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Traditional foods and wild edible plants of Spiti valley, Indian Trans Himalaya

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Traditional foods comprise unique recipes made from natural resources that are important for human survival and have cultural, social, and ecological importance. They are largely guided by geographical location and the prevalent environmental conditions in an area. We, therefore, documented the traditional foods prepared by the *Spitians*- the resident community of Spiti, a remote, isolated, cold arid region of the Himalaya. A semi-structured open-ended questionnaire was used for the same (n=72 respondents) along with onsite participant observations. It was revealed that the residents prepared foods based on cereals (n=22), wild edible plants (WEP) (n=37), meat (n=5), and dairy products (n=2). Roasted barley, locally known as *sattu* was the predominant ingredient in most food products (13 recipes). It was a rich source of carbohydrates (80.41 g 100 g^{-1}), specifically dietary fiber (17.3 g 100 g^{-1}). Naturally fermented food *Churpe* from cow or yak milk was another predominant food of the region with high protein content (56.67 g 100 g^{-1}). Among the WEP, the majority belonged to the Polygonaceae and Brassicacceae (05 each) family. The WEPs consumed by the local population have been reported to mitigate high-altitude stress such as exposure to intensive radiation levels (UV rays) and hypobaric hypoxia. Thus, the traditional foods consumed by the *Spitians* have nutritional as well as health implications for them and the society at large.

Keywords: *Churpe,* Himalaya, Spiti, Traditional foods, UV radiation, Wild edible plants

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Traditional food is the ethnic cuisine of a region that relates to its culture, is made from locally available resources using time-tested processes, and is guided by the geographical & environmental conditions prevailing in the area. It plays a crucial role in sustaining communities residing in remote localities and has an imprint on modern dietary patterns[1-4]. The same has been consumed for ages with oral transmission of the knowledge associated with recipes and their making.

Studies on the subject have shown their importance in nutrition, well-being, and in adapting to surroundings[5]. In the communities residing in the Himalaya, food traditions are closely interwoven with ecology, availability, seasonal variation, and cultural values, making them essential for human survival in harsh environmental conditions[6]. Traditional food systems thus represent an adaptive strategy, reflecting both ecological knowledge and cultural identity[7]. The evolution of the human race from a hunter-gatherer to a settled lifestyle revolves around food and its choices[8]. In recent times, the subject has seen a renewed interest that is often reflected in the emergence of subjects such as gastronomy[9]. At the same time, a large number of studies are now reporting a decline in knowledge of traditional foods and wild edible plants (WEP) even in interior areas[10,11]. This decline of knowledge, driven by modernization and lifestyle shifts, poses a serious challenge to both nutritional security and the continuity of cultural heritage. The coexistence of rich food traditions with a simultaneous decline in their practice highlights a paradox that has wide social and ecological implications. Therefore, documenting traditional foods and WEP consumed by tribal communities is much needed and is being promoted[11]. Such documentation is not only about recording recipes but also about safeguarding traditional knowledge and highlighting the adaptive strategies of high-altitude societies[12].

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It is with this background that the present study was conducted in a tribal landscape of Himalaya, *i.e.*, Spiti. The study objective focused on- 1) identifying and categorizing the indigenous foods (including beverages) consumed by the local community, and 2) cataloguing and analysing the use of wild edible plants.

Material and Methods

Study area

Spiti, a high-altitude cold desert lies between 31° 44'57 to 32° 59'57 latitude and 76° 46'29 to 78° 41'34 longitude[13] in the Lahaul and Spiti district of Himachal Pradesh (Fig. 1). It covers an area of ~5580 km^2 and is bordered by Ladakh in the north, Tibet in the northeast, Kinnaur in the southeast, and Kullu in the west[14]. Almost the entire area is located at elevations above 3000 m asl wherein the average temperature ranges from -40°C in the winter to 35°C in the summer[15]. The hottest months are June and July, while December and January are the coldest ones. Winters are marked by heavy snowfall, which begins to fall in December and remains on the ground until the end of April. Thus, during winters the region remains cut off from the rest of the world due to heavy snowfall. However, in all seasons, the diurnal temperature difference is noticeable. Being a cold desert, the region is dry with an average annual rainfall of 170 mm[16]. The soil of the region is mostly silty loam to silty clay loam in texture[17,18] that supports the characteristic sparse arid vegetation on which the local communities of the area are dependant[14]. The majority of people in Spiti are Buddhists who in addition to farming, raise cattle, yak, *churu/churi* (crossbred between cow and yak), sheep, and goats to suit their needs. Apart from the harsh climatic conditions, the region has high UV radiation (intensive radiation levels 6-7 kWh/mm), lower oxygen partial pressures (hypobaric hypoxia), longer photoperiod, low humidity (dryness) requiring unique physiological adaptive mechanisms and practices that include dietary patterns[19]. Owing to the unique geographical location and characteristic environmental conditions, the people have evolved their distinctive food habits and recipes.

