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## Cultural Adaptation of the Himalayan Ethnic Foods with Special Reference to Sikkim, Arunachal Pradesh and Ladakh

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The Himalayan people have developed the ethnic foods to adapt to the harsh conditions and environment. The in-take of such foods has been in the systems for centuries and people have adapted such foods to protect and sustain them. People living in high altitude (>2500) are adapted to cereals and food grains grown in dry and cold climates, with less vegetables and more meat products. More diversity of food items ranging from rice, maize to vegetable, milk to meat is prevalent in the elevation less than 2500 to 1000 m. Ethnic foods possess protective properties, antioxidant, antimicrobial, probiotics, bio-nutrients, and some important health-benefits compounds. Due to rapid urbanisation, development, introduction of commercial ready-to-eat foods have adverse effects on production and consequently consumption of such age-old cultural ethnic foods is declining. The people should be ascertained about the worth indigenous knowledge they possess, and biological significance of their foods. Detailed health status in terms of consumption of both fermented and non-fermented foods and their cultural adaption need to be carried out urgently.

### Introduction

The Himalayas (Fig 1) extend with a distance of 2500 km from the Indus Trench below Mt. Nanga Parbat (8125 m) in the West to the Yarlungtsangpo-Brahmaputra gorge below Mt. Namche Barwa (7756 m) in the East<sup>1)</sup> and include four countries viz. India (Jammu & Kashmir including Ladakh, Himachal Pradesh, Uttarakhand, Sikkim, Darjeeling hills, Arunachal Pradesh and some hill regions of northern Assam, Fig 2), Nepal, Bhutan and China (Tibet). The world highest mountain Mt. Everest (8848 m) and the third highest mountain Mt. Kangchendzonga (8579 m) are situated in Nepal and India, respectively. About 65 million people comprising more than 200 major ethnic communities live in the Himalayan regions of India, Nepal, Bhutan and Tibet in China<sup>2)</sup>. The Hindus of Indian origin mainly dominate the sub-Himalayan and middle Himalayan valleys, while the high mountain Himalayan region is influenced by the Tibetan Buddhists. The ethnicity of the Ladakh is predominantly Buddhist (Tibeto-Mongoloids). Sikkim is a mixture of both Hindu Nepali and Buddhist of

Tibetan origins. Arunachal Pradesh has culture similarity with the Chinese of the Yunnan province; however, in the northern district of Arunachal Pradesh have predominantly the Tibetan origin races. The major ethnic groups of people living in Ladakh are Ladakhi; in Sikkim are ethnic Nepali comprising of different castes (Rai, Limboo, Tamang, Gurung, Magar, Bahun, Chettri, Sansyasi, Pradhan, Bhujel, Dewan, Sunwar, Khagatey, Sherpa, Kami, Damai, Sarki, Maji), Lepcha and Bhutia; and in Arunachal Pradesh are Monpa, Sherdukpen, Memba, Khamba, Khampti, Singpho, Adi, Aka, Apatani, Bangni, Nishing, Mishmi, Miji, Tangsa, Nocte, Wancho, Nepali<sup>1,3)</sup>.

The agro-climatic zones of the Himalayas vary from hot sub-humid tropical to temperate, alpine and glacial. The lowest recorded temperature was at -28.3°C in Leh in Ladakh<sup>4)</sup>. The Himalayas have rich bio-diversity of plants, animals, and microorganisms due to their various ecological locations and altitudinal variation within a short distance. Belts of natural vegetation range from tropical monsoon rain forest or 'sal' forest (*Shorea robusta*) in the south to the upper timberline at

