Int.J.Curr.Microbiol.App.Sci (2018) *7*(4): 1873-1883

International Journal of Current Microbiology and Applied Sciences
***ISSN: 2319-7706* Volume 7 Number 04 (2018)**
Journal homepage: http://www.ijcmas.com

Review Article https://doi.org/10.20546/ijcmas.2018.704.214

Traditional Fermented Products of India

K. Rawat[1*], A. Kumari[1], S. Kumar[2], R. Kumar[2] and R. Gehlot[1]

[1]Centre of Food Science and Technology, Chaudhary Charan Singh Haryana Agricultural University, Haryana, Hisar, 125 004, India
[2]Department of Microbiology, Chaudhary Charan Singh Haryana Agricultural University, Haryana, Hisar, 125 004, India

**Corresponding author*

Keywords

Fermentation, Lactic acid bacteria, traditional, Food, Beverage

Article Info

Accepted:
16 March 2018
Available Online:
10 April 2018

A B S T R A C T

Traditional fermented products are those products with are indigenous to people and people of the local area prepare them with the help of their ethnic knowledge from the ancestors. There are uncountable varieties of traditional food present in the world. One such country is India, where numerous varieties of traditional food products are present due to the variation in culture, geographical indication and variability in the raw material present in that particular locality (grains, milk, plant sources). In past, to enhance the shelf life of the food product many food processing and preservation techniques were introduced in household level such as smoking, drying, fermentation and germination. Out of these technique the best techniques for the preservation of food was fermentation. Fermentation is bioprocess technology which is practiced since time immemorial. Fermentation technology lead to the formation of two products: fermented food and fermented beverage. Fermentation is manly done with the help of microorganism, specifically lactic acid bacteria (LAB). The microorganism involved in fermentation are generally probiotic in nature means they are good for the human health and when these microorganism are grown in the food product they enhance the nutritional property, with increasing the therapeutic property of the food. Fermented food must be eaten daily in human diet and some standardization technique should be developed so as these fermented product can be sale in the market which will be source of income generation to the villagers.

Introduction

Traditional Indian foods have been prepared for many years and preparation varies across the country. In India fermented foods and beverages are the fundamental part of ethnic heritage. One of the traditional oldest and most cost-effective methods for producing and preserving food is fermentation (Jeyaram, 2009). It has been practiced since ancient time by the antique man as the cost-effective method for providing longevity to fermented products (foods and beverages). Traditional fermented food preparation is one of the oldest biotechnological processes around the world (Sekar and Mariappan, 2007). Traditional fermented foods are defined as foods produced by native people using their inherited knowledge and skillful technology from vicinity available plant or animal raw

materials. Fermented product is prepared either naturally or by adding starter culture comprising efficient microorganisms which transform the substrates into edible products that are ethnically and socially conventional to the local people. Primeval people embraced diverse preservation methods to store superfluous food of any origin, particularly those foods which are periodic and have a small lifetime (perishable). At present, more than 5,000 diverse fermented foods are consumed by diversified people living worldwide, many of which are indigenous and manufactured in small amounts to meet the requirements of groups in a specific area (Ray *et al.,* 2016). Fermented foods make up an important contribution to Indian diets in since time immemorial because fermentation is not expensive technology which preserves food, improves its nutritional value and enhances its sensory qualities (Marco *et al.,* 2017). Fermentation involves the activity of microorganisms which play a vital role in enhancement of organoleptic characteristics, enrichment, health endorsing traits, and preservation of food product. Microorganism involved in fermentation are probiotic in nature i.e. they will provide health benefit to the consumer and arte essential part of gut micro flora (Angmo *et al.,* 2016). Most commonly found microorganisms are Lactic acid bacteria (LAB) accomplish a crucial role in the preservation and production of nutritious fermented foods (Satish *et al.,* 2013). Two type of microorganism are found in fermented food product those are homo-fermentative and hetero- fermentative" Lactic acid bacteria which are grow readily in most food substrates and lower the pH of the food to a point where other opposing organisms are not able to grow (Angmo *et al.,* 2016; Satish *et al.,* 2013). Fermentation also helps in proliferation of digestibility, breakdown of complex carbohydrates into simpler one, improves bioavailability essential amino acids, vitamins, and minerals, and upsurges the whole quality, taste, and aroma of the food (Şanlie *et al.,* 2017). Fermented food products act as neutraceutical agents to impart beneficial health effects (Sharma *et al.,* 2013). The protein and vitamin deficiencies are the major problems of the third world countries, hence providing those countries fermented product can meet the requirement of the essential amino acid present in the food with increased nutrient level.

