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The pioneering practice of food fermentation shares an integral part of cultural heritage from ancient Indian civilization

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Abstract

The pioneering practice of food fermentation shares an integral part of cultural heritage from ancient Indian civilization for sustained nutrition and food preservation. More than five thousand different fermented foods are being consumed worldwide, many of which are produced by native people of certain locality using locally available plant or animal products. These are prepared either naturally or by adding starter cultures containing some specific microorganisms which can modify the substrate into edible product. Assam, the second largest state of Northeast India, is rich in both biological and cultural diversity and inhibited by a number of ethnic communities. This study documents the traditional knowledge on fermented food products of Lakhimpur District of Assam, India.

Keywords:- *1.Food preservation**, 2.**Fermented food, 3.Traditional, 4.Assam.*

Introduction

Fermented foods and beverages have occupied an integral part in diet, culture and tradition of many ethnic communities throughout the world. Using inexpensive techniques for food preservation, fermented food products play a significant socio-economic role in developing countries across the globe. The action of microorganisms or enzymes causing desirable biochemical changes is the key to fermented food production. Fermentation transforms the raw materials by destroying or detoxifying harmful substances like tannins, polyphenols etc. (Sharma and Kapoor, 1996) increasing the level of proteins, vitamins and other micro and macro nutrients (Jeyaram et al., 2009). The microflora present in natural condition or in starter culture plays an imperative role in bio-embolden the substrate with various health promoting photochemicals, nutrients and other functional components of food.

Production of fermented foods dates back to thousands of years and represents one of the early evidence of the use of biotechnology. This traditional biotechnology evolved from natural process where the environment select the desired microorganism based on nutrient availability and continues its journey through the preparation and use of starter culture, strain improvement and the most recent gene technology. Fermented foods comprising dairy, beverage and cereal products are integral components of diets throughout the world due to its nutritional benefit, flavour and taste.

Assam is well known for its rich biodiversity and multiple ethnicities of the inhabitants. The socio-cultural diversity is reflected in the diverse traditional customs and rituals, foods, agriculture and other activities of day to day life of the people of Assam. Fermented foods share a vital part of age old practices with different tastes and textures linked with cultural diversity. Most of the rural women are engaged in the fermented food production following village art techniques. In this present investigation

an approach has been taken to document different traditional fermented food product prepared by different ethnic groups of Lakhimpur district of Assam. This study also deals with the documentation of raw materials, traditional processing, composition and ethno-medicinal importance of the food products so that new entrepreneurs can grow with fermented food industry to meet the growing market demand of traditional and functional food.

Materials and Method

The documentation study was carried out in different villages of Lakhimpur. The objective of the study was to record the traditional knowledge associated with indigenous fermented food preparation and processing by the rural people of different ethnic communities residing in Lakhimpur. The villages for the field study were selected randomly having adequate number of people of a certain ethnic group. A total number of 25 villages were surveyed having inhabitants of the ethnic groups, Ahoms, Sonowal Kachari, Deuri, Mising, Bodo, Bengali speaking community and Assamese community. Mostly the women of the studied area were questioned for the documentation process using semi-structured questionnaires. Information was recorded with the vernacular names of the plant and animal parts used for preparation of the fermented foods and method of preparation. Plant and animal specimens were collected and identified using standard references. For ease of understanding, the collected information was grouped into fish-based products, leafy vegetable based foods, fermented bamboo shoots, fermented beverages etc.

Result and Discussion

The Lakhimpur district of Assam is a region with rich cultural diversity and ethnicity. The indigenous Assamese ethnic groups like Chutiyas, Ahom, Koch, Mishing, Deuri, Tiwa (Lalung), Bodos, Khamptis dominate Lakhimpur. Moreover Tea tribes (Adivasi) community, other groups including immigrants like Bengali speaking Muslims and Hindus, Nepali speaking Gorkhas also reside in the western and northern part of the district along the foothills.