4000 to 4500 m, and above this zone till 5000 m, the *Rhododendron*-shrub belt dominates the alpine meadows, along with shrubs, herbs, bryophytes, pteridophytes and lichens<sup>5)</sup>. About 85 % of the Himalayan populace is directly or indirectly dependent on traditionally practiced integrated hill agriculture, animal husbandry, agro-forestry and forestry for livelihood. Mountain geography and inaccessibility due to difficult terrains and lack of infrastructure have compelled the people to adopt the agro-biodiversity system. The Himalayas have rich bio-resources consisting of many indigenous varieties of cereals such as rice, maize, finger millet, wheat, buckwheat, barley, sorghum, pearl millet; pulses such as soybeans, black gram, green gram, garden peas, black lentils, French beans; vegetables such as cabbage, cauliflower, leafy mustard (*rayo sag*), young tendrils, fruits and tubers of squash (*iskus*), brinjal, chilli, cucumber, young tendrils and fruits of pumpkin, sponge gourd, tomato, tree tomato, lemon, etc.; tubers and rhizome such as potato, beetroots, sweet potato, cassava, arum/taro, yam, ginger, turmeric, large cardamom; roots- radish, carrot, etc. Varieties of seasonal fruits such as orange, apple, mango, papaya, guava, banana, pear, peach, fig, avocado, etc. are cultivated and consumed. Tea, ginger, large cardamom, garlic, medicinal and aromatic plants, wild and domesticated ornamental plants and orchids are the cash generators for the people. Many wild edible plants including young bamboo shoots, ferns, stinging nettles, and their parts such as seeds, fruits, roots, leaves, flowers are eaten by the Himalayan people<sup>6-8)</sup>. The domestic livestock of the Himalayas includes cow, ox, goat, pig, sheep, yak, 'joe/churru' (hybrid of cow and yak), buffalo, poultry, etc., which are mainly used for meat, milk and its products, and eggs. Yaks (*Bos grunniens*) are reared mostly on extensive alpine and sub alpine scrub lands between 2100 m to 4500 m altitude for milk products, meat, hairs, tails and skins in Sikkim, Arunachal Pradesh and Ladakh<sup>9,10)</sup>. The river systems along with their tributaries and natural lakes in the Himalayas harbour many indigenous species of fish and other aquatic organisms as foods<sup>11)</sup>.

## Food Culture

There are two categories of ethnic foods-fermented foods and non-fermented foods. More than 150 varieties of ethnic fermented food and alcoholic beverages and drinks, more than 300 types of non-fermented ethnic foods, and about 350 wild edible plants are consumed in the Himalayas as staple, snacks, side dish, curry, soup, confectionery, condiments, refreshing, desserts, pickles, alcoholic drink, savoury, masticator and stew<sup>2)</sup>. Each food prepared by different ethnic communities in the Himalayas is unique and unparallel, due to wide geographical location, food preference, climatic conditions, and availability of plant or animal sources. The Himalayan culture is wedged between the Buddhist-Mongolian culture in the north and Hindu-Aryan culture in the south, hence, the Himalayan food culture is a fusion of the Hindu and the Buddhist cuisines with modifications based on ethnical preference and social ethos over a period of time<sup>2)</sup>. Rice or maize is a staple food in Sikkim and Arunachal Pradesh, whereas barley or millet is a staple cereal in Ladakh. *Bhat-dal-sabji-tarkari-dahi/mohi-achar* combination, which is corresponding to steamed rice-legume soup-vegetable-curry-curd/butter milk-pickle, is a typical recipe of every meal in the Eastern Himalayas (Fig 3). Ladakhi, Tibetan, Bhutia, Mongpa, Drukpa and Lepcha usually eat *tukpa* (noodles in soup), *skiu* or *momo* (small dumpling of wheat flour with meats), baked potato, *tsampa* (ground roasted barley grains), *chhurpi* (cottage cheese), *kargyong* and *gyuma* (sausages), butter tea and *chyang* (alcoholic beverage).

Drinking of locally fermented beverages and distilled alcoholic drinks is the social provision among many ethnic Himalayan people. Alcoholic beverages locally called *kodo ko jaanr* or *chyang* made from fermented finger millets or barley are common in Sikkim, northern part of Arunachal Pradesh and Ladakh. In high mountains (>2500 m), yak milk and its products are popular food items. The Himalayan food is less spicy and prepared in butter made from cow milk or yak milk, but now commercial edible oil is also used. Majority of the Himalayan ethnic people are non-vegetarians except the Brahmin communities belonging

to Hindu, who are strict vegetarians. Non-vegetarians eat chicken, mutton, lamb, chevon, pork, beef, buffalo, yak, fish, etc. Beef and yak is taboo to a majority of the Hindu communities.