Fermented food products are also supportive in maintaining the healthy configuration of celiac micro biota that play a crucial role in protection from numerous illnesses and can sustain physiological homeostasis. We can also called fermented food product as naturally invigorated useful food. There are many varieties of fermented products persisting in the market and can be classified on the basis, which food product is been fermented. They are categorized as follows: (i) cereal-based (with/without pulses) fermented foods, (ii) cereal/pulse and buttermilk-based fermented food, (iii) cereal-based fermented sweets and snacks, (iv) milk-based fermented foods, (v) vegetable, bamboo shoot (BS) and unripe fruits-based fermented foods, (vi) meat-based fermented foods and (vii) pulse (legume)-based fermented food (Satish *et al.,* 2013).

Beside this classification fermented food also differs according to the region. There are several regions in India as the change in region leads to the change in eating habits of the people and the way of fermenting different products also change.

Grain based fermented food products/ beverages

Fermented food

Grains are the principal staple nourishing food of India. Consumption of grains in different

civilizations of India can be observed from the literature. All grains have good calorific value, largely from starch and proteins. Some of the grains exhibit antinutritional properties such as the presence of phytate and trypsin inhibitors. Processing techniques such as fermentation, germination, soaking, and cooking help to remove these antinutritional factors (Egounlety and Aworh, 2003). Different ethnic products can be made from a single grain variety or combination of many grains. Different varieties of grains such as cereal can be mixed with pulses to make delicious products *like idli, dosa, dhokla, ambali, wari* etc. it is mostly seen that fermentation is generally caused by lactic acid bacteria (LAB). *idli, dosa, adai dosa, kallappam, ambali, dhokla* (Table 1), are popularly known south indian food which are fermented from *L. mesenteroides, E. faecalis, Pediococcus sp., Streptococcus sp* and *L. fermentum* [2]. The preparation involves the batter formation from the basic ingredients and is then left overnight at room temperature for fermentation, occasionally sodium bicarbonate is added to provide anaerobic conditions for the growth of LAB (Satish *et al.,* 2013). Sometimes yeast is also added to enhance the rate of fermentation (Satish *et al.,* 2013). Fermented sweets and snacks are prevalently eaten up throughout India. Some fermented products from grains are also made and are consumed mostly during festive season or other special occasions. To make these sweet dishes mainly Wheat, rice and barley flours are principally used cereals as a major ingredient and Sugar or salt is added compulsorily in the fermented foods. These foods select only those microorganisms which can endure at low water activity. Commonly found fermented sweetened product in india are *jilebi, seera, kulcha, gulgule, bhataru* etc. the microflora found to be associated with these food products are *L. fermentum, L. buchneri, L. plantarum, L. acidophilus, L. mesenter-oides, Lactococcus lactis, Streptococcus lactis* (Satish *et al.,* 2013). One of the sweet end fermented cereal product is sel roti, which is a rice-based fermented food, which is spongy and ring shaped and *Lactobacilli, Pediococci, Enterococci, and Leuconostocs* are the principal microorganisms (Sarkar *et al.,* 2015). It is found that in *jilebi* and *selroti* sugar as high as 25% is added (Tamang *et al.,* 2009a). Another important grain is pulses, which play a key role in human diet. Commonly used pulses in this type of fermented foods are chiefly Black gram, soybean, Bengal gram, red gram and green gram. Soybean food is a reasonable source of plant protein as compared to animal and milk products on the basis of protein cost per kg, which is easily accessible to the rural poor of the North-eastern region (Tamang 2015b), due to this reason soybean fermented product, are particularly consumed in northeast part of India. Here is enlisted fermented product from cereals, pulses or combination of both (Table 1).

