Characterization of some traditional fermented foods and beverages of Himachal Pradesh

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Traditional fermented foods and beverages are very popular in the tribal and rural areas of Himachal Pradesh. A number of fermented foods and beverages were identified and the traditional fermentation processes were studied. Some of the popular fermented foods and beverages were analysed for their microbiological characteristics. The fermented products that are unique to the tribal and rural belts of Himachal are Bhaturu, Siddu, Chilra, Manna, Marchu, Bagpinni, Seera, Dosha, Sepubari, Sura, Chhang, Lugri, Daru, Angoori and Behmi. Besides source of nutrition, these fermented foods e.g. Bhaturu, constitute staple food in larger part of rural areas of Kullu, Kangra, Mandi and Lahaul & Spiti districts of the state while others are consumed during local festivals, marriages and special occasions. Traditional starter cultures like ‘Phab’ (dehydrated yeast formulations), ‘Treh’ (previously fermented wheat flour slurry) and ‘Malera’ (previously fermented wheat flour dough) are the inocula used in preparing fermented products. Microbiological studies revealed that species of Saccharomyces cerevisiae is a dominant microorganism in fermentation along with species of Candida, Leuconostoc and Lactobacillus. The ethanol content of some of the fermented beverages was also analysed.

Keywords: Traditional Foods, Traditional Beverages, Fermented Foods, Fermented Beverages, Tribals, Himachal Pradesh.


The fermentation leading to the production of wine, beer, bread, yoghurt, cheese and pickles are probably the first biotechnologies man devised to improve the quality and storage life of some food materials since antiquity. This remained more or less an art till the dawn of microbiology in the 18th and 19th century, when it was proved beyond doubt that microorganisms are the agents for fermentation. With the advent of microbiology, biochemistry, molecular biology and biochemical engineering, the art of fermentation practised by a common man led to the rise of fermentation industries.

The fermentation industries added quality to the original products and expanded the range of products. The art of fermentation practised by common man,

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continued in spite of scientific and technological revolution but largely remained confined to rural and tribal areas due to (i) high cost or inaccessibility of the industry-made products in remote areas, (ii) taste of the people for the traditional fermented products, and (iii) their sociocultural linkages with such products.

The traditional fermented foods and beverages form important constituents of staple diet of the people belonging to the tribal belts of Lahaul & Spiti, Kinnaur, Chamba and rural areas of Kullu, Shimla, Mandi and Kangra districts of Himachal Pradesh. Wide range of traditional fermented products are prepared and consumed in Himachal Pradesh. The know-how of the traditional processes and technologies involved in the production of fermented products has been transferred from one generation to another. The raw materials needed are locally available; equipments used are easy to maintain and affordable by the folk people. In the present communication an effort has been made to document and characterise traditional fermentation products and processes along with their sociocultural importance in Himachal Pradesh.

Methodology

A survey of rural and tribal areas of Himachal Pradesh was done to identify popular fermented foods and beverages. Data about the traditional fermentation processes, raw materials, equipments used and the socio-cultural importance was collected by active interaction with people of rural and tribal areas. The raw materials, fermented foods and beverage samples were collected aseptically from the rural and tribal belts of Kullu, Shimla, Lahaul & Spiti and Kinnaur districts where these fermented foods and beverages are commonly prepared and consumed.

Bacteria and the yeast were isolated from the samples of nutrient agar, Lactobacillus Selective Oxgall Agar and Czapek Malt Agar plates. Incubation was done at 30°C for 48hrs. The microorganisms isolated were identified and submitted to Microbial Type Culture Collection & Gene Bank (MTCC), Institute of Microbial Technology, Chandigarh and also to Microbial Germplasm Bank (MGB) at the Department of Biotechnology, Himachal Pradesh University, Shimla. The samples of the fermented beverages were analysed for their ethanol content using standard method2.

Observations

(a) Fermented Foods

Some of the traditional fermented foods, commonly prepared by the rural and tribal people of Himachal Pradesh and popular among them are listed in Table 1. Most of these foods are cereal-based (wheat/barley/buckwheat) but some legume (black gram) and milk-based fermented foods are also common. Some of the products like Bhaturu, Siddu, Chilra, Marchu, Manna, Dosha, Pinni/Bagpinni, Seera, etc. are unique to Himachal Pradesh. In the tribal districts of Lahaul & Spiti and Kinnaur, large variety of fermented foods is prepared either daily, during special occasions or
Traditional starter cultures like ‘Malera’ and ‘Treh’ are used as inocula in making these fermented foods. However, the natural fermentation (without the addition of inoculum, as microorganisms present in the raw materials carry out fermentation) is used in the production of Seera, Sepubari and Borhe, etc.