### Ethnic Fermented Foods

A variety of fermented foods and alcoholic beverages are consumed across the Himalayas, and every community has its fermented foods specific to the community for more than 2500 years<sup>2)</sup>. Daily per capita consumption of ethnic fermented foods (excluding alcoholic beverages) is 167 g in Sikkim representing 13 % of daily meals in-take<sup>12)</sup>. Ethnic fermented foods of Sikkim, Arunachal Pradesh and Ladakh have been listed in Table 1-3. Some women

sell the ethnic food products in local markets and earn their livelihood enhancing the regional economy (Fig 4). Native microorganisms associated with age-old ethnic fermented foods bring about essential biotransformation of the substrates contributing a number of desirable properties such as making foods tasty, preserve foods, enrich diet with improved flavour and texture, ensure food safety by antimicrobial properties, enrich nutritional supplements, and promote probiotic and several health-promoting properties. Bacteria, mostly lactic acid bacteria (LAB), yeasts and filamentous moulds constitute the microbiota of fermented foods and beverages, which are present in or on the ingredients, utensils, environment, and are selected through adaptation to the substrates<sup>13-15)</sup>.

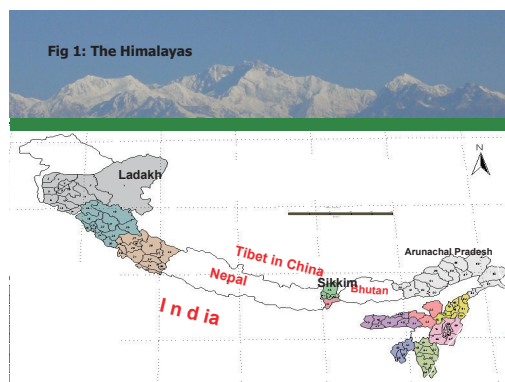


Fig.1 The Himalayas

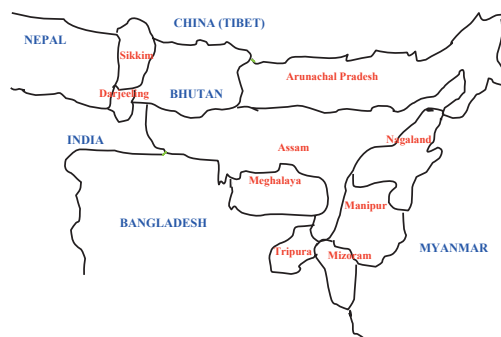


Fig.2 Location map of North East India



Fig.3 Traditional meals of the Himalayan people



Fig.4 Marketing of fermented bamboo shoots in North East India

**Table 1 Ethnic fermented foods of Sikkim**

Fermented food	Raw materials	Nature of product and Culinary
<i>Gundruk</i>	Leafy vegetable	Dried, sour-acidic; soup, pickle
<i>Goyang</i>	Green vegetable	Freshly fermented; juice as condiment, soup
<i>Sinki</i>	Radish tap-root	Dried, sour-acidic; soup, pickle
<i>Khalpi</i>	Cucumber	Sour; pickle
<i>Mesu</i>	Bamboo shoot	Sour; pickle
<i>Kinema</i>	Soybean	Sticky, flavoured; curry
<i>Maseura</i>	Black gram	Dry, ball-like; condiment
<i>Dahi</i>	Cow milk	Curd; savoury
<i>Shyow</i>	Yak milk	Curd; savoury
<i>Gheu</i>	Cow milk	Butter
<i>Maa</i>	Yak milk	Butter
<i>Mohi</i>	Cow milk	Buttermilk; refreshing beverage
<i>Lassi</i>	Cow milk	Buttermilk; refreshing beverage
<i>Chhurpi</i> (soft)	Cow milk	Soft, cheese-like; curry, pickle
<i>Chhurpi</i> (hard)	Yak milk	Hard-mass, masticator
<i>Dudh chhurpi</i>	Cow milk	Hard-mass, masticator
<i>Chhu or sheden</i>	Cow/Yak milk	Soft, strong flavoured; curry
<i>Somar</i>	Cow/Yak milk	Paste, flavoured; condiment
<i>Philu</i>	Cow/Yak milk	Cream, fried curry with butter
<i>Pheuja or Suja</i>	Tea-yak butter	Fermented butter tea
<i>Selroti</i>	Rice-wheat flour-milk	Pretzel-like, deep fried; bread
<i>Suka ko maacha</i>	River fish	Smoked, sun-dried; curry
<i>Gnuchi</i>	River fish	Smoked; curry
<i>Sidra</i>	Fish	Dried fish; curry
<i>Sukuti</i>	Fish	Dried fish; curry
<i>Lang karyong</i>	Beef	Sausage-soft or hard, brownish; curry
<i>Yak karyong</i>	Yak	Sausage-soft, brownish; curry
<i>Faak karyong</i>	Pork	Sausage-soft or hard, brownish; curry
<i>Lang satchu</i>	Beef meat	Dried or smoked meat, hard, brownish; curry