Fermented grain beverage

In western countries, numerous varieties of beverages are prepared by means of barley malt, as a source of starch and saccharifying agent. In contrast, in the preparation of Indian traditional beverages such as ragi, rice and barley are used as a rich source of starch and saccharifying enzyme. Many varieties of alcoholic beverages are manufactured and consumed by ethnic people of India. Traditionally different fermented beverage are been produced at different part of India, depending upon the geographical condition, climatic condition and the raw food material chiefly available in that locality of area. Fermented beverages like Soor, ghanti, jann, daru are popular drink of himalyan belt or himalyan region, but there is a variation in the raw material used, rice, barley or finger millet is used as raw materials for the preparation of soor, which contains 35-40 % alcohol. The

people of Himalayan region such as Ladakh call Ghanti as chang. Jann is a traditional local drink of Uttaranchal, which is prepared from rice (*Oriza sativa* L.), koni [*Setaria italica* (L.) P. Beauv.], wheat (*Triticum aestivum* L.), jau (Hordeum vulgare L.) (Sekar and Mariappan 2007). It contains very low concentration of alcohol.

Daru is a distilled liquor containing ethyl alcohol at a much higher concentration prepared from rice, jaggery, koni, chuwa, oowa (Sekar and Mariappan 2007). On the other hand lungi, tchang, Jhar, Zutho, Jnard, Atingba, apong, judima and baathi janr are popular product of north eastern region specifically from Nagaland, Tripura, Sikkim, Meghalaya (Table 2).

Apong is prepared by a combination of ash of paddy husk and straws, cooked glutinous rice and traditional starter and moved into an earthen pot, and are allowed to ferment for 20 days at 30 to 35°C. Many studies have found apong to be helpful in preventing kidney stones formation (Ray *et al.,* 2016).

Judima is prepared through mixing the starter powder humao with air dried boiled rice (1:100) and fermented at room temperature. The drink is very useful against infection and is anti-inflammatory, antiallergic, antioxidant, antibacterial, antifungal, antispasmodic, hepatoprotective, hypolipidemic, neuroprotective, hypotensive, antiaging, and antidiabetic (Ray *et al.,* 2016). For zutho preparation cooled rice porridge is mixed with grist and poured into an earthen jar. The mixture is allowed to ferment for 3 days (Ray *et al.,* 2016). This is known for enhancement of the immune system, lower the blood insulin level, prevent loss of appetite, lower bad cholesterol, assist in wound healing, and prevent infection (Teramoto *et al.,* 2002).These fermented beverage is very useful for the human health.

Fermented plant sources (fruit, vegetables, whole plant part) food product/ beverage

Fermented plant food

The lactic acid fermentation of plant sources is used as a preservation method for the production of finished and semi-finished products. In eastern Himalayan regions of India an extensive range of fermented plant sources products are prepared for storing and consumption fermentation technology is a significant technique to store the perishable plant products as well as their parts in the absence of any refrigeration. There are many fruits vegetable and plant part fermented products listed below (Table 3). Mostly Bamboo Shoots Fermented products are consumed as a traditional food by ethnic people of North-eastern states of India (Sonar *et al.,* 2015). In India, Bamboo Shoots are harvested yearly in Sikkim (26.2 tonnes), Meghalaya (435 tonnes) and Mizoram (426.8 tonnes) (Satish *et al.,* 2013). After many studies made it is considered that bamboo shoots are considered low down in fat and cholesterol, very high in potassium, extracted from bamboo shoots (Choudhury *et al.,* 2011). Fermented bamboo-based foods are considered to have many health benefits. Indigenous fermented bamboo shoot products of North east India are *Soibum, Soidon* and *Soijin* in Manipur *Bamboo Tenga* in Arunachal Pradesh. *Moiya Koshak*, *Melye Amiley*, *Midukeye and Moiya Pangsung* of Debbarma, Chakma and Uchoi tribes of Tripura, respectively (Uchoi *et al.,* 2015). Predominant micro flora associated with these products are *L. brevis*, *L. plantarum*, *L. curvatus*, *P. pentosaceus*, *L. mesenteroides* subsp. *mesenteroides*, *L. fallax*, *L. lactis*, *L. citreum*, and *Enterococcus durans* (Satish *et al.,* 2013; Uchoi *et al.,* 2015). Lactic acid fermentation vegetables such as *gundruk*, *sinki*, and *khalpi* are fermented vegetables of Sikkim and Bhutan product. Principal Lactic