A number of fermented foods have been prepared by the ethnic groups of the studied area and some of them are discussed below.

Fermented foods from perishable vegetables and bamboo shoots

Bio-preservation of perishable vegetables is a native skill where lactic acid fermentation plays the role of key mechanism of biopreservation. Some ethnic fermented vegetables from this study are Gundruk, Sinki, different types of pickle, fermented bamboo shoot products etc.

Gundruk is a common non-salted dried fermented leaf vegetable food prepared by the Nepali community. It is generally prepared during the time of availability of the leafy vegetables i.e. in the winter when large amount of mustard leaves, radish and other vegetables pile up. Similar fermented vegetable products are also available in different regions of the world like Kimci of Korea, Sauerkraut of Germany, Sunki of Japan, Suan-cai of China etc. Leaves of locally available mustered plant varieties (*Brasicca rapa* var. *cuneifolia*, *Brasicca juncea* etc.), cauliflower (*Brasicca oleracea*) are prepared for making Gundruk. The leaves are cleared, wilted and shredded first and then crushed and pressed into an earthen container. The container is left for fermentation for about 7-10 days after making it airtight. A mild acidic taste of the leaves indicates the completion of the fermentation. Then the Gundruk is removed from the container and sun-dried for 4-5 days for preservation. Most of the women of the Nepali community are involved in the preparation of Gundruk. It is consumed as a soup which is considered as a good appetizer or it is used as pickles.

Sinki is another fermented food product produced by the Nepali communities. It is fermented radish tap root product prepared by pit fermentation method. For this fermentation procedure, about a meter pit of same diameter is dug in a dry place. After being cleaned the pit is plastered with mud and warmed by burning. The ashes are removed and the pit is lined with bamboo sheaths and paddy straw. Radish tap roots are wilted in sun for 2-3 days, crushed and then dipped into lukewarm water, squeezed and pressed tightly into the pit and covered with dry leaves. Finally it is weighted down by heavy planks or stones. The top of the pit is plastered with mud and left for fermentation for about a month. After a month, the fresh Sinki is removed, cut into small pieces and sun-dried for 3-5 days. The properly dried Sinki can be stored for two years or more at room temperature. This Sinki is consumed as both soup and pickle. Highly acidic flavoured Sinki is used as a base for soup preparation and it is considered as a good appetizer. Nepali people use it as a homemade remedy for indigestion. Both Gundruk and Sinki are sold in the local markets by the rural women for their living.

Fermented Bamboo shoots are quite popular among different ethnic groups of north-east India. A number of edible bamboo varieties are present in the north-eastern region like *Arundinaria callosa*, *Bambusa balcoa*, *B. valgaris*, *B. nutans*, *B. pallida*, *B. polymorpha*, *B. tulda*, *Dendrocalamus hamiltonni*, *D. giganteus*, *D. brandisii*, *D. hookeri*, *D. sikkimensis*, *D. strictus* and *Melocanna bambusoides*, *Phyllostachys manni* (Hughes et al., 2002)

In Lakhimpur district fermented food products from bamboo shoots are prepared by almost all the ethnic groups studied. The procedure of preparing the fermented bamboo shoots is common among all of them. For the fermentation procedure young tender bamboo shoots are collected and outer casing and lower portions are removed. Then it is sliced into small pieces and transferred into jars or containers or bamboo hollow cylinders with a small amount of water sprinkled over it. Now it is kept for fermentation. Some people add chilli, especially Bhut Jolokia (King chilli) or other chillies and dried *Garcinia Morella* (kuji thekera) to increase the specific hot and sour taste of the fermented product. This product is locally known as Khorisa and it is consumed with meat, fish or other vegetables for its characteristic flavour and aroma. It is also taken as pickle and chatni by adding some other ingredients. For the preparation of dry Khorisa, the fermented products are taken out from the container, the water content is squeezed and then sun-dried on bamboo trays. The dried Khorisa is used to prepare pickle by adding crushed mustard seeds and locally available King chillies or Bhut Jolokia (*Capsicum cinense*).