(b) Fermented beverages

A number of cereal (rice/barley), fruit (grapes/wild apricot/apple), jaggery and
millet-based indigenously made fermented beverages are popular among the people of Himachal Pradesh. These fermented beverages are prepared and consumed regularly and also during special occasions. Some of the very common traditional fermented beverages of Himachal Pradesh are listed in Table 2. In the preparation of these fermented beverages except Sura, ‘Phab’ is the inoculum used for fermentation. However, Sura is a unique product of natural fermentation.

Fermented Foods

1. Siddu

Siddu, also called Khobli in Shimla district, is a traditionally fermented steam cooked, oval or disc shaped dish prepared as a delicacy in rural areas of Kullu and Shimla districts. In Siddu preparation, wheat flour, spices, mixed paste of opium seeds/walnut/black gram are the main ingredients. Inoculum used is ‘Malera’ (previously fermented left over dough). These days, yeast powder is also used for fermentation. The process of Siddu preparation is as follows:

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Wheat flour
  Mixed with water and ‘Malera’ or yeast powder (inoculum)
Knead as dough
  Left for 4 to 5 hours for fermentation in a warm place
Fermented dough is given oval shape
  Stuffed with spices mixed paste of opium seeds/walnut/black gram
  Steam cooked
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Siddu is served hot with desi ghee or chutney and these days it is also served as a traditional local dish in many restaurants in Kullu/Manali. It is prepared as a special/occasional dish in the rural areas.

2. Chilra

Chilra, called Lwar in Lahaul, is more or less like ‘Dosa’ but differs from it in terms of ingredients and shape, major ingredients being wheat/barley and buckwheat flour. Inoculum used for its preparation is called ‘Treh’ (previously fermented and left over wheat flour slurry). The traditional bucket shaped wooden vessel, used for fermentation is called ‘Lwarenza’. The process for the preparation of Chilra is as follows:

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Wheat/barley flour and buckwheat flour in 1:3 ratios
  Added water, ‘Treh’ (inoculum) and slurry made is left for fermentation for about 12h
  Fermented slurry
    Spread on hot plate and baked on both sides
  Chilra
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Chilra is served with coriander chutney, potato and mutton soup in Lahaul valley where it forms a staple food of the people and is a popular snack/staple food of the people in Lahaul. It is also prepared during marriage ceremonies and local festivals.

3. Marchu

Major ingredient for Marchu, prepared during the local festivals (phagli, halda) in Lahaul valley is wheat flour. Inoculum used for fermentation is called ‘Malera’,
which is previously fermented left over dough. The Marchu are roties, made on a wooden base with carving to give designed imprints on Marchu. The method of making Marchu is summarised as under:

Wheat flour

Added water, black jeera, little salt, ‘Malera’ (inoculum) and knead as dough, fermented overnight (12h).

Fermented dough

Roties

Deep fried (till brown) in mustard oil

Marchu

These are prepared during festivals, religious and marriage ceremonies as a snack/breakfast food to be taken with tea. It is customary for daughter to take Marchu with her, whenever she visits her maternal home from in-laws or vice-versa.

4. Dosha

Its preparation is similar to marchu but it has a shape of folded spirals. It can be sweet or salty.

5. Bhaturu

Bhaturu, also known as Sumkeshi roti in Lahaul, is an ‘indigenous bread’ or roties and constitutes staple diet of the Himachalis living in rural areas of Kullu, Mandi, Kangra, Chamba and Shimla districts. Rural migrants in urban areas also prepare Bhaturu. The starting material is wheat flour or sometimes barley flour. Inoculum used is called ‘Malera’. Normal fermentation time is 2-3 hours in summer and 4-5 hours in winter. In order to reduce the fermentation time, people knead flour using more inoculum and warm water. After fermentation one can see the rise in dough. The process of making Bhaturu is given below:

Wheat flour

Added ‘Malera’, water, mixed and knead as dough, left for 3-5 hours for fermentation

Fermented dough

Roties are made and baked after about half an hour

Bhaturu

Bhaturu serves as a staple diet for rural people who even take it during both meals along with vegetables or curries.

6. Bedvin roti

This is a modified form of Bhaturu as these are stuffed with spices mixed paste of dal (black gram), opium seeds or walnut. These are either simply baked or deep-fried. The fried ones are called ‘Kachoris’ in Mandi district. These are taken as breakfast or snack food with tea.