Acid Bacteria involved in traditional fermented vegetables are *Lactobacillus brevis*, *L. plantarum*, *Pediococcus pentosaceus*, *P. acidilactici*, and *Leuconostoc fallax*. Some fermented fruit and vegetable products which are solitary prepared by certain tribes of Tripura. *Amlai Ntoi*, *Bikang*, *Bochumba*, *Kosoi*, etc., are traditional products prepared by *Uchoi* and *Jamatia* tribes by fermenting *Amla*, *Bombax ceiba* L. flower and bean, respectively (Uchoi *et al.*, 2015). *Ziang Sang* and *Tapyo* is fermented leaf product of Manipur and Arunachal Pradesh (Satish *et al.*, 2013). Microorganisms involved in these fermented vegetable food products are *Lactobacillus fermentum*, *Lb. plantarum*, *Pediococcus pentosaceus*, etc. (Uchoi *et al.*, 2015). Given below is a list of plant sources fermented food product (Table 3).

Fermented plant beverage

Fermented beverage is supreme prevalent ethnic alcoholic drink prepared and mostly consumed in the festival period. Some popular traditional alcoholic beverages of North East India are *Apong* and *Ennog* in Arunachal Pradesh, *Bhaati*, *Jaanr* prepared by the *Gorkha* tribe (Uchoi *et al.*, 2015). Traditional beverages have different forms which vary from crystal-clear products to turbid liquid or thick gruels and pastes (Sekar and Mariappan 2007). Varieties of are consumed all over the world. In India, the widely consumed wines are *toddy*, *jackfruit*, *fenny* manufactured from coconut palm (*Cocos nucifera* L.), jackfruit (*Artocarpus heterophyllus* Lam.), and cashew (*Anacardium occidentale* L.) respectively. The palm wine fermentation *Leuconostoc* sp. and *Zymomonas* sp. *Leuconostoc* sp. and *Lactobacillus* species wich are early bacterial inhabitants of the palm sap. *Saccharomyces cerevisiae* carries out the alcohol fermentation (Sekar and Mariappan 2007). Jackfruit wine is consumed by tribal people of Nagaland, Tripura and other eastern hilly areas of India. Given below is the tabulated form of fermented beverage (Table 4).

Fermented milk and milk products

Cattle were an integral part of the Vedic culture. Literature before 800 BCE refers to cow, buffalo, and goat milk, which were consumed either fresh or boiled (Sarkar *et al.*, 2015). Milk and milk products are used up most prevalently due to their nutritive value, due to this reason milk is easily spoiled by pathogenic microorganisms, hence fermentation with the help of LAB is favored for prevention of nutrient quality of milk. LAB converts lactose (milk sugar) into lactic acid. Fermented milk products are mostly prepared by addition of LAB in the form of starter culture to milk (cow, buffalo or yak) and are allowed to ferment. One such popularly known fermented product which is most popular and commonly used traditional Indian fermented product *dahi* or *curd*. *Dahi* is a lactic acid fermented product of cow or buffalo milk or combination of both. It can be eaten directly as sweetened or salted form. It is also consumed with other food such as rice and *chapatti*. *Dahi* is rich in lactic acid bacteria and demonstrates probiotic effect, which helps in intestinal health (Sekar and Mariappan 2007). *Lassi* is a traditional milk beverage consumed in summer season which is prepared from *dahi*, by blended with water. To enhance the taste sugar, salt, and spices such as cumin seeds and coriander leaves can be added. Lassi is a probiotic product due to the presence of active cultures. Buttermilk is the liquid that is left over when butter is churned out of cream, consumed with or without added salt and spices (Sarkar *et al.*, 2015). It has less fat content and fewer calories compared with regular milk or *dahi*. *Rabdi* is a famous dairy preparation in the north-west part ofIndia. It is a lactic acid-fermented milk product with pearl millet (Table 5).