Respondent survey, data collection, and analysis

Intensive field surveys were carried out in three panchayats of Spiti wherein two villages each, namely, Chicham, Kibber (Kibber Panchayat); Komic, Hikkim (Langcha Panchayat); Tabo, Lari (Tabo Panchayat) were selected for the study. The selection of the villages was based on their spatial spread. Rapid door-to-door surveys were conducted in all six villages, and a total of 72 respondents (representing 10-30% of the total households) were interviewed (Fig. 2). Thirty-two of those interviewed were females aged between 32 and 89 years, while the remaining forty were males aged between 33 and 70 years. A semi-structured open-ended questionnaire was used for eliciting information along with onsite participant observations of the community to gain perspective on their relationship with plants, including their uses, knowledge, and practices (Supplementary Table S1). In addition to basic information (age, gender, education, and occupation) of the respondents, knowledge of

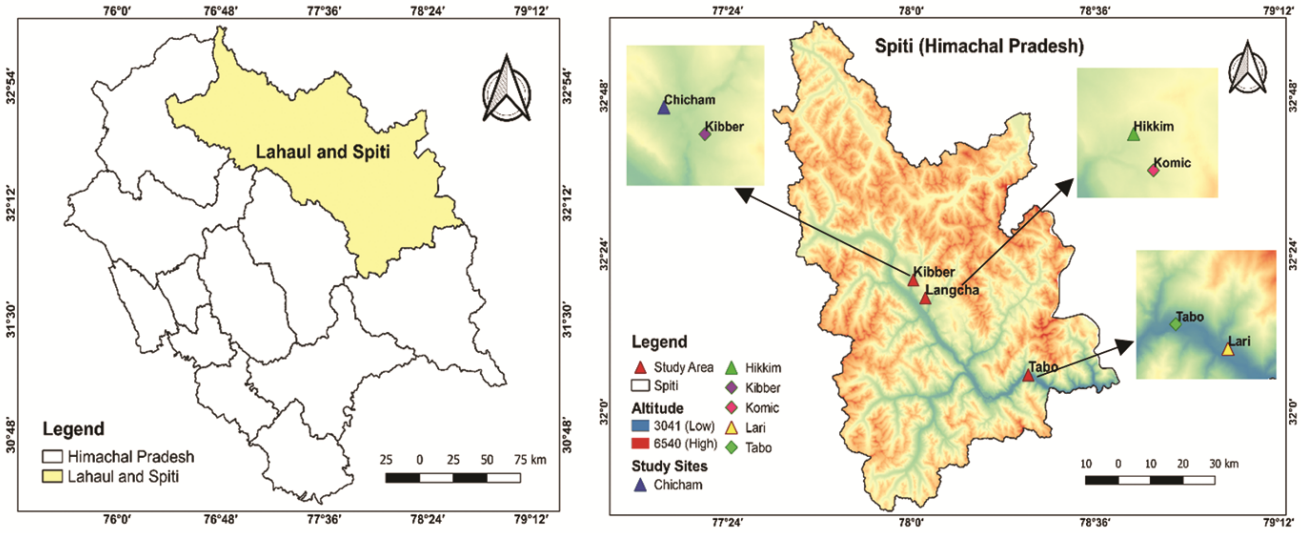

Fig. 1 — Map of the study area showing different study sites (Source: prepared using open access QGIS)

