520 CE; however, it was recorded that *dukkia*, considered as precursor to *dhokla*, was mentioned in Gujarati Jain literature in 1066 CE indicating its origin since 1520 CE (Achaya 1998). *Papad*, a popular crispy fermented pulse dried wafer-like product, first appeared in Buddhist Jain literature in 500 BCE as *parpata* (Prakash 1961), which may be considered as precursor to *papad*. Oral history on the origin of *gundruk* and *sinki*, fermented vegetable products of the Himalayas, was documented in details by Tamang (2010a). The word *gundruk* might have originated from the Newar (one of the major ethnic groups of the Nepali) word "gunnu" meaning dried taro stalk (Tamang 2010a). *Kinema*, a fermented sticky soybean of Kirat Nepali, might have originated in east Nepal bordering Darjeeling hills and Sikkim in India around 600 BCE to 100 CE during the Kirat dynasty (Tamang 2010a).

Domestication of animals for milk and milk products as well as dairy system has been recorded in Harappan civilization for the last 8000 years (Sarkar et al. 2016). In *Rig Veda*, the oldest sacred book of the Hindus which is a collection of Vedic Sanskrit hymns, sanctity and importance of cow as well as milk products were mentioned (Jamison and Brereton 2014). Periods of history of *dahi* production and consumption in India are variable. *Veda* and *Upanisad* mentioned the origin of *dahi* and fermented milk products during 6000–4000 BC, one of the oldest fermented milk products of the Hindus (Yegna Narayan Aiyar 1953). Preparation and consumption of *dahi* have been recorded since 2000 BCE in India (Prakash 1961). *Dahi* plays an important part

in the socioreligious habits in Indian subcontinent and is considered as sacred item in many of their festivals and religious ceremony both by Hindus and Buddhists. *Dahi Handi* is celebrated every year the day after "Krishna Janmashtami" where communities hang an earthen pot filled with *dahi* at a height difficult to reach. There is a legend in Hindu that Lord Krishan as a child used to steal *dahi* and *ghee* (butter) kept at difficult place, which may be correlated to history of *dahi*, *lassi*, and *ghee* (butter), the widely consumed milk products during Lord Krishna's time about 3000 BCE (Bryant 2007). *Dahi* was mentioned in *Rig Veda* as *karambha*, a blended *dah*i rice dish (Achaya 1998).

Indus Valley Civilization traced back to 8000 years (Sarkar et al. 2016) appeared to have alcohol drinking culture mostly through fermentation (Singh et al. 2010) and distillation (Achaya 1991), based on findings of clay pot items from excavation sites (Mahdihassan 1979). During the *Vedic* period of Indian history, liquor God called *Soma* was worshipped by *Soma rus*, a refreshing sweet juice prepared from leafless vine (*Sarcostemma acidum*) (Sarma 1939) by the Vedic Aryans which had medicinal values (Bose 1922). Highly alcoholic distilled liquor prepared by fermenting millets called *sura* and the alcoholic product fermented from flowers called *parisrut* were the earliest alcoholic beverages of India around 1500 BCE during the Vedic period (Mahdihassan 1981). No historical records on vinification (fermentation of grapes into wine), malting, and brewing (such as beer) processes are available in Indian food culture. It indicates that alcoholic beverages are fermented either by natural fermentation of plant or cereals or by using traditionally prepared dry amylolytic starters with different vernacular names such as *marcha*, *hamei*, *dabai*, *phub*, etc. (Tamang 2010a). Wine, beer, and whisky are not traditional drink or culture of India though these alcoholic drinks are becoming popular in modern Indian food culture. The popular Himalayan mild alcoholic beverages called *kodo ko jaanr* prepared from fermented finger millets by traditionally prepared dry amylolytic starter culture was mentioned in the history of Nepal during the Kirat dynasty in 625 BCE to 100 CE (Adhikari and Ghimirey 2000). During Malla dynasty in Nepal, the Newar, one of the ethnic communities of Gorkha, used to ferment alcoholic beverages from rice in 880 CE (Khatri 1987). The first record of *chyang*, fermented finger millet alcoholic beverage similar to *kodo ko jaanr* in Sikkim, was first mentioned in Gazetteer of Sikkim by Risley (1928) which quoted "*marwa* or *chyang*, is a kind of beer brewed by everyone in Sikkim, and might be called their staple food and drink." In historical documents on Darjeeling and Sikkim, brief descriptions of fermented millet beverages as alcoholic drink consumed by the local ethnic people were mentioned by Hooker (1854) and Gorer (1938).