7. Gulgule

Gulgule are prepared from wheat flour, made into viscous slurry by adding water, sugar and ‘Malera’ (inoculum). This sweetened slurry is given small oval shape to be deep fried in oil until brown. These are prepared during religious, and social ceremonies by both urban and rural population.
8. Pinni/Bagpinni

It is prepared in the tribal district of Lahaul & Spiti. Sattu (roasted barley flour) is mixed with Lassi (buttermilk) or Chhang and kneaded in the form of dough, which is finally given the shape of a ball with a cavity in the centre. This cavity is filled with ghee/butter.

9. Seera

Wheat grains are soaked in water for 2-3 days so as to allow fermentation to occur by natural microflora. After 2-3 days the grains are ground, steeping is done to allow the starch grains and some proteins to settle down and then bran is separated. Starch and proteins are removed, sundried and is called ‘Seera’. The dried material is made in to slurry by soaking in water; which is then poured in to hot ghee, sugar is added, cooked, and served as sweet dish/snack.

Seera is considered to be nutritious, easily digestible and fast snack food. Seera is prepared occasionally or offered to the guests as a sweet dish in the rural/urban areas of Kullu, Kangra, Mandi and Chamba districts.

Fermented beverages

1. Sura

It is a millet-based (Eleucine coracana) fermented beverage mostly prepared in Lug valley of Kullu district. Millet, locally called Kodra/Kached, has long storage life and because of this it was popular as the ‘famine grain’. No specific inoculum is used for its preparation. Natural microflora carry out starch hydrolysing (saccharolytic) and ethanol forming (fermentative) activities. Also, a herbal mix in Sattu (flour of roasted barley) base (called as Dhehli by the folk people) is added during fermentation. Herbal mix or Dhehli preparation is an annual community effort, in which elderly people go to forests on the 20th day of Bhadrapada month (usually 5 or 6th September) and collect approximately 36 fresh herbs. Next day, the herbs are crushed in ‘Ukhal’ (stone with a large conical cavity) using ‘Mussal’ (a wooden bar) and the extract as well as the plant biomass are added in to the Sattu and are roughly kneaded. This put in to a wooden mould, to give the shape of a brick and dried, is called Dhehli. It is divided among the villagers and is used whenever Sura is to be prepared. The Dhehli provides bioactive compounds as well as stimulatory effect.

Some of the important herbs used in Dhehli preparation are: Pistacia integerrima (Kkakar shinga), Solanum xanthocarpum (Katari), Clitoria ternatea (Kkayal), Aegel marmelos (Bhel), Viola cinerea (Banaks), Cannabis sativa (Bhang), Trachyspermum coticum (Ajwain), Micromeria biflora (Charbara), Spiranthes australis (Bakarshinga), Saussurea sp. (Bbacha), Bupleurum lanceolatum (Nima), Drosera lunata (Oshtori), Salvia sp. (Kotugha), Arisaema helleborifolium (Chidi richun), Fragaria sp. (Dudlukori) and a number of other herbs. Sura is consumed during local festivals like Shoeri saja and marriage ceremonies. The process for the preparation of Sura is as follows:
2. Chhang/Lugri

This is an indigenous rice beer made in the tribal belt of Lahaul & Spiti. The preparation of Chhang involves solid-state fermentation as no additional water is added to the ingredients i.e. cooked rice and ‘Phab’ (the traditional inoculum). Chhang is also prepared from barley; however it takes longer time (one week) to ferment and the beverage is called Lugri in Lahaul. The traditional vessel, made of metal or stone used to store Chhang, is called ‘Uthi’ in Lahaul. The process is as follows:

- **Millet flour**
  - Knead with water
  - Dough
    - Left for 10 days in a container for natural fermentation
  - Slurry made of this naturally fermented dough
  - Slurry spread on hot plate
  - Half-baked roties are made
    - Cut to pieces and cooled
    - Roti pieces, powdered Dhehli and water
      - Put in to earthen pot
  - Fermented for 8 to 10 days by covering the pot
    - Sura

- **Rice/Barley**
  - Water added
  - Cooked
  - Spread in open on mat to cool
  - Add ‘Phab’
  - Mix ‘Phab’ and rice properly
  - Mixture is put in to a container
    - Blankets are used to cover it and fermentation takes place
    - Semisolid rice after 4-5 days
      - Transferred to another container for storage
  - Filtered and filtrate consumed as Chhang

