



## Traditional food systems of Changthang, Ladakh

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The food production, consumption, and preservation systems and most of the food products of Changthang region are unique to it due to its extra-ordinary conditions largely governed by the ethnic preference, agro-climatic conditions and socio-cultural and religious ethos. The uniqueness is well expressed from the rest of Ladakh also. The inhabitants lead nomadic, semi-nomadic and sedentary ways of life thus having different food systems. The nomads are solely dependent upon meat and dairy products for the nutritional requirement with very little consumption of other food material. They consume a lot of meat around the year, either fresh or in preserved forms. The semi-nomads consume meat, dairy products and other food products, almost in equal quantities. The permanent settlers mostly depend upon cereals and vegetables and consume comparatively less meat and dairy products. A semi-structured questionnaire containing open-ended questions, semi-structured interviews and on spot observations was used for gathering information. The various traditional foods and beverages of Changthang are *gyuma*, *ruskhu* and *sha-spaqs* (meat based products); *nyakir* and *nyabon* (fish based products); *mar-khaqla*, *labo*, *churpe/chura*, *chura-narmo* and *thut* (dairy products); *kharyos*, *kholaq*, *paba* and *chang* (barley based products); *chu-tagi*, *paqtsa-markhu*, *timoq* and *tagi-skyurchuk* (wheat based products) and *zatsot*, *skoche* and *gege* (wild vegetables). These times tested systems undergo change due to change in food habits and need to be preserved to maintain the cultural identity as well as the health and wellness of the people of the region. This paper is an attempt to document the traditional food systems practiced in Changthang and foods and beverages enjoyed by the inhabitants.

**Keywords:** Changthang, *Churpe*, *Kholaq*, *Losar*, *Moqmoq*, *Paba*

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Changthang region falls in the eastern part of Ladakh and the aboriginals are known as *Changpas*. The word *Chang* means 'north' and *thang* means 'flat land' in Tibetan dialect, as it is situated in the northernmost part of Tibet (Now in China). The region spread over an area of 22,000 km<sup>2</sup> and comprises of two sub-divisions, i.e., Nyoma and Durbuk with Nyoma and Tangtse as headquarters, respectively. It has 23 revenue villages with 2217 holdings<sup>1</sup>. Rugged terrain, large flatlands, lofty mountains and high altitude passes constitute the general landscape of this region. The elevation ranges from 3588-4994 m amsl. The climate of Changthang is cold and arid in nature. Summers are warm but short and winters are very cold due to the high elevation. Storms occur throughout the year. The soil of the region is sandy except in cultivated fields where the soil is sandy loam. The temperature in the region varies from -5°C to -35°C in winter and up to a

maximum of 30°C in summer. The average precipitation mostly in the form of snow is less than 10 mm and can be fatal to the livestock of the nomads during winter month<sup>2</sup>. Crop farming is generally restricted to May to September months during which barley is grown besides pea, mustard and some vegetables. The population is dominated by the Buddhist community. The inhabitants lead nomadic, semi-nomadic and sedentary ways of life. The *rebo pa* lead a nomadic way of life, where they migrate around the year in search of pasture for their livestock. They don't have permanent settlements and live in tents known as *rebo*. The semi-nomads have some of the family members for livestock rearing and others for the cultivation of crops. *Mal pa* or *rong pa* lead a sedentary way of life, where they have permanent settlements and cultivate crops along with livestock. Changthang region is the home of Changthangi goats producing the world's best quality raw pashmina.

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Due to the harsh climate of the region and the availability of limited food resources, like other isolated communities, the people of Changthang have developed food production systems from the locally available substrate, largely governed by the ethnic preference, agro-climatic conditions and socio-cultural and religious ethos. In the past, food products that cannot be produced were procured from lower regions of Ladakh through the barter system where, salt, pashmina, wool, yak wool, dried cheese, butter, meat, *palu*, etc. are exchanged. The traditional food systems of Changthang are animal based (meat, fish and dairy products), plant based (barley and wheat) and others (tea). The nomads are solely dependent upon meat and dairy products for the nutritional requirement with very little consumption of other food material. They consume a lot of meat around the year, either fresh or in preserved forms. The semi-nomads consume meat, dairy products and other food products, almost in equal quantities. The permanent settlers mostly depend upon cereals and vegetables and consume comparatively less meat and dairy products. Typical meals are prepared, based on meat, milk, barley and vegetables (both wild and cultivated). The traditional food production and consumption systems are changing due to the availability of a variety of non-traditional food products in the market and changes in lifestyle. One person from each family of Changthang region is engaged as a labourer in Indian Army and Border Road Organization works, from where they get rice, pulses, sugar, canned foods, dried fruits, etc. as ration supply. Another reason is the PDS (Public Distribution System), where the government distributes rice and wheat at cheaper rates through its stores. Thus these times-tested systems need to be preserved to maintain the cultural identity of the people of the region. The traditional foods and beverages have tremendous health benefits along with the nutritional contents as some of these have already been documented. This paper is an attempt to document the traditional food production and

preservation systems as practiced in Changthang and foods and beverages used by the inhabitants.

## Methodology

### Study area

The study area is situated approximately between 32°N to 33°N latitude and 77°E to 78°E longitude. The elevation ranges from 3588-4643 m amsl. The coordinates of the study site were recorded using GPS device (*Oregon-650*, Garmin Ltd, Taiwan). The study was carried out during 2018-20. The study area was selected based on different ways of life i.e., nomadic, semi-nomadic and sedentary for the current investigation. Two villages each from the mentioned lifestyles were selected and details of which are given in Table 1.