1.4 Diversity of Ethnic Fermented Foods of India

Indian fermented foods are classified into ten major groups on the basis of substrates (raw materials) used from plant/animal sources:

Plant-based fermented foods: (1) fermented cereal foods; (2) fermented non-soybean legume foods; (3) fermented soybean foods; and (4) fermented vegetable foods
Animal-based fermented foods: (1) fermented dairy foods; (2) fermented/sun-dried/smoked fish products; and (3) fermented/sun-dried/smoked meat products
Alcoholic beverages: (1) amylolytic starters for production of alcoholic beverages and (2) alcoholic beverages
Miscellaneous fermented products: fermented tea, crabs, fruits, etc.

Very few outside the country have realized that India is the center of the huge diversity food culture comprising ethnic fermented and non-fermented ethnic foods and alcoholic beverages. Ethnic fermented foods and beverages are defined as foods produced by the ethnic people using their native knowledge from locally available agro-/bioresources of plant or animal origins either naturally or by adding starter culture(s) containing functional microorganisms/"back-slopping," which convert the substrates (raw/cooked) biochemically and sensorially into edible products with enhanced nutritive value, flavor, and health-promoting benefits that are culturally and socially acceptable to the consumers (Tamang 2010b, c). Due to varied ethnicity along with unparalleled food habits based on stable cereal diets, the ethnic people have adopted distinct food habits and preferences for specific fermented foods and beverages as state/region-wise in India (Table 1.1). Daily per capita consumption of ethnic fermented foods and alcoholic beverages is not available for any other state in India except Sikkim which shows 163.8 g/capita daily consumption of fermented foods and alcoholic beverages representing 12.6% of total daily diet (Tamang et al. 2007). Indian fermented foods are considered as essential for food and nutritional security of the region and are produced using the native skill of ethnic people practicing the crude knowledge of "microbiology," what I termed as "ethno-microbiology." Microbial community ranging from lactic acid bacteria, non-lactic acid bacteria, acetic acid bacteria, bacilli, micrococci, Gram-negative bacteria, filamentous mold, to enzyme- and alcohol-producing yeasts is associated with Indian fermented foods and alcoholic beverages (Chettri and Tamang 2015; Tamang et al. 2007, 2016a; Shangpliang et al. 2018; Sha et al. 2017, 2018, 2019), and some of them have functionality and health benefits (Tamang et al. 2009, 2016b). Most of Indian ethnic fermented foods are naturally fermented, except the alcoholic beverages, which are produced by using consortia of microbiota consisting of filamentous mold, yeasts, and bacteria in the form of dry, cereal-based amylolytic starter (Tamang 2010c; Tamang et al. 2016a). Some common as well as lesser-known or region-specific ethnic fermented foods and alcoholic beverages have been studied extensively focusing on microbiology, biochemistry, nutritional value, health benefits, upgradation of traditional technology, etc. for the last 50 years.

It is remarkable to note that unlike many countries, India has more than 350 diverse types of major or common and minor or region-specific ethnic fermented foods and beverages (234 fermented foods, 84 alcoholic beverages, and 32 traditionally prepared amylolytic starters) which are traditionally prepared and consumed by ethnic people of India for 5000 years (Tables 1.2, 1.3, 1.4, 1.5, 1.6, 1.7, 1.8, 1.9, 1.10 and 1.11). This indicates that India has rich and huge fermented food and alcoholic

beverage diversity comparable to the rest of the world. However, only 17% of ethnic fermented foods and beverages have been studied scientifically and reported till date, and the rest 83% of ethnic fermented foods and beverages are yet to be documented or studied in details. Some of the common and region-specific ethnic fermented foods and alcoholic beverages of India have been extensively studied focusing on microbiology, biochemistry, nutrition, health benefits, optimization of traditional processing methods, value addition, etc. for several years. References of various researchers working on some common and region-specific ethnic fermented foods and beverages are documented:

Table 1.1 Geographical distribution of substrate-based ethnic fermented foods in India