<i>Yak satchu</i>	Yak meat	Dried or smoked meat, hard, brownish; curry
<i>Suka ko masu</i>	Mutton, buffalo meat	Dried or smoked meat, hard; curry
<i>Yak chilu</i>	Yak fat	Hard, used as substitute of an edible oil
<i>Lang chilu</i>	Beef fat	Hard, used as an edible oil
<i>Luk chilu</i>	Sheep fat	Hard, used as an edible oil
<i>Yak kheuri</i>	Yak	Chopped intestine of yak; curry
<i>Lang kheuri</i>	Beef	Chopped intestine of beef; curry
<i>Sukula</i>	Buffalo	Dried, smoked; curry
<i>Marcha</i>	Rice, wild herbs, spices	Mixed starter to ferment alcoholic beverages
<i>Phab</i>	Wheat, wild herbs	Mixed starter to ferment alcoholic beverages
<i>Kodo ko jaanr</i>	Finger millet	Slightly sweet-acidic; alcoholic beverage
<i>Chyang/ Chee</i>	Finger millet/barley	Slightly sweet-acidic; alcoholic beverage
<i>Bhaati jaanr</i>	Rice	Mild-alcoholic, sweet-sour, food beverage

**Table 1 Ethnic fermented foods of Sikkim**

Fermented food	Raw materials	Nature of product and Culinary
<i>Makai ko jaanr</i>	Maize	Mild-alcoholic, sweet-sour, food beverage
<i>Gahoon ko jaanr</i>	Wheat	Mild-alcoholic, slightly acidic beverage
<i>Simal tarul ko jaanr</i>	Cassava tuber	Mild-alcoholic, sweet-sour; food beverage
<i>Jao ko jaanr</i>	Barley	Mild-alcoholic, slightly acidic beverage
<i>Faapar ko jaanr</i>	Buck wheat	Mild-alcoholic, slightly acidic beverage
<i>Raksi</i>	Cereals	Clear distilled liquor; alcoholic drink
<i>Achar or chatney</i>	Fruits, vegetables, mixed with oil, salt	Acidic, hot and sour; pickles

**Table 2 Ethnic fermented foods of Arunachal Pradesh**

Fermented food	Raw materials	Nature of product and Culinary
<i>Gundruk</i>	Leafy vegetable	Dried, sour-acidic; soup, pickle
<i>Ekung</i>	Bamboo shoot	Sour-acidic; curry, soup
<i>Hirring</i>	Bamboo shoot tips	Sour-acidic; curry, soup
<i>Eup</i>	Bamboo shoot	Dry, acidic; curry, soup
<i>Peruyaana</i>	Soybean	Sticky, soybeans; curry
<i>Shyow</i>	Yak milk	Curd; savoury
<i>Maa</i>	Yak milk	Butter
<i>Phrung</i>	Yak milk	Hard-mass, masticator
<i>Chur yuupa</i>	Yak milk	Soft, flavoured; curry, soup
<i>Pheuja or Suja</i>	Tea-yak butter	Fermented butter tea
<i>Mio</i>	Fish	Dried; curry
<i>Karyong</i>	Yak, beef	Sausage-soft or hard, brownish; curry
<i>Satchu</i>	Yak, beef	Dried or smoked meat, hard, brownish; curry
<i>Ipoh/Siye</i>	Rice, wild herbs	Starter to ferment alcoholic beverages
<i>Pham</i>	Rice-herbs	Starter to ferment alcoholic beverages
<i>Chyang/ Chee</i>	Finger millet/barley	Mild-alcoholic, slightly sweet-acidic beverage
<i>Apong</i>	Rice	Mild-alcoholic, beverage
<i>Pona</i>	Rice	Mild-alcoholic, sweet-sour, food beverage; paste
<i>Ennog</i>	Rice, paddy husk	Black rice beer
<i>Oh</i>	Rice-millet	Soft, alcoholic beverage
<i>Themsing</i>	Finger millet/barley	Alcoholic beverages
<i>Mungri</i>	Maize-rice/barley	Alcoholic beverages
<i>Lohpani</i>	Maize-rice/barley	Alcoholic beverages
<i>Aara</i>	Cereals	Clear distilled liquor; alcoholic drink
<i>Bhang-chyang</i>	Maize-rice/barley	Extract of <i>mingri</i> ; alcoholic beverages
<i>Achar or chatney</i>	Fruits, vegetables, mixed with oil, salt	Acidic, hot and sour; pickles