### Tools for documentation

Indigenous knowledge of food production systems, ways of consumption, and different types of food and beverages were documented using the Participatory Rural Appraisal Technique which consisted of key informants (elderly people and knowledgeable persons) and focused group discussion with groups randomly chosen from the study area. A total of 91 informants were sampled randomly and interviewed for this study hailing from the selected villages. Out of these 60% were female with ages between 39 to 70 years while 40% male with ages 36 to 70 years. A semi-structured questionnaire containing open-ended questions, semi-structured interviews, and on spot observations was used for gathering information. The information was gathered from the informants through their visits to the KVK office and personal visits to these villages.

### Prior Informed Consent (PIC)

Prior Informed Consent (PIC) was taken from every informant to use their knowledge for research and dissemination.

## Results

Pastoralism is the mainstay of the people of Changthang who live in the elevated regions<sup>3</sup>. They

Table 1 — Details of the study area

Sample villages	Way of life	Altitude (m)	Distance from sub-divisional headquarter
Korzok	Nomadic	4523-4643	80 Km to south
Hanle	Nomadic	4274-4387	88 Km to south-east
Nidder	Semi-nomadic	4156-4192	11 Km to south
Mudh	Semi-nomadic	4201-4261	10 Km to east
Liktse	Sedentary	3588-3635	113 Km to west
Hemya	Sedentary	3634-3688	103 Km to west

consume a lot of meat and also process milk in several ways for the development of different dairy products that are unique to Changthang. The lower belts of Changthang also cultivate crops along with the rearing of animals. They consume a very less quantity of mostly wild vegetables. The traditional methods of preservation of these food products are established through natural drying (under the sun or in shade), heating, freezing and fermentation which are meant for winter consumption (Table 2).

The production systems, preservation techniques and processing of food are somehow unique to the rest of Ladakh which are discussed below:

**Meat**

Local people of Changthang consume a lot of meat and meat products during the harsh winter season to keep their bodies warm and fulfill the nutrient requirement. The traditional method of meat preservation in Changthang is through freezing cum drying. They kill animals such as yak, sheep and goats at the onset of the winter season. On average, a single-family kills a yak or 3-4 sheep/goats for consumption during the winter period. Changthang is dominated by Buddhists and it is considered a sin in Buddhism to kill a living organism. Thus due to maximum awareness about it, the number of animals being killed is reduced these days. In the past, the locals, especially, the *rebo pa* used to sell the animals in other parts of Leh, in the autumn season in exchange for wheat and barley grains and other essential commodities. Every year a lot of livestock population (sheep and goats) is sold to the butchers for sale at Leh market. The sale of the yak is not as open as sheep and goats due to the restrictions from the local Wildlife Department. Slaughtering generally takes place by the traditional method, either by ceasing of breath or cutting off from the neck portion. The former method is done by covering the nasal

portion with some rope/cloth, whereas, the latter one is done by the Halal method by the hiring Muslim butchers. Part of the meat so obtained is consumed during the festival of *Losar* (Ladakhi New Year). The remaining carcass is cut into long strips and hangs on the ceiling of some colder room (Fig. 1). In yak carcass, the bones are separated and only the boneless parts are preserved. The cuts are then subjected to natural freezing due to sub-zero temperature. Over the time, the frozen meat cuts undergo drying. These are then consumed on daily basis throughout the winter months. During the summer season, the meat to be preserved is boiled before drying for enhancing the shelf life. The dried meat sometimes is eaten without cooking.

In the past, the inhabitants of Changthang also used to eat game meat of different wild animals and birds. The common among them is blue sheep/bharal (*napo*), ibex (*skin*), argali (*nyan*), urail (*shapo*), wild yak (*dong*), hare (*ribong*), marmot (*phia*), snow-cock (*ripja/kongmo*) and patridge (*sraqpa*). Hunting of these animals and birds are now prohibited by the Department of Wildlife, Leh.

**Milk**

Changthang is the livestock belt of Leh district of Ladakh. The locals consume a lot of milk and milk products along with meat and these foods fulfill their



Fig. 1 — Traditional method of meat.

Table 2 — Traditional methods of preservation

Particulars	Part/product used	Preservation method	Preserved products	Storage period (Months)
Meat	Meat strips/cuts	Freezing cum drying Blanching cum drying	<i>Sha-skam</i> (Dried meat strips/cuts)	6-12
Dairy products	<i>Labo</i> (Cottage cheese)	Drying	<i>Churpe</i> (Dried cottage cheese)	>12
	<i>Mar</i> (Butter)	Heating	<i>Mar-zhukan</i> (Ghee)	3-6
Fish	Whole fish	Dry salting	<i>Nya-skam</i> (Dried fish)	6-12
Cereals	Barley grains	Roasting	<i>Yoza/yos</i> (Roasted barley grains)	>12
			<i>Namphey</i> (Roasted barley flour)	>12
			<i>Tsotma skampo</i> (Dried leaves and root slices)	>12
Vegetables	Leaves and roots	Drying	<i>Tsotma skampo</i> (Dried leaves and root slices)	>12
	Roots	Fermentation	<i>Anchar</i> (Pickle)	3-6