Category	Sensory character (based on pH)	Microbiota groups	State-wise distribution of traditional consumers
Fermented cereal foods	Mild acidic	LAB, yeasts	All except Nagaland, Mizoram, Manipur, Meghalaya, West Bengal, Tripura, Odisha, Jharkhand, Bihar, Chhattisgarh
Fermented milk foods	Acidic	LAB, yeasts, molds	All, except Nagaland, Mizoram, Manipur, and Meghalaya
Fermented non-soybean legume foods	Mostly alkaline	LAB, *Bacillus* spp., yeasts	Punjab, Gujarat, Rajasthan, UP, Haryana, Madhya Pradesh
Fermented rice-legume mixture foods	Acidic	LAB, *Bacillus* spp., yeasts	Tamil Nadu, Karnataka, Kerala, Andhra Pradesh, Telangana
Fermented soybean foods	Mostly alkaline	LAB, *Bacillus* spp., yeasts	Sikkim and GTA, Nagaland, Mizoram, Manipur, Meghalaya, Arunachal Pradesh
Fermented vegetable foods	Acidic	LAB	Sikkim and GTA, Nagaland, Mizoram, Manipur, Meghalaya, Assam, Arunachal Pradesh
Fermented/ sun-dried/smoked fish products	Mild acidic	LAB, micrococci	Sikkim and GTA, Nagaland, Mizoram, Manipur, Meghalaya, Assam, Arunachal Pradesh, Odisha, West Bengal, Goa, Coastal regions of Tamil Nadu, Kerala
Fermented/ sun-dried/smoked meat products	Mild acidic	LAB, micrococci	Sikkim and GTA, Nagaland, Mizoram, Manipur, Meghalaya, Assam, Arunachal Pradesh, Jammu and Kashmir, Himachal Pradesh, Uttarakhand, Goa
Amylolytic starters for production of alcoholic beverages	Mild acidic, alcoholic	Filamentous molds, amylolytic and alcohol-producing yeasts and bacteria	Sikkim and GTA, Nagaland, Mizoram, Manipur, Meghalaya, Assam, Arunachal Pradesh, Tripura, Jammu and Kashmir, Himachal Pradesh, Uttarakhand, West Bengal, Odisha

(continued)

Table 1.1 (continued)

Category	Sensory character (based on pH)	Microbiota groups	State-wise distribution of traditional consumers
Fermented beverages	Alcoholic	LAB, yeasts, and molds	Cereal-based alcoholic beverages by amylolytic starters: Sikkim and GTA, Nagaland, Mizoram, Manipur, Meghalaya, Assam, Arunachal Pradesh, Tripura, Jammu and Kashmir, Himachal Pradesh, Uttarakhand, West Bengal, Odisha, Madhya Pradesh, Jharkhand, Chhattisgarh
			Toddy and other natural alcoholic fermentation: Goa, Kerala, Tamil Nadu, Orrisa, West Bengal, Karnataka, Andhra Pradesh
Miscellaneous fermented products (fermented tea, crabs, fruits, etc.)	Acidic and alkaline	AAB, LAB, yeasts, molds	Fermented tea, fruits, crabs: Ladakh, Sikkim, Himachal Pradesh, Uttarakhand, Nagaland, Mizoram, Tripura