Fig. 2 — Interaction with local inhabitants and onsite process recording

indigenous food and beverages, ingredients used, preparation methods, and consumption patterns was also noted. As mandated by the National Biodiversity Authority, the respondents were apprised of the research work, and prior oral informed consent was obtained from all of them. Subsequently, the data were entered into the database and analysed for taxa and food statistics. Based on the raw material used, the food has been categorized (cereal-based, meat-based, milk based, beverages). Further, the foods were categorized based on the frequency of their consumption such as frequent, occasional, and rare. *Frequently* refers to the food items prepared and consumed in every household throughout the year, whereas *occasionally* implies those food items that are prepared and consumed during religious ceremonies, birthdays, and marriages in every household. On the other hand, *rarely* indicates the items with little interest or whose process and preparation know-how is lost among the younger generation, and consumption of such items is declining in the region. The WEP were divided into five use categories *viz*., vegetable, fruit, flavouring agent, raw food, and local brew, depending upon their usage[11]. The plant species used by the locals were identified at the CSIR-Institute of Himalayan Bioresource Technology herbarium (PLP) with the help of the published Flora of Himachal Pradesh[20], and Flora of Lahaul-Spiti[21]. Also, the carbohydrates and dietary fibre of commonly consumed roasted barley flour (*sattu*), and protein content of *churpe* (dairy product) were determined using standard procedures of the Association of Official Analytical Chemists (AOAC)[22,23].

Results and Discussion

It was revealed that the residents of Spiti consume diverse and varied food. Owing to the harsh climatic conditions of the region and resource limitations, the native people have developed food products from locally available staples and other ingredients using simple techniques based on socio-cultural and religious values[24]. A variety of local herbs and spices were used to flavour the dishes. The categorization of food, production systems, and processing of food revealed a range of delicacies that are unique to the region. In general, the traditional food of the valley comprises cereals, meat, milk, WEP, and beverages (Supplementary Table S2 & S3). Eighteen food items were frequently prepared and consumed in every household throughout the year, whereas 13 items were occasionally consumed. These were prepared and consumed primarily on festivals and celebrations.

On the other hand, five food items were consumed rarely, indicating their declining consumption in the region.

The details of each of these are provided below:

Cereal based food

A number (n=22) of cereal based ethnic food preparations have been developed and are consumed by the inhabitants of the Spiti. Among cereals, barley (*Hordeum vulgare* L.) is widely grown and is the staple crop of the area. The barley is roasted and ground into flour, locally called *sattu*, and is used in a variety of dishes namely *fahtay, femer, sattu, shunali*, & *tsalma gungshi* and also for making alcoholic beverages namely *Chang* and *Arak* (Table 1).

Table 1 — Traditional food products consumed by inhabitants of Spiti Valley

Sr. no.	Food product	Crop used/ Main ingredient	Ingredients	Time of consumption/ pattern	Method of preparation
			Cereal based		
1.	Chinduk	*Hordeum vulgare* L.	Barley, water	Frequently	Soaking followed by drying.
2.	Chung	*Hordeum vulgare* L.	Black pea, wheat grains, water	Occasionally	Boiling
3.	Fahtay	*Triticum aestivum* L.	Wheat flour, water	Occasionally	Boiling
4.	Femer /Dhuru	*Hordeum vulgare* L.	*Sattu*, ghee, sugar, dry fruits	Occasionally	Sautéing/ frying in ghee
5.	Maida matar	*Triticum aestivum* L.	Wheat flour, water	Occasionally	Deep frying
6.	Momo (veg/non-veg)	*Triticum aestivum* L.	Wheat flour, onion, meat/vegetable, salt, chilli, *gamen* (local spice)	Occasionally	Steaming
7.	Murpa	*Hordeum vulgare* L.	Barley *sattu*, water	Occasionally	Boiling
8.	Nengu	*Hordeum vulgare* L.	Barley *sattu*, *phab*, dry fruits	Occasionally	Soaking, boiling followed by fermentation and frying in ghee.
9.	Pak/ Pawa/ Marnyuk	*Hordeum vulgare* L.	Barley *sattu*, salt/sugar, water	Frequently	Boiling
10.	Paksal marku	*Triticum aestivum* L.	Wheat flour, water, sugar, cumin, locally prepared fresh paneer (*phala*)	Frequently	Boiling
11.	Quo/kyupakse	*Triticum aestivum* L., *Hordeum vulgare* L.	Wheat flour/ *sattu*, vegetables/meat, onions, garlic, spices	Rare	Boiling followed by slow heating cooking
12.	Sattu	*Hordeum vulgare* L.	Barley	Frequently	Roasting
13.	Sheto/khura	*Triticum aestivum* L.	Wheat flour, water, soda/yeast, oil	Occasionally	Fermentation following by deep frying
14.	Tsunalik	*Hordeum vulgare* L., *Triticum aestivum* L.	Barley *sattu*, water, ghee, *churpe* (local dry cheese), sugar	Occasionally	Boiling
15.	Temok/ Temo	*Triticum aestivum* L.	Wheat flour, oil, turmeric powder, baking soda	Occasionally	Steaming
16.	Thukpa/Tenthuk	*Triticum aestivum* L.	Wheat flour/ *sattu*, vegetables/meat, *churpe*, tomatoes, onions, garlic, spices	Frequently	Boiling
17.	Tirik/ Dherha/ Dhuntrik	*Triticum aestivum* L.	Wheat flour, water, soda/ yeast	Occasionally	Fermentation followed by roasting
18.	Tsalma gungshi	*Hordeum vulgare* L.	Barley *sattu*, water, salt, chili, local spice	Occasionally	Boiling
19.	Tsung paksal	*Triticum aestivum* L., *Hordeum vulgare* L.	Wheat/ barley flour, salt, water	Frequently	Boiling
20.	Zara	*Hordeum vulgare* L.	*Sattu*, salt, chilli, *gamen*, vegetable/meat	Frequently	Boiling
21.	Zongpakshal	*Hordeum vulgare* L.	Black pea and wheat flour, refined wheat flour (*maida*)	Frequently	Boiling
22.	Zurvey	*Triticum aestivum* L., *Pisum sativum* ssp. *arvense* (L.) Asch. & Graebn.	Black pea, wheat grains, water, ghee	Rare	Boiling