nutritional requirements. The animals in Changthang are mostly grazed on pastures and the edible products are tastier than the rest of Ladakh. The products are also believed to have medicinal properties because of the varieties of medicinal plants eaten by the animals. A variety of dairy products are prepared from milk obtained from *dimo* (female yak), *dzhomo* (crossbred of cow and yak), cow, goat and sheep. The common fermented dairy products are *zho* (curd), *tara* (buttermilk), *labo* (boiled buttermilk/cottage cheese), *churku* (whey), *chura/churpe* (dried cottage cheese), etc.<sup>4</sup> *Khaqla-mar* (local butter) is the non-fermented but important product. Fermentation results in extended shelf life as well as bio-improvement in lactose metabolism<sup>5</sup>. The curdling of milk is done by putting up of some previous buttermilk or curd. The churning of curd is done in animal skin known as *skaylba*, particularly that of goat and sheep. All the openings are closed by stitching except the neck portion. The curd is poured into it through this opening. After closing of this, it is placed on the lap and the inside material is agitated continuously by shaking it with hand. The skin is washed after the work and immersed in water for sometime before the work. Milk production increases in summer, so as the dairy products. Fresh skin of small animals is used for storage of butter after washing off the impurities such as blood, hairs, meat pieces, etc. stuck to it. The external hair of the skin is shaved before storage. The stomach of the animal is also used for this purpose (Fig. 2). The butter is stacked hardly into the casing to ensure the maximum removal of trapped liquid. The casing is stitched properly to avoid the entrance of air. It is now kept in a cold store for consumption or sale during the winter season.

#### Fish

The Indus river and most of the streams in Ladakh are good sources of a variety of fresh and cold-water



Fig. 2 — Butter preserved in animal stomach.

fish. The locals consume fish as food in the past due to poverty. Stream water fishes were not eaten by local people at that time, as these were considered as sacred from the religious point of view. These are of different colors like, yellow, red and black. It is believed that killing or any damage to them can cause death or disaster. The common edible fish variants in river water are *damnya* with black colored skin, *saqnya* with black dotted skin, and *sernya* with light-yellow skin. *Balangkha* is another variant with black skin having a wide mouth like that of a cow. *Saqnya* is tastier than the others. The fish found in colder regions are overall believed to be tastier than that of the rest of Ladakh. In the month of April-May, the fish from the Indus river, head towards Hanle village through the stream water to a particular site known as *Shel-shel Lungba*, believed to be favorable for breeding. This process is locally known as *Nyabo Genlok*, which means an upward movement of fish. After breeding, these returned to the river through the same route. At the time of to and fro, people from surrounding villages such as Rongo, Mudh, Nyoma, Nidder, Tsaga, Hanle and Kuyul used to go for fishing. The fishing was usually done with hand gathering, netting and angling methods. Hand gathering had been done by diverting the course of water. Netting had been done with the help of sacks and fishing nets. Angling had been done by the fishing rope attached with a number of hooks. The fish so obtained were used to pack in sacks and load on cow, donkey, yak, etc. The killing of fish in Buddhism is believed to be a great sin as there is a saying, *nya chemet ki dikpa rhi sang chea*, means ‘the sin of killing of speechless fish is, as big as a mountain’. An old man from Rongo village is believed to donate for the first time, some of his livestock for performing forgiving prayers, of the earlier sin of fishing. Since then, special annual prayers known as *nyawe zhito* held every year in the surrounding villages in the 4<sup>th</sup> month of the Tibetan calendar. The fishing is not so open these days due to religious prohibition and restrictions by the Department of Fisheries. The fish stuck in stagnant water sometimes are caught by locals and release into the river. This practice is considered an important way of demonstrating pity and is known as *tsethar*. This practice is believed to be overall good and enhance the life span of a person.

The fresh fish had been used to eat, either by roasting or by frying. It had also been processed into products such as *nyakir* and *nyabon*. The remaining



lot after cleaning and rubbed with salt had been used to dry in shade by hanging on the ceiling of a room on a cloth or wooden flats for consumption in the winter season. Local *amchi* believed that fish is good for bones, eyes, and sexual empowerment. The eggs of the fish are known as *nyapdas* which are dried and powdered for the treatment of mouth ulcers.

**Vegetables**

Most of the vegetables consumed traditionally in Changthang are wild (Table 3). These are used either as fresh or in dried form. Solar drying is the oldest form of preservation known to Ladakhis for apricot and other fruits and vegetables<sup>6</sup>. The common wild vegetables are *zatsot* (Fig. 3a), *skoche*, *ambuk*, *naval/sniu*, *khala*, *suchili*, *dyat*, *toma* and *gege* (Table 2). These vegetables grow in mountains, grasslands, wetlands, and fields along with the cultivated crops. These are important ingredients of a variety of dishes or are eaten with other local dishes. The seed produced by *ambuk* is known as *konsnyot* and is used as a condiment. *Skoche*, is used while frying dishes. Animal fat, butter or mustard oil is used for frying purpose. For drying, it is slightly crushed and molded into a round shape with a hole in the centre. It is known as *skokir* (Fig. 3b). These blocks

are arranged on a thread and then subjected to drying. *Toma* and *gege* (Fig. 3c) are eaten as raw or preserved by drying. The fresh or dried produce after rehydration, are fried in a little butter oil and eaten as such or mixed with *thukpa*. These wild roots and rhizomes are grown naturally in soggy areas of Changthang. Good quality of *gege* is grown in Puga village of Changthang which is supplied to other parts of Ladakh by the villagers. *Thukpa* is a common word for a recipe thicker than soup and various types are *namthuk* (barley-based), *zathuk* (nettle based), *rimthuk* (thinly rolled wheat noodle), *paqthuk* (wheat flour-based), *gyathuk* (Chinese noodle), etc. The wild vegetables have medicinal properties also and are used for the formulation of medicines by local practitioners, *amchi*. Cultivation of vegetables is very limited due to cold climatic conditions. The common vegetables grown are turnip, radish, potato, carrot, onion, pea, lettuce (*ldums*), etc. Some of these vegetables are also dried for winter consumption. Turnip, carrot and radish are cut into slices and arranged on a thread passing through the center of slices and hanged for drying in the open sun. The matured turnip leaves that get at the time of root harvesting are collected and dried<sup>7</sup>. The dried