LAB lactic acid bacteria, *GTA* Gorkhaland Territorial Administration

1. Fermented milk (cow's/buffalo's/yak's) products of India such as *dahi* (Mohanan et al. 1984; Ghosh and Rajorhia 1990; Rathi et al. 1990; Sharma et al. 1993; Gupta et al. 2000; Rajpal and Kansal 2009; Behare et al. 2009; Agarwal and Bhasin 2002; Jain et al. 2010; Shruti and Kansal 2011; Jadhav et al. 2013; Balamurugan et al. 2014; Mohania et al. 2014), *shrikhand* (Boghra and Mathur 2000; Devshete et al. 2013; Dandile et al. 2014; Singh and Singh 2014; Singh et al. 2014b; Karche et al. 2015;), *lassi* (Patidar and Prajapati 1988; Padghan et al. 2015; Patel et al. 2015; Sudheendra Ch et al. 2018), *chhurpi*, *churkam*, *chhu*, *dahi*, *philu*, and *somar* (Katiyar et al. 1991; Tamang et al. 2000; Dewan and Tamang 2006, 2007; Rai et al. 2016; Shangpliang et al. 2018).
2. Fermented legume products such as *dhokla* (Joshi et al. 1989; Kanekar and Joshi 1993; Lohekar and Arya 2014; Shobha and Joshi 2016; Suman and Khetarpaul 2018), *khaman* (Shrestha et al. 2017), *wari* (Batra 1986; Sandhu and Soni 1989; Soni and Sandhu 1990), and *maseura* (Chettri and Tamang 2008).
3. Fermented soybean foods such as *kinema* (Sarkar et al. 1994, 1996, 1997, 1998; Sarkar and Tamang 1994, 1995; Tamang and Nikkuni 1996, 1998; Omizu et al. 2011; Rai et al. 2014; Tamang 1999, 2003, 2015; Tamang et al. 2002; Chettri et al. 2016), *tungrymbai* (Sohliya et al. 2009; Chettri and Tamang 2014, 2015; Thokchom and Joshi 2015), *hawaijar* (Jeyaram et al. 2008a, 2009; Keishing and Banu 2013; Singh et al. 2014, 2018; Thokchom and Joshi 2015; Keisam et al.

Table 1.2 Ethnic fermented cereal foods of India

S.no.	Products	Agro-produce and ingredient	Sensory character and edibles	State/region
1.	*Adai dosa*	Rice, Bengal gram, red gram, black gram, green gram	Slight acidic, like *dosa*; breakfast	Tamil Nadu
2.	*Ambil*	Rice	Cooked slurry; staple	Maharashtra
3.	*Aeersa*	Rice and jaggary	Fried, rounded sweet dish; dessert	Chhattisgarh
4.	*Ambali* or *amboli*	Millet flour and rice	Thick fermented batter; pancake like *uttapam*; staple	Maharashtra, Karnataka, Tamil Nadu, Andhra Pradesh, Kerala, Telangana
5.	*Appam*	Rice, black gram	White color, Concave shaped, bulged at the center with crisp edges; staple	Kerala
6.	*Appam/ kallappam* or *vellayppam*	Rice, black gram	Concave shaped with crisp edges; like *idli*; staple	Kerala
7.	*Aska*	Rice flour	Side dish	Himachal Pradesh
8.	*Babru*	Wheat or rice flour	Pancake; breakfast, snack	Himachal Pradesh
9.	*Bagpinni*	Roasted barley flour *sattu* with *chhyang*	Ball-like; snack	Himachal Pradesh
10.	*Bhatabaru*	Wheat flour, milk, sugar	Sweet, deep fried, oval shaped; snack	Himachal Pradesh
11.	*Bhatooru* or *Bhaturu*	Wheat or barley flour	Baked breads; staple	Himachal Pradesh
12.	*Bedvin roti*	Wheat flour, black gram and walnut	Baked; staple	Himachal Pradesh
13.	*Bobra*	Rice, wheat, jiggery	Sweet dish; dessert	Chhattisgarh
14.	*Boree Basi*	Rice	Baked; breakfast	Chhattisgarh
15.	*Chakuli*	Rice and black gram	Fermented batter, fried; breakfast	Odisha, West Bengal
16.	*Chhuchipatra pitha*	Rice and black gram	Pancake, snack	Odisha, West Bengal
17.	*Chitou*	Rice, black gram, sugar and grated coconut	Fermented batter, baked; snack	Odisha, West Bengal
18.	*Chilra*	Wheat and buckwheat flour	Similar to *dosa*; staple	Himachal Pradesh
19.	*Chzot* or *Girda*	Wheat	Baked, staple	Jammu and Kashmir
20.	*Czochwor*	Wheat, baker's yeast	Baked; staple	Jammu and Kashmir

(continued)

Table 1.2 (continued)