... Contd.

Table 1 — Traditional food products consumed by inhabitants of Spiti Valley (Contd.)

Sr. no.	Food product	Crop used/ Main ingredient	Ingredients	Time of consumption/ pattern	Method of preparation
			Meat based		
23.	Gyuma	Goat/ Sheep/ Yak	Goat/ Sheep/Yak intestine, oil, salt, chilli, *gamen*, *sattu*	Occasionally	Boiling followed by deep frying
24.	Luksha	Sheep	Sheep meat, oil, spices, salt, *gamen*	Frequently	Boiling followed by roasting with oil and spices
25.	Rasha	Goat	Goat meat, oil, spices, salt, *gamen*	Frequently	Roasting with spices followed by slow heat cooking
26.	Shapchin/ Shekambo/ Seeka	Goat/Sheep/Yak	Goat/Sheep/Yak meat (dried), oil, spices, salt, *gamen*	Frequently	Boiling followed by roasting with oil and spices
27.	Yaksha	Yak	Sheep meat, oil, spices, salt, *gamen*	Rare	Roasting with spices followed by slow heat cooking
			Milk based		
28.	*Churpe*	Milk	Curd/buttermilk	Frequently	Fermentation followed by boiling
29.	*Churship*	Milk	Curd/buttermilk	Frequently	Fermentation followed by boiling
			Beverages		
30.	Arak	*Hordeum vulgare* L.	Barley, *phab*, water	Frequently	Fermentation followed by distillation
31.	Chang	*Hordeum vulgare* L.	Barley, *phab*, water	Frequently	Fermentation
32.	Chirul/ Chapshul	*Hordeum vulgare* L.	Barley flour, milk, sugar, salty tea, ghee, *churship*	Rare	Blending
33.	Dhechang	*Oryza sativa* L.	Rice, water, *phab*	Rare	Fermentation
34.	Saja/Chatang	*Camellia sinensis* (L.) Kuntze, *Acacia catechu* (L.f.) Willd.	Water, salt, tea stem and leaves, ghee, milk	Frequently	Brewing and boiling
35.	Tirku/ Seabuckthorn tea	*Hippopheae rhamnoides* ssp. *Turkestanica* Rousi	Seabuckthorn berry, water, sugar	Frequently	Boiling
36.	Yoe/Barley coffee	*Hordeum vulgare* L.	Barley grains, sugar, milk	Frequently	Roasting followed by blending