Table 3 — Common wild vegetables of Changthang

Common name	Local name	Scientific name	Part used	Used in diet
Stinging nettle	<i>Zatsot</i>	<i>Urtica hyperboria</i>	Leaves	<i>Zathuk</i> is prepared from it and also mixed with other types of <i>thukpa</i>
Wild onion	<i>Skoche</i>	<i>Allium przewalskianum</i>	Leaves	Used instead of onion for frying purposes in all types of curry making. Fried leaves are also mixed in <i>thukpa</i>
Caraway	<i>Ambuk</i> <i>Konsnyot</i>	<i>Carum carvi</i>	Leaves	Mixed with <i>thukpa</i> and curry making
			Seeds	Used as a condiment
Chenopodium	<i>Naval/sniu</i>	<i>Chenopodium foliosum</i>	Leaves	Mixed with <i>thukpa</i> <i>Tangtur</i> is prepared from it
Sow thistle	<i>Khala</i>	<i>Sonchus oleraceus</i>	Leaves	Mixed with <i>thukpa</i> <i>Tangtur</i> is prepared from it
Mallow	<i>Suchili</i>	<i>Malva neglecta</i>	Leaves	Mixed with <i>thukpa</i>
Buckwheat	<i>Dyat</i>	<i>Fagopyrum tartaricum</i>	Leaves	Curry is prepared from it
Arnebia	<i>Toma</i>  <i>Gege</i>	<i>Arnebia euchroma</i>	Roots	Eaten as raw or mixed with <i>thukpa</i> after frying
			Bulb	Eaten as raw or mixed with <i>thukpa</i> after frying



Fig. 3 — Vegetables based products (a) Dried *Zatsot* (b) *Skokir* (c) *Toma* and *gege* (d) Carrot pickle.

vegetables are rehydrated before preparation or sometimes eaten as such. Sometimes pickle is also made from these vegetables and carrot pickle (Fig. 3d) is popular. The short growing season and the hard conditions made the population highly dependent on these species to meet the kitchen requirements. The ethnic knowledge of these wild vegetables has survived and passed on to successive generations.

#### Cereals and oilseed

Among cereals, barley is widely grown in the Changthang belt and is the staple food of the region. Wheat cannot be grown here because of the short growing season and lower temperature. However, in the past, wheat grains or flour were procured from lower regions of Ladakh through the barter system. At present, the wheat flour is distributed by the government through PDS at very cheaper rates. The wheat grains and wheat flour are also purchased from the lower belts of Ladakh. Mustard is the only oilseed crop grown in lower elevations of Changthang such as Likkse, Tukla, Tarchit, Tiri, Hemya, and Kungyam villages of Nyoma sub-division and Shayok, Tharuk, Tangtse and Durbuk villages of Durbuk sub-division. Among pulses, local pea is grown in Changthang. All the farming operations right from sowing to threshing are done by traditional means. Seeds are sown by the broadcasting method. Ploughing of the field is done either on a single horse or a pair of yak. Locally available manure which is considered as of high quality and night soil maintains the fertility of the soil. Local wooden tools are used for the leveling and making ridges in the field. Stream water is the main source of irrigation flown through channels into the fields. Harvesting is done manually with a sickle or uprooting method. Threshing is done by crushing the harvested crops under the hooves of animals and biting up with a stick in case of mustard. Winnowing is done on the wind. The barley and pea are grounded into flour in a traditional flour mill *rantak*, which run on fast-moving water<sup>8</sup> as well as by hand-driven mill. Oil is extracted from mustard by crushing seeds between two stones (a round and a flat).

#### Others

Salt or *tsa* (Fig. 4) was one of the prominent candidates of the barter system and had been procured from Tibet before Chinese occupation. Tibet is the land of brackish water lakes from where salt is extracted. The locals used to load the salt in bags made up of yak-wool, *nugal*, on sheep, goats, yaks, etc., and exchange with other essential commodities



Fig. 4 — *Tsa* (salt).



Fig. 5 — *Gyuma* (sausage).

in other parts of Ladakh. Good quality of salt is also extracted from the famous Tsokar Lake in Changthang. The higher quality salt is used for human consumption and that of lower quality is used for animal feeding.

#### Traditional foods and beverages

Owing to the extraordinary conditions of Changthang, most of the foods and beverages are typical, from the rest of Ladakh in terms of methods of preparation, ingredients, and nomenclature. These are discussed one by one as under:

#### Animal based food and beverages

##### *Meat based foods and beverages*

*Gyuma*: Sausage prepared as a special dish on occasions such as *Losar* or family feasts. The fresh intestine of goat and sheep is stuffed with a paste made from animal blood, barley flour, salt, and *konsnyot*. The whole stuffed intestine is then cooked in water and after that, it is cut into convenient pieces. These pieces are then fried and served hot (Fig. 5). For frying, no extra oil is used but the fat stuck to the outer wall of the intestine does the job.