S.no.	Products	Agro-produce and ingredient	Sensory character and edibles	State/region
21.	*Dahi rice* or *Thayir sadham*	Rice—*dahi*	Mildly sour taste; staple	Tamil Nadu
22.	*Dehori*	Rice—*dahi*	Round, fried dough into jaggery syrup	Chhattisgarh
23.	*Dosa* or *dosai* or *dose*	Rice and black gram	Thin, crisp pancake; shallow fried; staple	Tami Nadu, Kerala, Karnataka, Andhra Pradesh, Telangana
24.	*Dhuska*	Rice-lentil	Ball like, fried; snacks; breakfast	Jharkhand
25.	*Enduri pitha*	Rice and black gram	Fermented batter; steamed; snack	Odisha, West Bengal
26.	*Gulgule*	Wheat flour	Cooked as flat pancake; snack	Himachal Pradesh
27.	*Hakua*	Rice	Strong off-flavor; therapeutic uses	Darjeeling hills, Sikkim
28.	*Handwa*	Rice, red gram, and Bengal gram flour	Fermented, baked, spongy; snack	Gujarat
29.	*Idli*	Rice and black gram	Mild acidic, soft, moist, spongy; breakfast	Tamil Nadu, Kerala, Karnataka, Andhra Pradesh, Telangana, Pondicherry
30.	*Jalebi*	Wheat flour	Crispy sweet, deep fried pretzels; snacks	All
31.	*Khadi-badi*	Wheat flour—*dahi* mixture	Boiled, fried; snack	Bihar, Jharkhand
32.	*Khandvi*	Cereal	Soft, slippery texture, mild sour; snack	Gujarat
33.	*Koozh* or *koozhu*	Sorghum, pearl millet, little millet, and foxtail millet flour	Slightly sour, cooked; breakfast	Tamil Nadu
34.	*Lawaas*	Wheat	Baked breads; staple	Jammu and Kashmir
35.	*Marchu*	Wheat flour	Baked breads; staple	Himachal Pradesh
36.	*Munha pitha* or *podo pitha*	Rice and black gram	Spongy like *idli*; staple	Odisha
37.	*Naan*	Wheat flour	Leaved bread; baked; staple	Punjab, Haryana, Delhi, UP, Himachal Pradesh
38.	*Neyyappam*	Rice and jaggary	Solid, spherical, oily; snack	Kerala
39.	*Olyafenya*	Rice	Thin, round shape, fried flat batter like *dosa*; breakfast	Maharashtra
40.	*Pakk*	Barley, butter (*ghee*), *lassi*	Cooked; staple	Himachal Pradesh

(continued)

Table 1.2 (continued)

S.no.	Products	Agro-produce and ingredient	Sensory character and edibles	State/region
41.	*Pazhaya sadham*	Rice	Cooked; breakfast	Tamil Nadu
42.	*Pej* or *Peja*	Rice, *dahi*, salt	Cooked; staple	Madhya Pradesh
43.	*Podo pitha*	Rice and black gram	Fermented batter, fried; breakfast	Odisha, West Bengal
44.	*Poita bhat*	Rice	Cooked, acidic, sour in taste; staple	Assam
45.	*Pua*	Wheat flour	Fermented batter fried, served hot as sweet confectionary	Bihar, Jharkhand
46.	*Puda/Pudla*	Maize, Bengal gram	Solid food, pancake; snack	Tamil Nadu
47.	*Rabadi* or *rabri*	Wheat, barley, pearl millet or maize, milk	Mild-acidic, thick slurry-like product; drink	Punjab, Haryana, Rajasthan
48.	*Salpapdya*	Rice	Dried, circular shape, like *papad*	Maharashtra
49.	*Sannas*	Rice, black gram	Soft round steamed rice cakes; staple	Karnataka
50.	*Selroti*	Rice wheat flour	Pretzel-like; deep fried; bread; staple	Darjeeling hills, Sikkim, Northeast India, Uttarakhand, Himachal Pradesh
51.	*Seera*	Wheat grains	Dried, sweet dish	Himachal Pradesh
52.	*Siddu*	Wheat flour, walnut/opium seeds/black gram	Steamed bread, oval-shaped; staple	Himachal Pradesh
53.	*Thatte idli*	Rice, tapioca, black gram	Spongy, *idli*-like; breakfast	Karnataka
54.	*Tchog*	Roasted barley flour, *chhang*	Solid ball-like dough; staple	Himachal Pradesh
55.	*Unniyappam*	Rice flour and jaggary	Soft, spongy; snack	Kerala
56.	*Uttappam* or *Uthappam*	Rice, black gram	Thick, soft, non-crispy; staple or side dish	Kerala, Tamil Nadu, Karnataka

2019), *bekang* (Chettri and Tamang 2014, 2015), and *akhonii* (Tamang et al. 2012; Singh et al. 2014a).