The people of the Assamese community also use fermented foods prepared from mustard seeds (*Brassica compestris*). For the preparation of this food item locally known as Kharoli, black mustard seeds are used. The seeds are first washed properly and sun dried. They are then grinded and transferred to an earthen pot locally known as Koloh. Now, the locally made alkali by burning banana peels, known as Khar is added to this mixture. Then the mixture is pressed and the mouth of the earthen pot is sealed making it air tight and left for 10-15 days for fermentation. After this period, the fermented product is taken out and eaten as a side dish with rice. Ethno medicinally, it is also used to cure gastrointestinal problems.

Fermented areca nut

Raw areca nut and betel leaves are locally known as tamul and paan which is an important symbolic element of the Assamese culture and used in almost all ritual and customs as a token of devotion, respect and friendship. The fermentation of areca nut is done to preserve it for long time. There are two types of fermentation procedures. In one method, a pit is dug of about 2.5 feet and leaflets of areca nut are placed covering the sides and bottom of the pit properly. Some amount of cow dung is put over the areca nuts. Then the nuts are covered with jute bags with some soil and left for 3-4 months to ferment. After the specified time the areca nuts are taken out from the pit. The fermented areca nuts can be preserved for more than two years if the procedure for fermentation is carried out properly. The fermented nut gives a specific aroma and taste. In the second type of procedure, the raw areca nuts are

put into a jute bag and the mouth of the bag is properly tied. Now, the bag is kept under water in a pond. A specific smell indicates the completion of the fermentation procedure after 3-4 months. These areca nuts can be preserved for 4-5 months.

Fermented beverages

Fermented alcoholic beverages are consumed by different ethnic groups residing in the district. Each ethnic community has its own method of preparing fermented beverages. Ahom, Mishing, Deuri, Sonowal Kacharis, Bodo, Lalung people of the district had its roots in their socio-cultural life. These beverages have less significant effects on the health of the tribal people which may be credited to the medicinal properties of the plants used in the preparation of the starter culture (Das et al., 2012). Different ethnic groups used different plant parts based on their own traditional knowledge and experience. The fermented beverages are prepared by some starter cultures which contain certain yeasts and other microbes to carry out the fermentation procedure.

The starter cultures are locally called Pitha. Different ethnic groups has different local name for the fermented alcoholic beverages. The Ahoms call it Xaj pani or Lao pani. Similarly the Deuri people call it Suzae,. Mishings' call it as Apong and Sonowal Kacharis' call it as Mod. The starter cakes are called Xaj pitha by the Ahom, Suzae pitha by the Deuris, Apob by the Mishings and Mod pitha by the Sonowal Kacharis. All the ethnic communities follow almost similar methodology for the preparation of the starter culture by adding ground rice mixed with powdered leaves of some selected medicinal plants. An attempt was taken to document these medicinal plants of different ethnic groups of Lakhimpur and it is documented in the chapter entitled "Ethnobotany of starter culture used in indigenous alcoholic liquor prepared by some ethnic communities of Lakhimpur" of this book.

The leaves of the plants are collected and washed properly and then sun dried for 1-2 days. The dried leaves are grounded and mixed with the powder of rice grain with few ml. of water. Then a portion of previously prepared starter culture is added inocula of the yeast species. The previously prepared starter culture cake is locally known as Ghai pitha. Some disc-shaped (each of around 50 g) cakes are now prepared from the starter culture cake and wrapped with banana leaves and kept in air tight condition for 4-5 days over fire hearth. The dried disc-shaped starter culture cake is now enriched with yeasts, rice powder and plant materials and is locally called as Vekur pitha. This starter cake is preserved for future use which acts as the main inoculant for the fermentation procedure of preparing rice beer.