*Chilgam/lobyo*: Meat sausage prepared as a special dish by stuffing of fresh intestine with finely chopped meat and animal fat with spices and salt. Soft meat and stomach part are usually preferred for this purpose. The whole stuffed intestine is cooked in water then cut into pieces and serve hot.

*Gosha and sugu*: The hairs or wool from the head and the legs of the animals are removed by putting up on fire. These are then cut into pieces after washing. This is followed by cooking in water with some salt. Meat, as well as the soup, is eaten with *paba*.

*Moqmoq*: Wheat dumplings stuffed with finely chopped meat, animal fat, onion with spices, and salt. It is prepared on occasions and feasts. The dumplings are either steam-cooked in a specially designed vessel, *moqto*, or directly in water. *Moqto* is generally a set of perforated cooking compartments arranged one over another. Steam is produced in the lowermost compartment, which passes to the upper compartments through the holes. The steam is made by boiling bones and the extract is used as a soup. *Moqmoq* is served as hot with some chutney accompanied with soup.

*Shaspaq*: Meat cuts are fried followed by the addition of salt and spices and curry is prepared.

*Ruskhu*: It is the soup extracted from bones. It is usually taken with *paba* or bread or taken as such. It is generally given to patients because of easy digestibility and a speedy recovery.

*Shakh*: It is the soup extracted from the meat. It is also taken with *paba* or bread or taken as such.

**Fish based foods and beverages**

*Nyakir*: For *nyakir* (Fig. 6a) the fish is cooked in water, the skeleton is removed and the boneless part is mixed with spices and salt. The whole mixture is then molded into a round shape. An egg is used as a binding material. The product is fried in oil and then boiled in curry for softening.

*Nyabon*: The preparation of *nyabon* (Fig. 6b) is the same as that of *nyakir*, however, the boneless part is

fried as such after the addition of spices and salt. Here egg is not used at all

*Nyakhu*: The leftover soup after the cooking of fish for the making of *nyakir* and *nyabon*, is consumed with some salt put in it. This soup is called *nyakhu*.

*Nya-mesraq*: Fish is roasted on charcoal fire with a little salt and *skeche* (wild onion) powder rubbed on it. It is then eaten as such after the removal of the skeleton.

*Nyaspaq*: The fish is cut into pieces and fried in oil. Curry is made by the addition of spices and salt. It is eaten with bread or *paba*, while removing the bones.

*Nyaphey*: Sometimes the dried fish is grounded into powder *nyaphey* and mixed with barley flour. *Namthuk* is then prepared from this flour mixture.

**Milk and milk products**

*Oma*: *Oma* is the local name for milk. It is obtained from *dimo* (female yak), *dzhomo* (crossbred of cow and yak), cow, goat, and sheep. A variety of products is made from milk. It is also an important ingredient of many dishes.

*Zho*: The curd is known as *zho* in the local dialect. Fresh milk is boiled and allowed to cool. It is then inoculated with the previous batch of buttermilk or curd and incubated overnight at a warm place or covered over by some woolen blanket. Fresh and pleasant flavored curd is obtained in the morning. It is eaten with bread, *kholaq* and *paba*.

*Mar-khaqla*: *Mar-khaqla* (Fig. 7a) is the local name for butter. After the churning of curd, the fat portion (butter) suspends on the surface. It can thus easily be separated from the lot by hand. The butter is turned into a compact spherical mass by continuous pressing between the two hands which also ensures removal of entrapped buttermilk. Sometimes butter is also obtained by the churning cream separated from the upper surface of boiled milk. Butter is preserved for winter consumption in either in skin or stomach of goat or sheep.

*Markhu*: Butter is boiled to remove the entrapped buttermilk. The so obtained clarified oil (*mar-khu*) is used for cooking or eaten with *paba*. It is also used for the lighting of prayer lamps in monasteries.

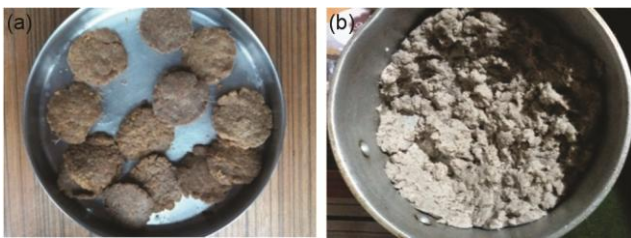


Fig. 6 — Fish based products (a) *Nyakir* (b) *Nyabon*.



Fig. 7 — Dairy products (a) *Mar-khaqla* (Butter) (b) *Labo* (Cottage cheese) (c) *Churpe/chura* (d) *Chura-narmo* (e) *Thut*.



**Mar-zhukan:** *Mar-zhukan* (ghee) is the clarified fat prepared by boiling butter after that stored in containers. The shelf-life of ghee is greater than that of butter. It is an important ingredient of *pheyman* and also taken with *paba*.

**Tara:** After the removal of butter there remains the buttermilk (*tara*) which is a little bit sour. It is a thirst quencher and taken during field works and traveling.

**Tarsrul:** When roasted barley flour is added to buttermilk up to a consistency thicker than soup, then it is called as *tarsrul*. It is generally taken during field works and traveling in the summers.