Production and consumption of some lesser known but culturally important ethnic fermented foods is declining due to possible climate change, change in life style, shifting from cultural food habit to commercial

Table 3. Ethnic fermented foods of Ladakh

Fermented food	Raw materials	Nature of product and Culinary
<i>Shyow</i>	Yak milk	Curd; savoury
<i>Maa</i>	Yak milk	Butter
<i>Lassi</i>	Cow milk	Buttermilk; refreshing beverage
<i>Chhurpi</i> (soft)	Cow milk	Soft, cheese-like; curry, pickle
<i>Chhurpi</i> (hard)	Yak milk	Hard-mass, masticator
<i>Phenja or Suja</i>	Tea-yak butter	Fermented butter tea
<i>Kargyong</i>	Yak	Sausage-soft or hard, brownish; curry
<i>Satchu</i>	Yak	Dried or smoked meat, hard, brownish; curry
<i>Chilu</i>	Yak fat	Hard, used as substitute of an edible oil
<i>Phab</i>	Wheat, wild herbs	Dry, mixed starter to ferment alcoholic beverages
<i>Chyang</i>	Barley	Mild-alcoholic, slightly sweet-acidic beverage
<i>Lugri</i>	Barley	Alcoholic beverages
<i>Sing sing</i>	Barley	Beverage

foodstuffs and fast foods effecting drastically on traditional culinary practices. Detailed survey on such possible impact of climate change on production of culturally important ethnic foods in the Himalayas is necessary.

Culturally many ethnic foods are used for non-edible purposes such as worshipping Gods, offering to nature, temples and shrines, and performing the unique spirit possession, which is common among some ethnic groups of people in the Himalayas. Every food has its social or ethnic value and is associated with custom and culture of the community. Invention of biopreservation methods by the ethnic people of the Himalayan regions, mainly practiced by the Nepali, through pit fermentation or lactic acid fermentation is significant due to transforming of the availability of raw materials at a particular season to those of deficit absence of cold-storage or refrigeration. Sun drying of freshly prepared *gundruk* (fermented leafy vegetable product) and *sinki* (fermented radish tap root product)<sup>16)</sup> is a traditional preserving method by which the shelf life of the products is prolonged. Dried products are preserved for several months without refrigeration and consumed during long monsoon season when fresh vegetables are scarce in the Himalayas. Dry *gundruk* and *sinki* are comparatively lighter than the weight of fresh substrates and can therefore, be carried easily while travelling a long distance in the difficult terrains