4. Fermented cereal products of India such as *rabadi* (Khetarpaul and Chauhan 1989, 1990a, b, 1991; Gupta et al. 1992a, b; Modha and Pal 2011) and *sel roti* (Yonzan and Tamang 2009, 2010, 2013).
5. Fermented rice black gram food of South India such as *dosa* (Soni et al. 1985, 1986; Soni and Sandhu 1989a; Palanisamy et al. 2012; Srinivasan et al. 2013; Gupta and Tiwari 2014), *idli* (Mukherjee et al. 1965; Steinkraus et al. 1967; Soni and Sandhu 1989b, 1991; Sridevi et al. 2010; Vijayendra et al. 2010; Ghosh and

Table 1.3 Ethnic fermented non-soybean legume foods of India

S.no.	Fermented foods	Agro-produce and ingredient	Sensory character and edibles	State/region
1.	*Amriti*	Black gram	Rings, deep fried; snack	West Bengal
2.	*Bhallae*	Black gram	Deep-fried patties; snack	Punjab, Haryana
3.	*Bijori*	Black lentils	Flat round, fried; snack	Chhattisgarh
4.	*Borhe*	Black gram	Staple	Himachal Pradesh
5.	*Dangalbari*	Black gram, spices	Staple	Himachal Pradesh
6.	*Dhokla*	Bengal gram and rice	Mild acidic, slightly salty-sour taste, spongy; snack	Gujarat
7.	*Dhuska bara*	Chickpea, black gram, rice *dahi*	Deep fried; snacks	Chhattisgarh
8.	*Handvo*	Lentil-rice	Spicy with cake-like texture; savory	Gujarat
9.	*Khaman*	Bengal gram	Mild acidic, spongy; breakfast	Gujarat
10.	*Masauyra*	Black gram	Cone-shaped hollow, brittle, similar to *wari*, side dish	Sikkim and Darjeeling hills
11.	*Mashbari*	Black gram, spices	Staple food	Himachal Pradesh
12.	*Pao/undoh*	Wheat; baker yeasts	Bread; staple	Goa
13.	*Papad*	Black gram	Circular wafers; snack	All
14.	*Rakhiya Bari*	Black lentils, flesh of ash gourd	Fermented, dried round nuggets	Chhattisgarh
15.	*Sepubari*	Black gram	Fermented paste, side dish	Himachal Pradesh
16.	*Vadai*	Black gram	Paste, fried patties; snack	South India
17.	*Wadi* or *wari* or *bari*	Black gram	Ball-like, brittle; condiment	Punjab, Haryana, UP, Himachal Pradesh, Delhi

Chattopadhyay 2011; Agaliya and Jeevaratnam 2013; Kalki and Shetty 2015; Shrivastava and Ananthanarayan 2015; Chelliah et al. 2016; Chandrasekar Rajendran et al. 2017; Regubalan and Ananthanarayan 2018, 2019), and *uttapam* (Dubey and Jeevaratnam 2015; Saraniya and Jeevaratnam 2015).

6. Fermented vegetable products such as *gundruk* (Tamang et al. 2005, 2009; Tamang and Tamang 2010) and *sinki* (Tamang and Sarkar 1993; Tamang et al. 2005, 2009).
7. Fermented bamboo shoot products such as *mesu* (Tamang and Sarkar 1996; Tamang et al. 2008), *soibum* (Giri and Janmejay 1994; Sarangthem and Singh 2003; Tamang et al. 2008; Jeyaram et al. 2010; Romi et al. 2014, 2015), *soidon* (Tamang et al. 2008; Sonar and Halami 2014; Romi et al. 2015; Sonar et al. 2015), and *khorisa* (Sharma and Barooah 2017).