**Tangtur:** Wild green leafy vegetables after cooking are put in buttermilk along with salt and chili powder. The vegetable lot after cooking is pressed between the hands to remove the excess water. The most common combination of *tangtur* is with *paba*.

**Labo:** The buttermilk on boiling curdles, is known as cottage cheese and the local name is *labo* (Fig. 7b). After cooling, it is separated from the liquid part, whey. Sugar is added to it on the individual's choice. It is taken with *paba*, *kholaq*, bread, etc.

**Churkhu:** After the removal of cheese there remains the yellowish liquid part which is called as whey or *churkhu*. It is also a thirst quencher.

**Chura or Churpe:** *Chura* or *Churpe* (Fig. 7c) is dried cottage cheese. The fresh cottage cheese is hanged in a cotton bag for the maximum removal of whey or sometimes a heavy stone is put upon the bag. After that, it is made to fall upon a cloth for drying while rubbing between the palms of hands, which give it a gritty/floury texture. The cheese flour/grits after sun drying are added to *kholaq* and *chasrul* or for making of *thut*. The cheese after the removal of whey is also shaped into strips. The cheese is kneaded with hands and made to fall in the form of strips by pressing between palm and fingers. The strips are then let for open sun drying. It is a common ingredient of almost all types of *thukpa*. For obtaining gritty/floury textured cheese, the buttermilk is boiled for a longer time than that for the cheese strips. The purpose of

drying cottage cheese is mainly to increase the storability which is not possible in the fresh products.

**Chura-narmo:** *Chura-narmo* (Fig. 7d) is the sweetened dried cheese. Sometimes the cottage cheese is added with sugar and shaped into small candies. It is kept in the mouth and masticates after softening. It is usually sent as a gift to far-away relatives.

**Sri:** After giving birth to a calf, the milk of the animals is thick and yellowish up to 2-3 days. It is known as colostrum or *sri*. Upon boiling, it gets curdled into a yellowish mass. Either salt or sugar is added to it before boiling. *Sri* is served to all the family members and even distributed among the neighbors and friends for celebrating the arrival of a new member in the family

**Thut:** *Thut* (Fig. 7e) is an edible block made, by the addition of butter, sugar, and jaggery to the dried cheese flour. It is eaten as such or put in *chasrul* and *kholak*.

#### Plant based food and beverages

##### Barley based foods and beverages

**Yos/yoza:** The huskless barley or grim grains, *shiroq*, after the removal of inert materials are washed and dried. This is followed by roasting in a large iron tub known as *langna* continuously stirred with a long wooden spatula known as *yoqdu*. Roasting is also done in hot sand. The roasted barley after cooling is eaten as such as snack and is called as *yos* or *yoza*.

**Kharyos:** The roasted barley is sometimes mixed with molten jaggery and sugar and blocks are made. It is eaten as such after cooling. *Kharyos* blocks (Fig. 8a) are mostly prepared and eaten during winters.

**Namphey:** The roasted grim is grounded into flour in a traditional flour mill run on fast-moving water. This flour is called *namphey* and is taken as such, as a snack with tea, buttermilk, local beer, etc.

**Bangphey:** The fermented barley grains after the extraction of beer are dried and ground into flour and it is called as *bangphey*. *Bangphey* is mixed with *namphey* in the ratio of 3:1 and eaten as such with tea

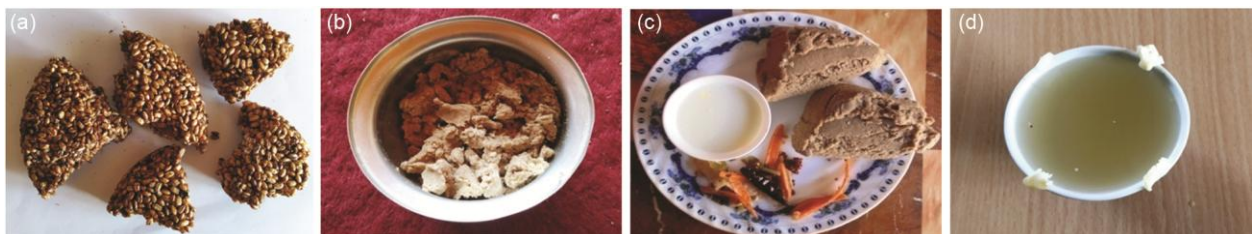


Fig. 8 — Barley based products (a) *Kharyos* (b) *Kholaq* (c) *Paba* (d) *Chang* (beer).



or *kholaq* and *chasrul* are prepared from it. For *kholaq*, it is mixed with tea and left for sometime before eating.

**Kholaq:** *Kholaq* (Fig. 8b) is one of the most commonly used dishes in Changthang. The roasted barley flour, *namphey*, is mixed with tea to a consistency, where it does not stick to the hand. It does not require cooking. Sometimes dried cheese flour is also added to it. When buttermilk is added to barley flour then it is called *tar-kholaq*, when the beer is added then it is called as *chang-kholaq*. These are the favourite lunch of shepherds.

**Pheyamar:** Similar to *kholaq*, but butter or ghee is added along with tea. Sugar can be added depending upon the individual's choice. It is usually served to the guests on occasions such as festivals and weddings.