The people of the studied area especially the rural women are involved in the household preparation of the rice beer. They prepare the starter cake with utmost care so that no contamination can damage the whole preparation. The local women prepare it in a room confidentially having hygienic condition free from dust and insects. No outsiders are allowed in the room during the preparation to avoid contamination. Such taboos are in accordance with their age old experienced traditional knowledge. They believed that the plant parts used in the starter culture is the key to the health benefits of the alcoholic beverages. They use different plants to add flavour, to increase the concentration of alcohol, to check various health related problems, for sweetness, a little bitterness and stickiness of the prepared product, colour and better taste of the rice beer and for aeration of the starter culture. The following table (Table 1) depicts the plants used by the ethnic groups studied in this investigation. The table documents the plants used in the fermentation procedure according to the interviewed persons of different ethnic communities of the studied area.

Table 1: Names, plant part used and purpose of different plants used by the four studied ethnic communities during the preparation of the starter culture

Sl. No	Botanical name	Local name	Parts used
1	*Acanthus leucostachys*	Pani-madhuri	Whole plant
2	*Ananas comosus*	Mati kothal	Leaf
3	*Artocarpus heterophyllus*	Kathal	Leaf
4	*Areca catechu*	Tamul	Tender root
5	*Capsicum annum*	Jolokia	Fruit
6	*Centella asiatica*	Bor manimuni	Whole plant
7	*Cinnamomum bejolghota*	Pati-hunda	Leaf
8	*Cinnamomum tamala*	Tezpat	Leaf
9	*Clerodendron infortunatum*	Dopat tita	Leaf and bark
10	*Corton joufra*	Goch-mahudi	Leaf
11	*Costus speciosus*	Jomolakhuti	Leaf
12	*Cyclosorus extensa*	Bihlongoni	Frond
13	*Desmodium laxiflorum*	Beoni-haputa	Leaf
14	*Drimeria cordata*	Lai jabori	Whole plant
15	*Hydrocotile rotundifolia*	Saru mani-muni	Aerial parts
16	*Jasmimum sambac*	Duamali	Leaf and stem
17	*Lygodium flexuosum*	Kapau-dhekia	Aerial parts
18	*Madhuca longifolia*	Mahua	Flower and leaf
19	*Naravelia zeylanica*	Ramnum	Twig
20	*Oldenlandia corymbosa*	Saru bon-jaluk	Aerial parts
21	*Oldenlandia diffusa*	Bon-jaluk	Aerial parts
22	*Oryza sativa*	Dhan	Seed
23	*Piper longum*	Pipoli	Tender shoot
24	*Polygonum hydropiper*	Loram	Tender twig
25	*Psidium guajava*	Madhuri	Leaf
26	*Saccharum officinarum*	Kuhiar	Leaf
27	*Sansevieria roxburghiana*	Dompak	Leaf
28	*Scoparia dulcis*	Bor bon-jaluk	Aerial parts
29	*Selaginella sp.*	-	Aerial parts
30	*Robus moluccanus*	Jetulipoka	Leaf
31	*Zanthoxylum hamiltonianum*	Tez-moori	Root

The main rice variety used to prepare the rice beer is Bora rice belonging to Sali variety. The fermentation procedure using rice as the substrate is locally known as Sewa diya. The Bora rice is cooked and spreaded on a plate which is left open for an hour. The boiled rice is then mixed with the starter culture cakes (Verkur pitha) which contain yeast (*Saccharomyces cerevisiae*). Now the cooked rice with the other ingredients is poured into a clay pot locally known as Koloh and kept at a dark place of a room for 4-5 days. The pot is made air tight and after this time period of 4-5 days the juice produced inside the clay pot is poured into another pot though filtration usually using rice straw. The fermented juice is highly aromatic, alcoholic and sweet to drink. The tribal people use it as energy booster during heavy physical labour for the agricultural processes. Moreover, it is also used in certain ceremonial occasions of the society. Some people use jackfruit as a substrate instead of rice. This fermented alcoholic product also has sweet and aromatic taste. Besides household consumption of the fermented alcoholic beverages prepared by different ethnic groups, it is distributed and consumed among the folk during Bihu festivals, religious rites and rituals and marriage ceremonies. It is also served to guests as a token of love and respect.