Table 1.4 Ethnic fermented soybean foods of India

S.no.	Fermented foods	Agro-produce and ingredient	Sensory character and edibles	State/region
1.	*Aagya*	Soybean	Alkaline, sticky; side dish	Arunachal Pradesh
2.	*Aakhone* or *Akhonii* or *Axone*	Soybean	Alkaline, sticky, paste; side dish	Nagaland
3.	*Bari*	Soybean	Alkaline, sticky; soup	Sikkim
4.	*Bethu*	Soybean	Alkaline, sticky; soup; side dish	Manipur, Nagaland
5.	*Bekang* or *Bekang-um*	Soybean	Alkaline, sticky, paste; curry	Mizoram
6.	*Hakhu mata*	Soybeans	Alkaline, sticky, paste; curry	Manipur
7.	*Hawaijar*	Soybean	Alkaline, sticky; curry	Manipur
8.	*Kinema*	Soybean	Alkaline, sticky; curry	Sikkim, Darjeeling hills, Assam
9.	*Khuichang*	Soybean	Alkaline, sticky; side dish	Manipur
10.	*Libi chhurpi*	Soybean	Alkaline, sticky, crushed, dried; curry	Arunachal Pradesh
11.	*Peron naming*	Soybeans	Alkaline, paste, ball; side dish	Arunachal Pradesh
12.	*Pehak*	Soybean	Alkaline, after fermentation; side dish	Arunachal Pradesh
13.	*Peruyaan*	Soybean	Alkaline, sticky; side dish	Arunachal Pradesh
14.	*Theisui*	Soybean	Alkaline, sticky; side dish	Manipur, Nagaland
15.	*Tungrymbai*	Soybean	Alkaline, sticky; curry, soup	Meghalaya
16.	*Yanni perung*	Soybean	Alkaline, paste, ball; side dish	Arunachal Pradesh

8. Fermented and traditionally preserved fish products such as *ngari* (Thapa et al. 2004; Abdhul et al. 2014; Devi et al. 2015; Majumdar et al. 2015a; Thapa 2016; Singh et al. 2018), *hentek* (Thapa et al. 2004; Aarti et al. 2016, 2017; Singh et al. 2018;), *namsing* (Chowdhury et al. 2018), *sukuti* (Thapa et al. 2006; Thapa and Pal 2007), *sidra* (Thapa et al. 2006; Thapa and Pal 2007), *tungtap* (Thapa et al. 2004; Rapsang et al. 2011; Rapsang and Joshi 2012), *sheedal* (Majumdar et al. 2009, 2015b; Kakati and Goswami 2013a, b; Muzaddadi and Basu 2003, 2012; Muzaddadi 2015), *bordia*, *karati*, and *lashim* (Thapa et al. 2007; Thapa 2016).
9. Fermented meat products such as *chartayshya*, *jamma*, *arjia* (Oki et al. 2011), *kargyong*, *satchu*, *suka ko masu* (Rai et al. 2009, 2010a, b), and *sa-um* (De Mandal et al. 2018).
10. Traditionally prepared dry amylolytic starters such as *marcha* (Tamang and Sarkar 1995; Tsuyoshi et al. 2005; Tamang et al. 1988, 2007; Jeyaram et al.

Table 1.5 Ethnic fermented milk foods of India

S.no.	Fermented foods	Agro-produce and ingredient	Sensory character and edibles	State/region
1.	*Chhash*	Cow/buffalo milk	Non-alcoholic beverage; mildly sour taste	Gujarat, Rajasthan
2.	*Chhu* or *sheden*	Cow or yak milk	Soft, strongly flavored; curry	Darjeeling hills, Sikkim
3.	*Chhur chirpen*	Yak milk and crab apple	Pressed, light yellowish brown; side dish	Arunachal Pradesh
4.	*Chhur singba* or *chhur mingba*	Yak milk	Pressed, light yellowish brown; side dish	Arunachal Pradesh
5.	*Chhura*	Dzomo (crossed breed of cow and yak), yak milk	Hard mass; masticator	Ladakh
6.	*Chhurpi* (soft variety)	Cow or yak milk	Soft, cheese-like; curry, pickle	Sikkim, Darjeeling hills, Arunachal Pradesh
7.	*Chhurpi* (hard variety)	Cow or yak milk	Hard mass; masticator	Sikkim, Darjeeling hills, Arunachal Pradesh, Ladakh, Himachal Pradesh, Uttarakhand
8.	*Chhurapi*	Yak milk	Soft, cheese-like; curry, pickle	Arunachal Pradesh
9.	*Chhurpupu/ churtang*	Yak/cow milk	4–5-year-old *chhurpi*; side dish	Arunachal Pradesh
10.	*Churkham*	Fresh and old *chhurpi*	Soft cheese packed in yak skin and sun dried, eaten as masticator, mouth freshener	Arunachal Pradesh
11.	*Dahi*	Cow/buffalo/yak milk	Curd; savoury	All
12.	*Dahi Vada*	*Dahi* and legumes mixtures	Soft semiliquid, side dish	Bihar, Jharkhand, UP
13.	*Dudh chhurpi*	Cow milk	Hard mass; masticator	Darjeeling hills, Sikkim
14.	*Ghee/Gheu*	Cow/buffalo milk	Butter	All
15.	*Kadhi*	Cow/buffalo milk/mixed milk	Prepared from sour *dahi* or *chhash*, sour; savory	Gujarat, Rajasthan
16.	*Khalari* or *Maesh-kraej*	Cow/buffalo/ goat milk	Semisoft, cottage cheese; side dish	Jammu and Kashmir
17.	*Lassi*	Cow/buffalo milk	Buttermilk; refreshing beverage	All
18.	*Maa/Maar*	Yak milk	Butter	Sikkim, Ladakh