**Paba:** *Paba* (Fig. 8c) is another most commonly eaten dish among the people of Changthang. Here the flour used is a mixture of roasted barley and local pea and is known as *yoches*. The flour is cooked with water in a stone pot, *doltoq*, and stirred with a special wooden spatula known as *skya*. *Skya* is also used for making final shapes (pyramid-shaped), *skyalaq*. The combination of *paba* and butter is the most common, although it can be eaten with meat, vegetable and other dairy products. It is eaten either hot or cold.

**Namthuk:** Roasted barley flour with dried cottage cheese is boiled in meat soup. The flour and cheese strips are put into the boiling soup and mixed properly with *silkya*, a bunch of hard stalks of a typical grass combined together. It is a favorite breakfast meal in winter and also given to a person suffering from cold and pregnant women.

**Zathuk:** Ingredients and preparation are the same as *namthuk* excluding the meat soup, except a good quantity of *zatsot* (nettle) are used in it.

**Chanthuk:** Barley grains after cleaning, are broken down into grits with the stones. These are then cooked in water with meat, dried cheese, and vegetables. After that, the product is fried on oil or animal fat, with spices, onion, and salt. It is the main welcome

dish when someone goes for *Losar* wishing to relatives.

**Lduru:** Barley flour, cottage cheese powder, and butter are boiled in water up to a consistency thinner than *paba*. It is a special diet, served hot, to pregnant women, lactating mothers, and infants. Here continuous stirring is done with a *silkya*.

**Chang:** *Chang* (Fig. 8d) is the local beer prepared by the fermentation of barley with the help of yeast, *phab*. The *phab* is procured from Nubra valley in the form of dried nuggets. The brew is prepared in a wooden pot, *zem* and after maturation, the extract is kept for aging. It is one of the most common beverages taken by both males and females during field works and weddings and festivals. Guests are served beer with a brass pot, *chabskyang*, having a small piece of butter on it.

**Araq:** It is the distilled clear liquor obtained by cooling up of vapour released upon boiling of *Chang*. In the past, the preparation of *araq* was common on occasions, but now its production is decreased.

**Changsrul:** When roasted barley flour is added to beer up to a consistency thicker than soup, then it is called as *changsrul*. It is usually taken during field works and traveling in the summers.

#### Wheat based foods and beverages

**Chutagi:** It is a boat-shaped wheat dumpling cooked in meat soup with spices and salt or meat curry (Fig. 9a). There should be enough watery portions in it as indicted from the name as *chu* means water. Sometimes vegetables are also added to it.

**Skyu:** Cap shaped dumpling made from wheat flour. The method of preparation and ingredients are the same as *chu-tag*i, but have comparatively lesser water content. *Oskyu* is also famous among the nomads, where milk is used instead of meat soup. General practice is that a small wooden stick is inserted on *skyu* to eat it.

**Paqtsa markhu:** Wheat dumplings are cooked in water and strained. These are then mixed with butter, cheese powder, and sugar. The dumplings here are flat round or spherical shaped and small in size



Fig. 9 — Wheat based products (a) *Chu-tag*i (b) *Paqtsa-markhu* (c) *Timoq* (d) *Tagi-skyurchuk*.

(Fig. 9b). It is specially prepared during fasting at the beginning of the first month of the Tibetan calendar.

*Timoq*: *Timoq* (Fig. 9c) is steamed bread cooked in a special pot, *moqto*. *Timoq* is generally taken with meat curry, meat soup, vegetable curry, etc.

*Tagi-skyurchuk*: *Tagi* means bread and *syurchuk* means added with sour ingredient (yeast). *Tagi-skyurchuk* (Fig. 9d) is known as *Tagi khambir* in other parts of Ladakh. A small piece of dough from the previous batch is added for fermentation which provides a sour taste to the bread. The prepared dough is incubated overnight and bread is then baked in mud or iron made stove. The bread is half cooked on an iron or stone plate placed over one of the holes of the traditional stove and finally on cow dung or charcoal fire inside it. *Khambir* is a popular staple food in a few places in Tibet and China<sup>8</sup>.

*Tagi-sramo*: *Tagi* means bread and *sramo* means thin. It is unleavened local *chapati* baked on an iron plate placed over a local stove.

*Tagi-buskuruk*: The bread is thicker than *tagi-sramo* but thinner than *tagi-skyurchuk*. Here the baking procedure is the same as that of *tagi-skyurchuk*.

*Tagi-thaltaq*: The bread is thicker and harder than *tagi-skyurchuk*. The bread is kept between two iron plates for baking, the upper one is slightly bowl-shaped and the lower one is flat. The plates with bread are then covered from all sides with hot burned goat/sheep dung.

*Tagi-markhur*: It is as thick as *tagi-thaltaq* but comparatively smaller in size. The extra ingredients added are butter and egg. Method of baking is same as of *tagi-thaltaq*

*Tagi-thalkuruk*: Smaller in size as *tagi-markhur*. Baking is done by the direct covering the bread with hot ashes without the plates. It is considered as more easily digestible than all other bread and is especially given to patients and oldies.

*Khura*: Thin rolls of wheat dough like that of noodles are arranged together and fried in oil. It is specially prepared during *Losar* and carried as a gift to the parent's home by a married girl. It is also served during the prayers performed upon the death of a person. Salt or sugar can be added for palatability.

*Gyathuk*: Dried Chinese noodles cooked in meat soup with spices and salt. Also prepared on occasions and serve hot.

*Rimthuk*: Hand rolled noodles are cooked in meat soup or soup having local pea, dried cheese strips and

vegetables is called as *rimthuk*. It is served to the sick being nutritious and easily digestible.