Table.1 Grain based fermented food

NAME	INGREDIENTS	STATE
Koozhu	*E. coracana* (ragi) (ragi) flour, boiled rice, non-fat yoghurt	Tamil Nadu
Pazhaiya soru	Rice, curd and salt	Tamil Nadu
Idli	Rice, black gram dhal, Table salt, fenugreek seeds	South Indian
Dosa	Rice, black gram dhal (either raw or parboiled rice), Table salt	South Indian
Adai dosa	Boiled rice, Bengal gram, red gram, black gram, green gram	South Indian
Kallappam	Boiled or raw rice, coconut toddy	South Indian
Dhokla	South Bengal gram dhal, rice and leafy vegetables	South Indian
Ambali	Ragi (Millet) flour and rice	Karnataka and Tamil Nadu
Jilebi	*Wheat, sugar and curd*	*South Indian*
Gulgule	Wheat flour and starter material Malera	Himanchal Pradesh
Seera	Wheat, sugar and ghee	Himanchal Pradesh
Chhuchipatra pitha	Par-boiled rice, black gram, coconut, sugar and curd	Orissa
Bhatura or indigenous bread	Wheat and starter material Khameer/Malera	Himanchal Pradesh
Kulcha	Wheat and the starter Khameer/Malera	Northern India
Chitou	Par-boiled rice and black gram	Orissa
Sel roti	Rice, banana, honey, ghee and spices	H.P and Sikkim
Manna	Wheat	Himanchal Pradesh
Kurdi	Wheat	North India
Aska, anarshe, aenkadu/askalu, patande	Rice	Himanchal Pradesh
Torani	Rice	Orissa
Aet, aktori, baari, babroo, bhatooru, chhura, mande/manna, malpude, tcung, shunali	Wheat flour	Himachal Pradesh
Chhangpa, doo, khawalag, marpinni/ marjag, tchog, thuktal	Roasted barley flour	Himachal Pradesh
Mangjangkori	Buck wheat bran	Himachal Pradesh
Endure pitha	Fermented batter of parboiled rice and black gram	Odisha
Sinki	Fermented raddish taproot	Nepal, Darjeeling, Sikkim and Northeast
Sez	Rice	Uttarakhand, Himachal Pradesh
Ragi hurihittu	Popped finger millet flour	North east
Akhone	Soybean	Khasi and Garo in Meghalaya.
Tiskori	Wheat bran	Himachal Pradesh
Sour rice	Raw rice	Assam, Bengal, and Odisha
Anarshe	Gluten-Colloid Type Fermented Food	Sikkim and Himalayan India
Uttapam	Rice and Urad Dahl	South India
Kinema	Soybeans	Darjeeling, Sikkim
Bari	Soybeans	Sikkim
Hawaizaar, hakhu mata/akhuni	Soybeans	Manipur
Wari	Black bean and soybean Uttar Pradesh	U.P
Masyaura	Black gram or green gram, Colocosia tuber, ashgourd or radish	Darjeeling hills and Sikkim
Bedvin roti	Black gram, opium seeds or walnut	H.P

Table.2 Grain based fermented beverage

Name	Ingredient	State
Lungi	rice	Tripura
Soor	Rice, barley, finger millet	Himalayan belt
Jhara	Rice and fresh plants	West Bengal
Tchang	millet	Sikkim
Jhar	millet	Sikkim
Jaan	Fermented cereals	Uttarakhand
Daru	Ric, jaggarey and wheat	Himalayan belt
Zutho	Rice flour	Nagaland
Jnard	Finger millets	Nepalese and Tibetans
Atingba	Hamei (natural starter)	Manipur
Apong	mixture of ash of paddy husk and straws, cooked glutinous rice, and traditional starter	North-east India
Judima	Glutinous variety of rice	Northeast
Bhaati jaanr	Glutinous variety of rice	Northeast
Ghanti	Fermented musk	Himanchal Pradesh