Fermented fishes

Many ethnic communities N.E. India prepare fermented fish products using locally available small species of fishes. In the Lakhimpur district also, a few ethnic groups prepare fermented fish products. The methods of preservation of the fishes are traditionally used by the ethnic groups and this household art is handed down through generations. It is practiced more frequently in the fishing season when abundant fish species are locally available. The fishes as a whole are cleaned and intact ones are selected for the preservation procedure by fermentation. Some ethnic tribes and people from ethnic Bengali speaking both Hindu and Muslim communities are involved in the preparation the fish product Shidal which is a pasty and solid semi fermented fishery product. The indigenous fish oil extraction method and Shidal recipe preparation are also traditionally passed from generation to generation. It is believed that this fermented fish product has the ability to prevent malaria (Muzaddadi and Basu, 2012). The village people prefer local varieties of *Puntius* sp. (Puthi) as the raw material to prepare Shidal. It is a pasty and solid food where the shape of the fish remains intact. It is consumed after preparing Shidal chutney (Shidal bhorta) or Shidal curry and mostly popular in the tribal belts and Bengali speaking areas.

The main materials for preparation of Shidal are fishes, earthen pot (mutka), edible oil/fish oil, cover paste made from fishes and clay seal. The fishers extract fish oil from entrails of *Puntius* sp. which is used in Shidal preparation. Fish oil is preferred over edible oil, if available. While processing the *Puntius* sp. for fermentation, the internal surface of the earthen pot locally called as Mutka where the fishes will be put, is smeared with fish oil as long as the oil gets absorbed by the earth material and subsequently dried under the sun. This process is repeated for several times until the internal wall of the pot gets saturated with the oil leaving no air vent open in the earth material. The indigenous method to prepare fish oil needs *Puntius* sp. as the raw material. Firstly, the fishes with bulged abdomen are selected and degut partially to take out entrails of the abdomen but keeping attached to the pharynx. These are then transferred to an earthen pot with a large mouth. A little amount of water is poured and the mixture is stirred with bare hand for 10-20 minutes vigorously. Now the stuck oil gathered on the inner side of the pot is collected by scrapping with hand and stored in solid form in a wide mouthed steel or glass pot by scrapping the hand against the rim of the pot. The process is repeated several times to collect the entire oil produced. The oil is now boiled to make it liquid and stored in a bottle for further use.

To prepare the Shidal firstly the fishes are descaled, degut and washed properly. Intact and same sized fishes with no injury of insects and other wounds are selected for this purpose. These fishes are semi dried in the sun so that about 50% of the total moisture remains in the fishes. Now, these fishes are packed in the oil processed earthen pots. The mouth portion of the pot is sealed with cover paste which is covered with a cover leaf. The cover paste is prepared by crushing dried fishes. Generally to prepare the paste, broken and small fishes which can't be used for preparing intact Shidal are used. Broad plant leaves such as banana leaves are used to cover the paste temporarily to restrict fly infestation and dusts. After a week, the cover leaf is removed and the earthen pot is sealed airtight with clay and fishes are allowed to ferment for almost 6 months by the resident microorganisms. Thick clay is prepared from soil for final sealing of the earthen pot. It ensures anaerobic condition inside the pot and shields insect infestation. Subsequently layers of clay are applied very promptly when cracks appear on the earthen pot failure of which is resulted in insect infestation as well as poor quality of the final fermented product. No salt is added during the preparation of Shidal, a little extra oil is added if needed. The final Shidal product of ideal quality have a sticky surface with the intact shape of the fish, dark brown in colour, soft in texture and typical Shidal smell and flavour.