*Paqthuk*: A large sheet of dough is cut into small pieces and cooked in a soup containing meat, dried cheese, vegetables, etc.

#### Other foods and beverages

*Cha-khante*: A little tea extract, *chathang*, is added to water with milk and salt and let for boiling. Butter is also added to it and *chasroq*, a wooden stirrer, is used for proper mixing. The tea extract is made by boiling tea leaves with a small amount of *pul*, for a longer period until the blackish brown colour concentrate is obtained. *Pul*, local soda is procured from Nubra valley. *Chathang* is stored in a pot to be used for several days. The leaves of local tea are different from that of common tea in appearance.

*Cha-khunaq*: The tea leaves are boiled in water and salt and butter is added to it. The boiling is done for a shorter period. The local people are accustomed to drinking a lot of tea throughout the day to keep their body warm, refresh, and as a substitute for water. Tea is the basic thing which is offered on the arrival of a guest.

*Chasrul*: When *namphey* or *bangphey* is added to tea up to a consistency thicker than soup, then it is called as *chasrul*. A small butter is also added to it. It is taken hot to keep the body warm during winters.

#### Discussion

The health benefits of some traditional foods of Ladakh are well documented. Traditional foods of Ladakh such as *churpe*, vegetable pickle and *chang* serve as potential sources of lactic acid bacteria (probiotics). Additionally, these foods and beverages are proposed as delivery vehicles for probiotics, leading to increased demand for these traditional foods which indirectly lead to the improvement of rural economy<sup>9</sup>. *Tagi Khambir* carries health benefits and is rich in phenolics, as it exhibits significant antimicrobial, antioxidant, antiradical, and anti-toxic effects. Additionally, a group of food graded microbes in the product can provide some added advantages to consumers<sup>10</sup>. Products made from *dimo's* milk may harbor a distinctive microbiota<sup>11</sup>. The probiotic properties of indigenous microorganisms isolated from the cheese-like product *churpe* have been reported<sup>12</sup>. Probiotic milk products can have health-promoting benefits such as modulation of the immune system, maintenance of gut flora, regulation of bowel habits, alleviation of constipation, and curing of

gastrointestinal infections<sup>13</sup>. Still other foods are needed to be analyzed for their functional properties.

Some of the food products of Changthang have great demand outside the region. The meat and dairy products are also exported outside Ladakh, where a considerable population of Buddhists resides. A substantial population of the student community of Ladakh study outside the region, like Jammu, Delhi, Chandigarh, Bangaluru, etc. and a chunk of the army serve within and outside Ladakh. These products are sent to them as a gift by their family members and relatives. The prospective economic benefits mostly remain untapped due to a few bottlenecks and need the attention of researchers and policymakers. During the whole process of meat production, right from slaughtering, handling, and preservation, proper hygiene is not maintained. During the course of storage during the long winter months, the same problem is there. Despite that, there is a great demand for preserved meat and 1 Kg of it at present, fetches Rs 2000 to Rs 3000. The surplus of dairy products also provides an opportunity to generate income for the locals. There is a great demand for products, especially local butter (*mar*) and dried cheese (*chura/churpe*). Both the products at present fetch Rs 400/- to Rs 450/- per Kg. Proper packaging of the butter is the major issue in its marketability. The traditional storage of butter is, no doubt of a longer period, but deteriorates, once the casing is opened. Thus it needs to be consumed in a few days. The storing of butter in animal stomachs and skin also hinders its acceptability among Muslims. So a proper packaging technique needs to be devised. In the case of cottage cheese, the traditional drying method is also non-hygienic and time-consuming. The drying is done in the open under sunlight where dirt, leaves, insects, rain, etc. deteriorate its quality and hence fetches a low price. Scientific intervention is thus needed to improve the quality of the products. Conventionally, the dried cheese is being sold, loose in the market. So proper packaging is also needed.

### Conclusion

The traditional systems of food production, preservation, and consumption of Changthang are at a faster pace of extinction in the light of modernization accompanied by other factors. The food habits of the people these days have changed to some extent but they still relish the traditional recipes. Most of the food products of the Changthang region are unique to it due to its extra-ordinary climatic and cultural, living

conditions. Some of the foods and beverages are specially prepared during occasions and constitute an important part of the culture and tradition of the region. These time-tested systems need to be preserved to maintain the cultural identity of the people of the region. The traditional foods and beverages have tremendous health benefits along with the nutritional contents as some of these have already been documented. Further, these need to be analyzed for their nutritional and nutraceutical properties. The outcomes of these studies should be imparted to the locals through awareness programs, workshops, exhibitions, etc. The society is moving towards fast-food, ready-to-eat, and ready-to-cook systems under the ages of modernization. The ill-effects of exotic and processed foods at the same time should also be shared. Changthang has various famous tourist spots and serving of local foods in the home-stays, restaurants, hotels, and camping sites could be a good source of income generation. The traditional food products can further be value-added through the modern techniques of processing, preservation, and storage to make these more nutritious and healthy. This can also lead to their popularity among the already nutritionally deprived people of Changthang. Scientific methods of packaging should be encouraged for better marketability of the products.

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### Conflict of Interest

There is no conflict of interest among the authors.

### Authors' Contributions

SP helped in field survey of the study and provided information about wild vegetables being grown in Changthang region. PT has helped in review and editing of the literature.

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