Table.3 Fermented plant based products

FERMENTED FOOD	INGREDIENTS	STATE
Gundruk	Leaves of mustard/ radish/cauliflower	Arunachal Pradesh
Sinki	Radish root	North East Indians
Sauerkraut or Sauerkohi	Cabbage	India
Anishi	Yam	Nagaland
Soibum or soijim	Bamboo shoots	Manipur, Nagaland
Soidon	Bamboo shoots	Manipur
Kardi or handua	Bamboo shoots	Orissa
Bamboo tenga	Bamboo shoots	Arunachal Pradesh
Hikhu	Bamboo shoots	North-east India
Hiring	Bamboo shoots	North-east India
Ekung	Bamboo shoots	Manipur
Eup	Bamboo shoots	Arunachal Pradesh
Khorisa-tenga, ushoi, amil, romba	Bamboo shoots	North-east India
Mesu	Bamboo shoots	Darjeeling hills and Sikkim
Khalpi	Cucumber	Sikkim
Rai (brassica juncea) seeds	Mustard seeds	North-east India
Goyang	magane-saag (*Cardamine macrophylla* Willd.) leaves	Darjeeling hills and Sikkim
Inziangsang	Mustard leaves	Nagaland, Manipur
Kanji	Carrot or beet root, rice, mustard	North India
Moiya pangsung	Bamboo shoots	Uchoni tribe Tripura
Moiya koshak	Bamboo shoots	Debbarma tribe Tripura
Midukeye	Bamboo shoots	Chakma tribe Tripura
Melye amiley	Bamboo shoots	Tripura
Amlai ntoi	Raw amla fruit	Uchoni tribe Tripura
Kosoi	Lima bean	Jamata tribe Tripura
Bikang	Sword bean	Uchoi tribe Tripura
Bochu-mba	*Bombax ceiba* flower	Tripura
Ziang-sang	Fermented leaves	Manipur and Arunachal Pradesh
Tapyo	Fermented leaves	Manipur and Arunachal Pradesh
Rep	Fermented leaves	Manipur and Arunachal Pradesh

Table.4 Fermented plant based beverage

Fermented beverage	Ingredients	State
Rokshi	Plants and plant parts	Sikkim
Jaan	Banana, pumpkin and orange	Uttarakhand
Daru	Fruits	Uttarakhand
Jackfruit wine	Jackfruit	Nagaland, Tripura and eastern hilly areas
Toddy	Coconut palm	India
Fenny	Cashew	India
Ziang- dui	Brassica leaves	Manipur

Table.5 Fermented milk and milk products

FERMENTED FOOD	INGREDIENTS	STATE
Curd (dahi, thayir)	Milk	India
Chhurpi or durkha or churapi	Yak milk is preferred for making this cheese, fresh milk may be used	Arunachal Pradesh
Chhur chirpen	Yak milk and cut fruits of crab apple (Thung)	Arunachal Pradesh
Churkham	Chhurpi and fresh milk	Arunachal Pradesh
Chhu	Yak or cow milk Sikkim	Sikkim
Philu or Philuk	Cow or yak milk	Sikkim
Shyow	Cow/yak milk	Sikkim
Gheu	Cow milk	Sikkim
Mohi	Cow milk	Sikkim
Somar	Cow milk	Sikkim
Maa	Yak milk	Sikkim
Jhol	Buttermilk/curd	Himachal Pradesh
Khadi	Buttermilk/curd	Gujarat
Misti doi	partially concentrated sweetened milk	Bengal, Gujarat
Shrikhand	Curd	southern India
Lassi	Curd	North India
Ginna	colostrum	India
Rabdi	Maize flour and buttermilk	North India
Buttermilk	Left over of churned cream	Gujarat and Rajasthan
Sandesh	chenna	All over India

Table.6 Fermented meat and sea products

Fermented food	Ingredients	Place
Ngari	Puntius sophore (Phoubu) Fish	Manipur and Assam
Hentak	Esomus danricus (Fish), petioles of A. macrorhiza	Manipur
Tungtap	Danio sp. (Fish)	Khasi tribe Maghalaya
Fermented fish	*Puntias sophore*	Manipur
Lona ilish	*Tenualosa ilisha*	North-eastern India
Crab	Crabs, Sesamum orientale	North-eastern India
Utonggari	Local fish (named 'phobou')	Assam
Lang kargyong	Beef	Eastern Himalayas
Yak kargyong	Meat of yak	Eastern Himalayas
Faak kargyong	Pork	Eastern Himalayas
Kheuri	Yak/beef meat	Sikkim
Lang satchu	Beef	Sikkim
Yak satchu	Red meat of yak	Sikkim
Suka Ko Masu	Red meat of buffalo or goat	Darjeeling hills and Sikkim
Chilu	Yak/beef/lamb meat	Sikkim
Chartayshya	Red meat of goat	Western Himalayas
Geema	Red meat of goat	Western Himalayas
Arjia	Red meat of goat	Western Himalayas
Shidal	*Puthi shida*	North east India
Karoti	Fermented fish	Assam
Bardia	Fermented fish	Assam

Ginna is a colostrum-based Indian sweet. It is also known as *junnu*, *posu*, or *kharvas* in different regions of India (Sarkar *et al.*, 2015). According to resent studies Colostrum is a rich source of immunoglobulin's, and iron binding lactoferrin protein, and nutrients such as vitamin A and minerals (Swami *et al.*, 2012).