(continued)

Table 1.5 (continued)

S.no.	Fermented foods	Agro-produce and ingredient	Sensory character and edibles	State/region
19.	*Marchang*	Yak ghee and barley flour "kongpu"	Side dish	Arunachal Pradesh
20.	*Mattha*	Milk	Acidic, spicy, like buttermilk	Maharashtra
21.	*Mohi*	Yak milk	Butter milk; refreshment	Sikkim, Darjeeling hills
22.	*Mishti dahi*	Cow/buffalo milk and sugar	Mild acidic, thick gel, sweet; dessert	West Bengal, Odisha, Assam
23.	*Paneer*	Whey of cow milk	Soft, cheese-like product; curry	North India
24.	*Pheuja/Suja*	Tea-yak butter	Fermented butter tea	Sikkim, Ladakh
25.	*Philu*	Yak milk	Cream, fried curry with butter; side dish	Sikkim
26.	*Phrung*	Yak milk	Hard mass; masticator	Arunachal Pradesh
27.	*Phuh*	Milk	Soft cheese; side dish	Jammu and Kashmir
28.	*Raita*	Cow/buffalo milk	Viscous custard like; side dish	Gujarat, Rajasthan
29.	*Shrikhand*	Cow, buffalo milk	Acidic, sweet, viscous; dessert	Gujarat, Rajasthan, Haryana
30.	*Shyow*	Yak milk	Curd; savoury	Sikkim, Ladakh
31.	*Somar*	Milk	Paste, flavored; condiment	Darjeeling hills, Sikkim
32.	*Tara*	Dzomo (crossed breed of cow and yak), yak milk	Butter milk; refreshment	Ladakh
33.	*Zamuthdod*	Milk	Like *dahi*; savory	Jammu and Kashmir

2011; Sha et al. 2016, 2017, 2018), *dawdim* (Anupma et al. 2018; Sha et al. 2018, 2019), *xaj-pittha* (Bora et al. 2016), *hamei* (Tamang et al. 2007; Jeyaram et al. 2008b; Mangang et al. 2017; Sha et al. 2018, 2019), *chowan* (Anupma et al. 2018; Sha et al. 2018, 2019), *humao* (Anupma et al. 2018; Sha et al. 2018, 2019), *khekhrii* (Anupma et al. 2018; Sha et al. 2018, 2019), *thiat* (Anupma et al. 2018; Sha et al. 2017, 2018), and *phut* (Anupma et al. 2018; Sha et al. 2018, 2019).

11. Alcoholic beverages and distilled liquor such as *kodo ko jaanr* or *chyang* (Bhatia et al. 1977; Basappa 2002; Basappa et al. 1997; Thapa and Tamang 2004, 2006; Angmo and Bhalla 2014; Ray et al. 2016), *bhaati jaanr* (Tamang and Thapa 2006), *toddy* (Shamala and Sreekantiah 1988; Kunjithapatham and Balasubramaniam 2012), *kanji* (Sura et al. 2001; Goel et al. 2005; Kingston et al. 2010), *haria* (Ghosh et al. 2014, 2015a, b), *judima* (Chakrabarty et al. 2014), *zutho* (Teramoto et al. 2002), *sura* (Thakur et al. 2004; Thakur 2013), and *feni* (Khorjuvenkar 2016).