The Deuri and Mishing community also prepare fishery food products- Dried fish and grinded fermented fishes. Deuri people call the dried fishes as Nakia chiya and the grinded fish products as Chucha. The Mishing people call the dried or smoked fishes as Perup and the grinded semi fermented fish products as Numsing. The indigenous dry fish product of tribal communities of upper Assam is commonly

known as Xukoti. This product is used as a household food item as well as used as local therapeutic to cure malaria and to reduce pain. The ethnic people of Lakhimpur follow almost similar procedures to make the fish products.

Commonly available fishes like Moa (*Amblypharyngodon mola*), Puthi (*Puntius sophore*), Sokoriputhi (*Puntius ticto*), Goroi (*Channa punctatus*), Xingora (*Mystus vittatus*), Kawoi (*Anabus testudineles*), Khlihona (*Colisa fasciatus*), Dorikona (*Rasbora daniconius*), Karati (*Gadusia chapra*), Boliora (*Aspidoparia morar*), Tora (*Macrognathus punctatus*),Naro (*Labeo bata*), Punga (*Tetradon* sp.) etc. are used for preservation and preparation of food products by the local inhabitants of Lakhimpur.

The fishes after collection are washed properly and dressed to remove scales, fins, intestines, except very small sized fishes and washed with water for several times. Then the fishes are mixed with salt and spread uniformly on a bamboo tray locally known as Chaloni. The fishes are now either sun-dried for 2-3 days or dried over traditional fire hearth in the kitchen on a bamboo rack. Sometimes salt is not added and allowed to sun-dry for 2-3 days and then placed the semidried fishes over the traditional fire hearth. After proper drying the fishes are preserved as dry fish in airtight condition in earthen or wooden container for future use.

Another method for the preparation of grinded semi fermented fish product is also there. Small sized fishes are cleaned properly removing scales, fins and intestine and sun dried without salting for 2-3 days. Then the dried fishes are grinded with the help of traditional grinder called Ural or Dheki in local language till the mixture becomes coarse paste. At the same time period, edible part of arum petioles are sorted out, peeled and sliced using kitchen knife. *Colocasia marcrorrhiza* (locally known as Borkosu) is used by a number of ethnic people. About 100g of *Colocasia* stems are mixed with 1 kg of dry fish powder. *Eubhorbia ligularia*, commonly known as Leafy spurge or Milk hedge and locally known as Xiju is also added to the mixture sometimes. This mixture is now grinded properly. To increase the adhesiveness of the prepared mixture these plant species are used following their traditional knowledge and experience. Some people use spices like ginger, garlic etc. and a particular type of chilli locally known as Bhut Jolokia (*Capsicum chinense*) during the grinding procedure to enhance the taste of the product. Now the paste of the mixture appears deep green in colour. The paste is then transferred to locally made bamboo cylinders and the contents are covered with dry banana leaves and sealed airtight with clay. Subsequently, the bamboo cylinders are placed about 2-3 feet above the traditional oven in the kitchen allowing the mixtures to ferment for a period of 2-3 months. The product can be stored for a year or two in the same bamboo container for further use. This fish product is consumed with hot rice either by streaming it with other spices or by preparing curries with vegetables.

Considering popularity and health beneficial properties of smoked, dried and fermented food products, it demands scientific and high quality production with fine packaging for retail sale. The rural inhabitants of the remote areas of Lakhimpur would definitely capture the urban markets of fermented food products. Small scale enterprises of such fermented food products can stimulate sustainable development in rural and semi-urban areas by strengthening livelihood of a large number of rural people.