of mountainous in the Himalayas<sup>17)</sup>. In Arunachal Pradesh, some ethnic tribes preserve young bamboo shoots by fermenting into numbers of products such as *hurring*, *eup* and *ekung* for future use<sup>18)</sup>. Curd locally called dahi (Fig 5) is an important food component in the socio-religious habits of the Himalayan people and is considered as sacred item both by Hindu and Buddhists. *Dahi* is also used as adhesive to make 'tika' with rice and coloured-powder during the Hindu festival called 'dashai' mainly by the Nepali and is applied to foreheads by the family elders. *Dahi* is also mixed with beaten-rice locally called 'chiura' and makes an essential food item during Nepali festival such as 'ashar ko pandra' signifying the beginning of work in the agriculture fields for the farmers. Tibetans, Bhutia, Ladakhi, Mongpa and the Lepcha also use curd (which is called *shyow*) in their religious and social events in marriages and funerals. *Shyow* is served exclusively during 'shoton' festival of Tibetan. *Gheu* or fresh butter is given to new born baby along with honey by father to protect from any disease is a tradition among Nepali. *Gheu* is also used for lighting the lamps in altars, temples and monasteries by Hindu and Buddhists. Hard *chhurpi* (fermented yak milk cheese like product) is eaten in high altitudes by Ladakhi, Bhutia, Tibetans and Mongpa as chewing gum and masticator which gives an extra energy to body by continuous movement of jaws and gum. *Somar* is consumed mostly by the older generation of the Sherpa in Nepal and Sikkim and is generally consumed to increase the appetite and to cure digestive problems. Production of *somar* is now declining. *Selroti* is a fermented cereal product mostly eaten by the Nepali as fried, sweet confectionary donut like food during festivals<sup>19)</sup>. *Selroti* is traditionally served along with other traditional food items during 'bhai tika', a Hindu festival, which is observed to honour the brothers by Nepali sisters. Daily consumption of meat is expensive for a majority of the Himalayan people. They slaughter domestic animals (goats, pigs, cow, yaks and sheep) usually on special occasions, festivals and marriages, and the fresh meat is cooked and eaten as family feast; the remaining meat is preserved by smoking, drying and fermentation for future

consumption. Number of ethnic meat products (Fig 6) is prepared and consumed mostly in the high altitudes (> 2500 m) including sausages and smoked meats<sup>20)</sup>.

Apart from drinking, ethnic alcoholic drinks are used culturally to perfume many family rituals in the Himalayas. Eloping is a common practice in the Himalayas. Traditionally relatives of the boy usually after 3 days visit to girl's parents with bottles of locally prepared freshly distilled liquor *raksi* or *aarak* to respect the verdict of her parents, and pay the penalty for elopement. Once the consent is granted by the girl's parents, freshly prepared *raksi* is served to signify the union of two families and the marriage is thus solemnised. Such practice of bridging between two families by a bottle of alcoholic drink is common only among the Himalayan people mostly the non-Brahmin Nepali. Alcoholic beverages and drinks are offered to pray family Gods and Goddesses by the different ethnic people. *Mong chee* or (alcoholic beverage of Lepcha) is essential in various cultural functions such as 'lirum', 'sejum' and 'namsung' of Lepcha. *Mandokpenaa thea* or *kodo ko jaanr* (alcoholic beverage of Limboo) filled in 'toongbaa' (Fig 7), and rice-made *raksi* are used for performing a ritual of the Limboo called 'tonsin mundhum'. Those who come to offer condolences gathered at a funeral or a memorial service for the deceased are served with alcoholic beverages, mostly among Tibetans, Ladakhi, Drukpa, Sherpa, Bhutia, Lepcha, Mongpa, etc. 'Lama', the Buddhist priest, 'Phedangma' and 'bijuwa', the Limboo priests essentially use freshly distilled liquor *raksi* or *aarak* during spirit possession. 'Losar' or the Tibetan New Year is celebrated by the traditional Tibetan cuisines which consists of *chyang* (fermented barley beverage), fresh roasted barley flour for *phyem-mar* (sweetened barley flour symbolizing good wishes), *gro-ma* (a small dried sweet potato), 'bras-sil' (sweet rice), and *lo-phud* (a young sprout of barley symbolising the birth of the new year), tea, butter, sheep's head, butter lamps, fruits and sweets, especially locally produced foodstuffs.

### Cultural Adaptation

Table 4 shows the accessibility of major food items

**Table 4. Accessibility of food items in the Himalayas according to elevation**

Food items	Altitudes (metre)		
	>2500	900-2400	< 900
Staple Food	Potato, barley, finger millet	Rice, maize	Rice, wheat, maize
Milk and Milk products	Yak milk and its fermented products	Cow milk and its fermented products	Cow and buffalo milks and their fermented products
Meat	Yak	Beef, pork, mutton, Chicken	Beef, pork, mutton, Chicken
Fish	Less or none	River and lake fish	River and lake fish
Vegetables	Less vegetables	More seasonal vegetables and wild edible plants	More vegetables-all types
Legumes	Less or none	Legumes including soybeans	Legumes including soybeans
Alcoholic drinks	<i>Chyang</i> or <i>kodo ko jaanr</i>	<i>Chyang</i> or <i>kodo ko jaanr</i> and distilled liquor	More distilled liquor