Yak milk is also used for manufacturing of a number of dairy products like *Kurut*, *Chhurpi*, *Chhur churpen*, *Churkham*, *Chhu*, *Philuk*, *Shyow* and *Maa*. *Chhurpi* has a white, soft with a mild to strong flavoured taste and is consumed as curry mix (Tamang *et al.*, 2007c). *Chhu* a product predominantly consumed in Sikkim, Darjeeling hills, Arunachal Pradesh and Ladakh. *Shyow* is a thick gel curd like product, prepared from yak milk is.mainly fermentation is by LAB bacteria LAB strains yield various enzymes such as esterase, phosphatase, leucine-arylamidase, b-galactosidase and peptidase which inhibited pathogens such as *Enterobacter agglomerans, Enterobacter cloacae and Klebsiella pneumonia* (Satish *et al.*, 2013).

Fermented meat and sea products

Meat is highly prone to microbial spoilage. Traditional processing of meat is done by various methods such as Drying, smoking and fermentation. In India, societies of the North-eastern region ferment meat of yak, goat, pig, fish and crab for longer preservation period. *Kargyong* is an traditional sausage-like fermented product from yak, beef and pork. Kargyong are of three varieties prepared and consumed: *yak kargyong* (yak meat), *lang*

kargyong (beef) and *faak kargyong* (pork) (Satish *et al.,* 2013). *Yak kargyong* is a popular fermented sausage in Sikkim, Ladakh, Tibet, Arunachal Pradesh and Bhutan in the Himalayas. Usually fishes are also preserved by traditional method that are sun drying, salting fermentation and smoking. Fermentation of fish is brought about by autocatalytic enzymes from fish and microorganisms in the presence of high-salt concentration (Majumdar and Basu, 2010). In Northeast India, conventionally preserved fish products are *Ngari* and *hentak* in Manipur and *tungtap* in Mehalaya *Karoti* and *Bardia* in Assam. *Shidal* and *Lona ilish* in Tripura, *Gnuchi, Sidra* and *Sukuti* in Sikkim (Uchoi *et al.,* 2015). Fermented fish product of *ngari, hentak* and *tungtap* have LAB associated with them namely *Lactococcus lactis, L. plantarum, Enterococcus faecium, Lactobacillus fructosus, L. amylophilus, L. coryniformis, L. plantarum, Bacillus subtilis B. pumilus, Micrococcus* sp. *Candida* sp., and *Sacchromycopsis* sp (Jeyaram, 2009; Uchoi *et al.,* 2015). *Lona ilish* is another popular salt fermented fish product which is prepared from as *Ilish maach* mainly by the *Bengali* community people of this state. Microorganism associated with it is *Lactococcus lactis subsp cremoris, Lc. plantarum, Enterococcus faecium, Micrococcus* (Uchoi *et al.,* 2015). Given below is the table of different fermented meat and fish product and the place they are associated with (Table 6).

Indian fermented food products have a great diversity due to the diversity in the geographical condition, different culture of different region and the raw material present in abundant amount especially in North East Indian states. Traditional fermented products of India are prepared at house hold level through the homegrown practices of food processing and preservation, but there is lacking of hygienic knowledge and specific microorganism for the production of these products. There should be proper knowledge of Good Manufacturing Practice (GMP), microbe and safety of the product so that the product can be marketed and by producing they can be a source for earning to the villagers. There is necessary requirement to settle new biotechnological tools for standardizing them and discovering them in the local markets for their marketable potential.

References

Angmo, K., Kumari, A., and Bhalla, T. C. 2016. Probiotic characterization of lactic acid bacteria isolated from fermented foods and beverage of Ladakh. LWT-food Science and Technology, 66: 428-435.

Choudhury, D., Sahu, J. K., and Sharma, G. D. 2011. Bamboo shoot based fermented food products: a review.