Fermented milk products

Naturally fermented milk products are results of one of the oldest and widely used milk fermentation techniques known as “back-sloping” method in which a previous batch of fermented product is used to inoculate the new batch (Shangpliang et al., 2017). Naturally fermented milk products are integral part of the common people of the studied region. Some of the widely used such milk products are curd (Doi/dahi)., sweet curd (Mitha doi/misti dahi), ghee (Gheu), butter, lassi etc. Curd and sweet curd are the popular fermented milk products for direct consumption. Fresh cow or buffalo milk is boiled and then cooled to room temperature and allowed to ferment for 2-3 days. A small quantity of previously prepared curd is added which serve as the source of inoculum to the milk. Different lactic acid bacteria

and yeasts are responsible for the fermentation procedure. Curd serves as a potent probiotic and it is used traditionally for its biological functions enhancing the health promoting benefits.

The changes in metabolite composition in the fermented foods are carried out by participating microbiota and nature of fermentation (Ghosh et al., 2015). According to Roberfroid (2000), a food product can be made functional by (1) eliminating components which are responsible for deleterious effects when consumed (allergenic protein, lactose, phenylalanine etc.), (2) fortification with a micronutrient by increasing the concentration of the naturally present component in the food to the level known to produce beneficial effects, (3) increasing the nutritive components to a point at which the desired beneficial effects can be drawn, (4) adding any component which is not a part of the food but for which beneficial effects have been shown (antioxidants and prebiotics), (5) replacing the macro nutrients which are responsible for deleterious effects and (6) increasing bioavailability or stability of functional components or assuage the disease risk potential of the food. Rural folk knowingly or unknowingly use microbes in primitive ways for preparation of different fermented food products which are the reservoirs of a number of unexplored metabolites having various health promoting components and major sources of energy and nutrients. Most of these metabolites are responsible for protection over human diseases manifesting beneficial effects on the immune system (Fitzgerald et al., 2009). A number of previous researchers had documented various metabolites by analyzing the fermented foods. The most commonly and widely used yeast species, *Saccharomyces cerevisiae* var. *boulardii* (*S. boulardii*) is reported to have probiotic activity and widely used as dietary supplement for prevention of intentional diseases (Yan and Polk, 2006). Over the past decade a significant rise in the spectrum of biomedical activities and applications in food processing industry has been reported with *S. boulardii.* This yeast species has been seen to be beneficial for breakdown of dietary phytate and biofortification of folate to improve nutritional value of the food products (Sindhu and Khetarpaul, 2002), But, there exists a significant lack of knowledge regarding the ability of probiotics to alter the photochemistry of the substrates during fermentation and therefore, this reinforces to profile metabolites to detect phytochemical changes due to fermentation without a bias towards certain chemical classes.

Indian traditional foods are regarded as functional foods for their functional components such as antioxidants, dietary fibers, probiotics and other micro and macro nutrients. The functional properties of foods are further enhanced by processing techniques like sprouting, malting and fermentation.

India has a rich diversity of ethnic fermented foods, however, most of these functional foods are confined to some specific communities belonging to some specific regions. Processing, preservation and knowledge on therapeutic benefits of these foods are transferred from generation to generation in a specific ethnic community. Proper scientific intervention of the folkloric fermented foods could be a potent tool to explore the nutritional and nutraceutical potential of it. The various traditional methods need to be documented for detail study of nutritional and anti-nutritional content of the final food product. All the available nutrients present in food items are essential to be scientifically analyzed and displayed on the product (FAO, 1998). The standardization of procedures and adaptation of appropriate technologies for fermentation can boost up the production of fermented foods and beverages for better nutritional status and community health.

Conclusion

Nowadays, holistic approaches for isolation, identification and complete profiling of culturable and non-culturable microorganisms present in the fermented food products are of great interest to food microbiologists. Extensive investigation on the valuable but hitherto-microbial strains is required to enumerate the safety profile of the preserved foods as there are some reports on the presence of toxic pathogens in some fermented food products. Improvement of crude traditional methods with advanced scientific inputs can be effective accelerator of production of safe fermented foods in large scale.

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