in the Himalayas according to elevations. People living in high altitude (>2500) are adapted to cereals and food grains grown in dry and cold climates, with less vegetables and more meat products, mostly yak meats. More diversity of food items ranging from rice, maize to vegetable, milk to meat is prevalent in the elevation less than 2500 to 1000 m. Food diversity is directly associated with longevity, and quality of life<sup>21,22)</sup>. The Himalayan people have developed the ethnic foods to adapt to the harsh conditions and environment for many centuries. Some of the remarkable observation on cultural adaption of ethnic foods even in harsh climate has been discussed in this paper. Food habits of the Himalayas usually do not require additional medicines or supplementary drugs. Most of the ethnic foods, both fermented and non-fermented, have therapeutic values and eaten for prevention of illness. Traditionally the Himalayan ethnic people do not have habits of taking drugs and medicines in forms of tablets and syrup. This may be due to therapeutic values of their ethnic foods possessing protective properties, antioxidant, antimicrobial, probiotics, bio-nutrients, and some important health-promoting benefits<sup>23)</sup>.





Fig.5 Ethnic fermented milks of the Himalayas



Fig.6 Himalayan ethnic meat products

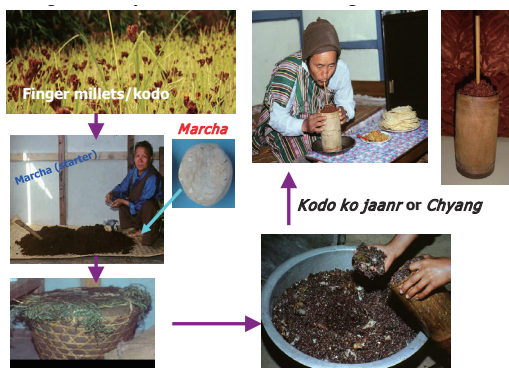


Fig.7 Himalayan ethnic fermented beverages



Fig.8 Kinema, fermented soybean food

*Somar* (fermented milk product) is used to cure stomach upset and to control frequent diarrhoea by the Sherpa<sup>24</sup>. Because of the acidic taste, *gundruk* and *sinki* are said to be good appetizers, and the ethnic people use these foods for remedies from indigestion<sup>17</sup>. *Kinema* (fermented soybean, similar to *natto* of Japan) (Fig 7) is highly nutritive and is eaten to boost protein in-take and to cure heart diseases<sup>25</sup>. *Jaanr* or *chyang* is high calorie food beverages and rich mineral contents and vitamins mostly given to post-natal women and ailing persons to regain strength<sup>26,27</sup>. Ethnic Himalayan milk products (Fig 8) have protective and probiotics properties which stimulate the immune systems, cure stomach-related diseases<sup>24,28-30</sup>. *Raksi* or *arak* is a stimulator alcoholic

drink which has both social and medicinal importance in the food culture of the Himalayan people<sup>31</sup>. Ethnic people believe that their foods have certain therapeutic values, and have been in use both as foods and therapy for centuries, though clinical analysis of such foods is yet to be studied.

### Conclusion

In the context of possible impact of climate change, the cultural adaption of age-old ethnic foods include fermented foods may have many biological importance and support to the ethnic people of the Himalayas. The in-take of such foods has been in the systems for centuries and people have adapted such foods to protect and sustain them. Due to rapid urbanisation, development, introduction of commercial ready-to-eat



foods have adverse effects on production and consequently consumption of such age-old cultural ethnic foods is declining. The people should be highlighted about the worth indigenous knowledge they possess, and biological significance and medical values of their foods so that importance of ethnic foods will gain. However, impact of consumption of some ethnic foods may also be studied. In Ladakh and in north Sikkim, cases of cancers and other fatal diseases have been reported. Less consumption of fresh vegetables, fruits, and milk products, and high consumption of smoked meats by highlanders may be the reasons for such diseases. Whether it is due to consumption of such ethnic foods or other factors, needs to be studied. If balance food like in Okinawa diet<sup>32)</sup> in Japan is considered, then ethnic food or traditional foods are always regarded as highly nutritious and healthy foods. Detailed health status in terms of consumption of both fermented and non-fermented foods in the Himalayas need to be carried out urgently.

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