Chhang/Lugri is a very popular fermented beverage which is served during Phagli (traditional new year of Lahulis) and marriage ceremonies to guests. Chhang is called Jhol, Chakti in Kullu. Distilled form is known as Sra in Lahaul valley. This beverage has a religious significance, as it is sprinkled on guests as shagun (tribal custom). Chhang serves as a tonic in winters as it contains vitamins, amino acids, and sugars besides alcohol and considered to provide protection against cold.
3. Daru

Daru is a jaggery-based traditionally fermented beverage prepared and consumed in rural areas of Shimla, Kullu and other regions of Himachal Pradesh. Daru is also called Chakti in Kullu valley. This is one of the popular alcoholic beverages prepared in the rural areas especially for entertaining guests during local festivals and marriage ceremonies. Babool wood locally called kikar (Acacia nilotica) is added to give taste and aroma to Chakti. The process of Daru preparation is summarized as follows:

\[ \text{Jaggery (Gur)} \]
\[ \text{Added water, ‘Phab’, babool wood (Kikar)} \]
\[ \text{Mixture left on simmering heat} \]
\[ \text{Fermented for 4-5 days} \]
\[ \text{Fermented mixture filtered} \]
\[ \text{Filtrate is Daru} \]

4. Chulli

Dried wild apricots, locally called chulli are used for making the alcoholic beverage. It is a traditional fermented beverage, indigenous to the tribal district of Kinnaur. The process of Chulli preparation is as follows:

\[ \text{Crushed wild apricot} \]
\[ \text{Added water, ‘Phab’ and warm up the mixture} \]
\[ \text{Fermented for 2 to 3 days} \]
\[ \text{Filtration of the mixture} \]
\[ \text{Filtrate (Chulli)} \]

It forms an integral part of the social life of Kinnauris, as it is served to the guests during local festivals, fairs and marriage ceremonies.

5. Angoori

In the preparation of Angoori, grapes (red and the usual green ones) are used. A number of grape varieties are cultivated in the Kinnaur district and its produce is used to make this local alcoholic beverage (wine) as shown below:

\[ \text{Crushed Grapes (Red/Green)} \]
\[ \text{Added sugar, water and ‘Phab’} \]
\[ \text{Fermentation for 15 days} \]
\[ \text{Mixture filtered and distilled} \]
\[ \text{Distillate (Angoori)} \]

Angoori is also called Kinnauri in Kinnaur district. This is one of the very popular traditional fermented beverages consumed during local festivals and marriage ceremonies by the tribal people of Kinnaur.

Microbiological evaluation of fermented foods (inocula) and beverages

The predominant microflora (yeasts) were characterised on the basis of microscopic, physiological and biochemical characteristics. The yeast isolates identified at MTCC, IMTECH Chandigarh, are listed in Table 3 and Table 4.

The commonly encountered organisms in the inocula of fermented foods and beverages are Saccharomyces cerevisiae and Candida sp. Zygosaccharomyces bisporus and Kluyveromyces thermotolerance
were also found. The predominant bacteria in the fermented products included species of *Leuconostoc* and *Lactobacillus*. The microbiological analysis of the starter culture ‘Phab’ revealed a mixed microflora consisting of yeasts, actinomycetes and *Bacillus* species.

The fermented beverage samples were analysed for ethanol content. The ethanol content in the beverages exhibited a large variation (Table 5). The highest ethanol content was recorded in *Sura* (a millet-based naturally fermented beverage), followed by *Chhang* and *Lugri*. *Behmi*, *Chulli* and *Angoori* had a low content of alcohol, while jaggery and red grapes based beverage contained 5% ethanol.

**Discussion**

Fermented foods and beverages are nutritionally beneficial and easy to preserve. A number of fermented foods (e.g. *Siddu*, *Chilra*, *Marchu*, *Manna*, *Dosha*, *Bhaturu*, *Bedvin roti*, *Bagpinni* and *Churpa*) and fermented beverages (e.g. *Sura*, *Chhang*, *Lugri*, *Daru*, *Angoori* and *Behmi*) were identified, which have become an integral part of the food and nutrition of the rural and tribal people of Himachal Pradesh. Traditional fermented