Egounlety, M., and Aworh, O. C. 2003. Effect of soaking, dehulling, cooking and fermentation with *Rhizopus oligosporus* on the oligosaccharides, trypsin inhibitor, phytic acid and tannins of soybean (*Glycine max* Merr.), cowpea (*Vigna unguiculata* L. Walp) and groundbean (*Macrotyloma geocarpa* Harms). Journal of food engineering, 56(2-3): 249-254.

Jeyaram, K. 2009. Traditional fermented foods of Manipur. Indian Journal of Traditional Knowledge, 8(1): 115-121

Majumdar, R. K., and Basu, S. 2010. Characterization of the traditional fermented fish product Lona ilish of Northeast India.

Marco, M. L., Heeney, D., Binda, S., Cifelli, C. J., Cotter, P. D., Foligne, B., and Smid, E. J. 2017. Health benefits of fermented foods: microbiota and beyond. Current opinion in biotechnology, 44: 94-102.

Ray, M., Ghosh, K., Singh, S., and Mondal, K. C. 2016. Folk to functional: an explorative overview of rice-based fermented foods and beverages in India. Journal of Ethnic Foods, *3*(1): 5-18.

Şanlier, N., GÖkcen, B. B., and Sezgin, A. C. 2017. Health benefits of fermented foods. Critical reviews in food science and nutrition, Pp. 1-22.

Sarkar, P., Dhumal, C., Panigrahi, S. S., and Choudhary, R. 2015. Traditional and ayurvedic foods of Indian origin. Journal of Ethnic Foods, 2(3): 97-109.

Satish Kumar, R., Kanmani, P., Yuvaraj, N., Paari, K. A., Pattukumar, V., and Arul, V. 2013. Traditional Indian fermented foods: a rich source of lactic acid bacteria. International journal of food sciences and nutrition, 64(4): 415-428.

Sekar, S., and Mariappan, S. 2007. Usage of traditional fermented products by Indian rural folks and IPR. Indian Journal of Traditional Knowledge, (6): 111-120

Sharma, N. I. V. E. D. I. T. A., Handa, S. H. W. E. T. A., and Gupta, A. N. U. P. A. M. A. 2013. Comprehensive study of different traditional fermented foods/beverages of Himachal Pradesh to evaluate their nutrition impact on health and rich biodiversity of fermenting microorganisms. International Journal of Research in Applied Natural and Social Sciences, 1: 19-28.

Sonar, N. R., Vijayendra, S. V. N., Prakash, M., Saikia, M., Tamang, J. P., and Halami, P. M. 2015. Nutritional and functional profile of traditional fermented bamboo shoot based products from Arunachal Pradesh and Manipur states of India. International Food Research Journal, 22(2).

Swami, S. B., Thakor, N. J., Haldankar, P. M., and Kalse, S. B. 2012. Jackfruit and its many functional components as related to human health: a review. Comprehensive Reviews in Food Science and Food Safety, 11(6): 565-576.

Tamang, J. P. 2015b. Naturally fermented ethnic soybean foods of India. Journal of Ethnic Foods, 2(1): 8-17.

Tamang, J. P., Chettri, R., and Sharma, R. M. 2009a. Indigenous knowledge of Northeast women on production of ethnic fermented soybean foods. Indian Journal of Traditional Knowledge 8(1): 122–126.

Tamang, J. P., Dewan, S., Thapa, S., Olasupo, N. A., Schillinger, U., Wijaya, A., and Holzapfel, W. H. 2000. Identification and enzymatic profiles of the predominant lactic acid bacteria isolated from soft- variety Chhurpi, a traditional cheese typical of the Sikkim Himalayas. Food Biotechnology, 14(1-2): 99-112.

Teramoto, Y., Yoshida, S., and Ueda, S. 2002. Characteristics of a rice beer (zutho) and a yeast isolated from the fermented product in Nagaland, India. World Journal of Microbiology and Biotechnology, 18(9): 813-816.

Uchoi, D., Roy, D., Majumdar, R. K., and Debbarma, P. 2015. Diversified traditional cured food products of certain indigenous tribes of Tripura, India. Indian journal of traditional knowledge, 14(3): 440-446.

How to cite this article:

Rawat, K., A. Kumari, S. Kumar, R. Kumar and Gehlot, R. 2018. Traditional Fermented Products of India. *Int.J.Curr.Microbiol.App.Sci.* 7(04): 1873-1883.
doi: https://doi.org/10.20546/ijcmas.2018.704.214