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<th>Source of isolation</th>
<th>Strain identification</th>
<th>Microorganisms isolated &amp; identified</th>
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</thead>
<tbody>
<tr>
<td><em>Chilra ‘Treh’</em></td>
<td>MTCC 4785</td>
<td><em>Saccharomyces cerevisiae</em></td>
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<td><em>Bhaturu ‘Malera’</em></td>
<td>MTCC 4790</td>
<td><em>S. cerevisiae</em></td>
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<td></td>
<td>MGBB 74</td>
<td><em>Lactobacillus sp.</em></td>
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<td><em>Borhe dough</em></td>
<td>MTCC 4791</td>
<td><em>S. cerevisiae</em></td>
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<tr>
<td><em>Siddu/Khobli ‘Malera’</em></td>
<td>MTCC 4804</td>
<td><em>S. cerevisiae</em></td>
</tr>
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<td></td>
<td>MTCC 4806</td>
<td><em>Candida valida</em></td>
</tr>
<tr>
<td><em>Phab</em></td>
<td>MTCC 4837</td>
<td><em>S. cerevisiae</em>, <em>Bacillus sp.</em>, <em>Actinomycetes</em></td>
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</tbody>
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<tr>
<th>Fermented beverage</th>
<th>Strain designation</th>
<th>Microorganism isolated &amp; identified</th>
</tr>
</thead>
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<tr>
<td><em>Sura</em></td>
<td>MTCC 4800, MTCC 4801</td>
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<td></td>
<td></td>
<td><em>Zygosaccharomyces bisporus</em></td>
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<td><em>Chhang</em></td>
<td>MTCC 4789, MTCC 4795</td>
<td><em>Candida caco, S. cerevisiae</em></td>
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<td><em>Lugri</em></td>
<td>MTCC 4783, MGBB 73</td>
<td><em>S. cerevisiae</em>, <em>Leuconostoc sp.</em></td>
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<td></td>
<td>MGBB 75</td>
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<td><em>Daru/Chakti</em></td>
<td>MTCC 4797, MTCC 4798</td>
<td><em>S. cerevisiae</em>, <em>Candida famata</em>, <em>C. valida</em>, <em>Kluveromyces thermotolerance</em></td>
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<td><em>Angoori</em></td>
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<td><em>Behmi</em></td>
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<td><em>Ark/Ara</em></td>
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<td><em>S. cerevisiae</em></td>
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products have been reported from Sikkim and Darjeeling hills. The traditional rice beer *Chhang* of Lahaul is called ‘*Bhaate Jaanr*’ in Sikkim. A number of traditional beverages similar to *Chhang* are also prepared in South East Asian countries e.g. *Tape ketan* in Indonesia, *Lao-Chao* in China, *Yakin* in Korea and *Krachae* in Thailand. The similarity in the beverages of tribal areas of Indian Himalayas with those of South East Asian countries may be due religious, anthropological or cultural commonalities.

The microbiological analysis of fermented products or their inocula, revealed *Saccharomyces cerevisiae* as the main fermenting yeast. Few species of *Candida* have also been isolated, along with the species of *Zygosaccharomyces bisporus* and *Kluveromyces thermotolerance*. The bacterial species of *Lactobacillus* and *Leuconostoc* are prominently involved in fermentation, causing acidification and leavening.

It has been observed that ‘*Phab*’ is the inoculum used in the preparation of most of the traditional fermented beverages. It is known with different names in many North-eastern parts of India and other South East Asian countries like, *Marchai/Bakhar* in Nepal, Bhutan and China, *Ragi* in Indonesia, *Nuruk* in Korea, *Bubod* in Philippines, *Chi-tu-yueh* in China and *Loog pang* in Thailand. ‘*Phab*’ was observed to contain yeast, bacteria and actinomycetes. However, the types of yeast, bacteria and actinomycetes in a particular ‘*Phab*’ samples varied from one preparation to another, as no stringent microbiological precautions were observed during the preparation and formulation of ‘*Phab*’.

As a result, it not only contains fermentative microorganisms but also have saccharolytic and acidogenic microorganisms, which might be responsible for the release of fermentable sugars from starch-based raw materials like rice in *Chhang* preparation. Tamang has also reported mixed microflora from ‘*Phab*’ samples. These mixed culture inocula degrade starch in to reducing sugars and ethanol with enhanced aroma and flavour to the product.

The large variations in ethanol content of naturally fermented beverages indicate lack of standardised technologies, low content of fermentable sugars in some raw materials and the inefficiency of the fermentative microorganism (as there is large variation in the microflora of ‘*Phab*/inoculum) to carry fermentation. This has also been observed in ‘*Pisco*’, a South American beverage and in naturally fermented beverages of Himachal Pradesh.

**Conclusion**

Traditional fermentations have low cost of production, need less labour input and raw materials needed for preparation are locally or easily available. The tradi-
Traditional fermented foods and beverages form a part of socio-cultural life of hill people. These fermented products have a potential to grow into a small or medium size industry, if scientific and technological support is extended to the existing folk technologies/practices.

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