Sattu was a predominant ingredient in many food items and was stored for winter consumption[25]. *Sattu* has a very high dispersibility, indicating its suitability in the preparation of products that require uniform dispersal and thick slurry-like consistency, such as *Zara*, *Tsalma gungshi*, *Pak* and *Khwalang*[26]. Apart from its use as an ingredient in many food products, *sattu* is used as a complementary food for children[27]. Furthermore, *sattu* possesses a high Water Absorption Capacity (WAC) and Oil Absorption Capacity (OAC), indicating its suitability for the preparation of dough-based food products[28]. Some of the dough-based food products from the study region are *Tsung Paksal*, *Tsunalik*, *Tcung*, *Marpinni*, and *Tchog*. *Sattu* was found to be rich in dietary fibre (17.3 g 100 g^{-1}) and also an energy-rich food due to the high concentration of carbohydrates (80.41 g 100 g^{-1})[24].

Meat based food

The inhabitants of the Spiti valley consume meat and meat products. A total of 5 meat-based food products used by them were namely, *Gyuma*, *Yaksha*, *Rasha*, *Luksha*, and *Shapchin* (Table 1). Since agriculture is difficult and often limited, meat-based products become an important source of nutrition. Meat is mostly consumed fresh; however, it is also dried and frozen so that it can be used during severe winters when the area becomes inaccessible due to snow.

Milk/Dairy based food

Livestock rearing is an integral part of the inhabitants of the Spiti valley. It provides meat, milk, other dairy products, and fermented foods. As a result, the locals prepare and consume a wide range of dairy products derived from the milk of animals such as yak, *churi* (a crossbred of cow and yak), cow, and goat. Apart from catering to the nutritional security of the region, dairy products and fermented foods contribute directly to the rural economy of the region[29]. It is noted that fermentation not only increases shelf life but also helps in bio

improvement[30]. The major fermented milk products of the region are *sho* (curd), *thara* (buttermilk), *churpe*, *churship* (dried cottage cheese), and *mar* (local butter), which find extensive use in daily diets and religious activities.

The cottage cheese, *churpe*, was another predominant food ingredient of the Spiti valley. It is naturally fermented, unlike the commercially produced cheese varieties that use rennet[31]. *Churpe* is made by boiling buttermilk and subsequently separating the coagulated solid mass from the liquid whey. It is then wrapped and hung in a thin cloth to drain out the liquid. After draining, the cheese is shaped into strips and also rubbed by hand to give it a floury texture, which is then left open to dry in the sun. *Churpe* is consumed in various ways, including cooking with vegetables, sweet dishes, stuffing for local dishes, and in *thukpa*. Apart from its use as a food ingredient, *churpe* is used as a masticator or as chewing gum for sustained energy and movement of the jaws during harsh winters. The people also prepare *mar*, which is used for preparing various food items and imparting flavour (Fig. 3). Additionally, the survey revealed that *churpe* is generally used for enhancing the aroma and flavour of foods. This could be attributed to the presence of *Lactobacilli* spp. (predominant bacterial groups) in *churpe*. During the process of fermentation, these lactic acid bacteria generate several volatile compounds that contribute to the unique aroma of *churpe*[32,33]. The *churpe* reported

Fig. 3 — Images of Traditional food, (a) Chinduk (b) Maida matar (c) Momo (veg/nonveg) (d) Sheto/khura (e) Temok/Temo (f) Thukpa/Tenthuk (g) Tirik/Dherha/Dhuntrik (h) Zara (i) Zurvey (j) Zongpakshal (k) Churpe (l) Churship (m) Mar (n) Arak (o) Chang (p) Chirul (q) Namkeen tea

high protein content (56.67 g 100 g^{-1}) and thereby its importance in the local diet[23].

Wild edible plants based food

The native people consume a diversity of WEP; these are species collected from their natural habitats for human consumption but are not cultivated. The Food and Agriculture Organization describes them as "plants that grow spontaneously in self-maintaining populations in natural or semi-natural ecosystems and can exist independently of direct human actions"[11,34]. The WEP play an important role in the livelihoods of the residents. A total of 37 species belonging to 18 families were reported to be used by them. Members of Polygonaceae and Brassicaceae (05 each) accounted for the majority of the WEP used, followed by Amaryllidaceae (04) and Amaranthaceae (03) (Fig. 4a). The WEP can be categorized into five use

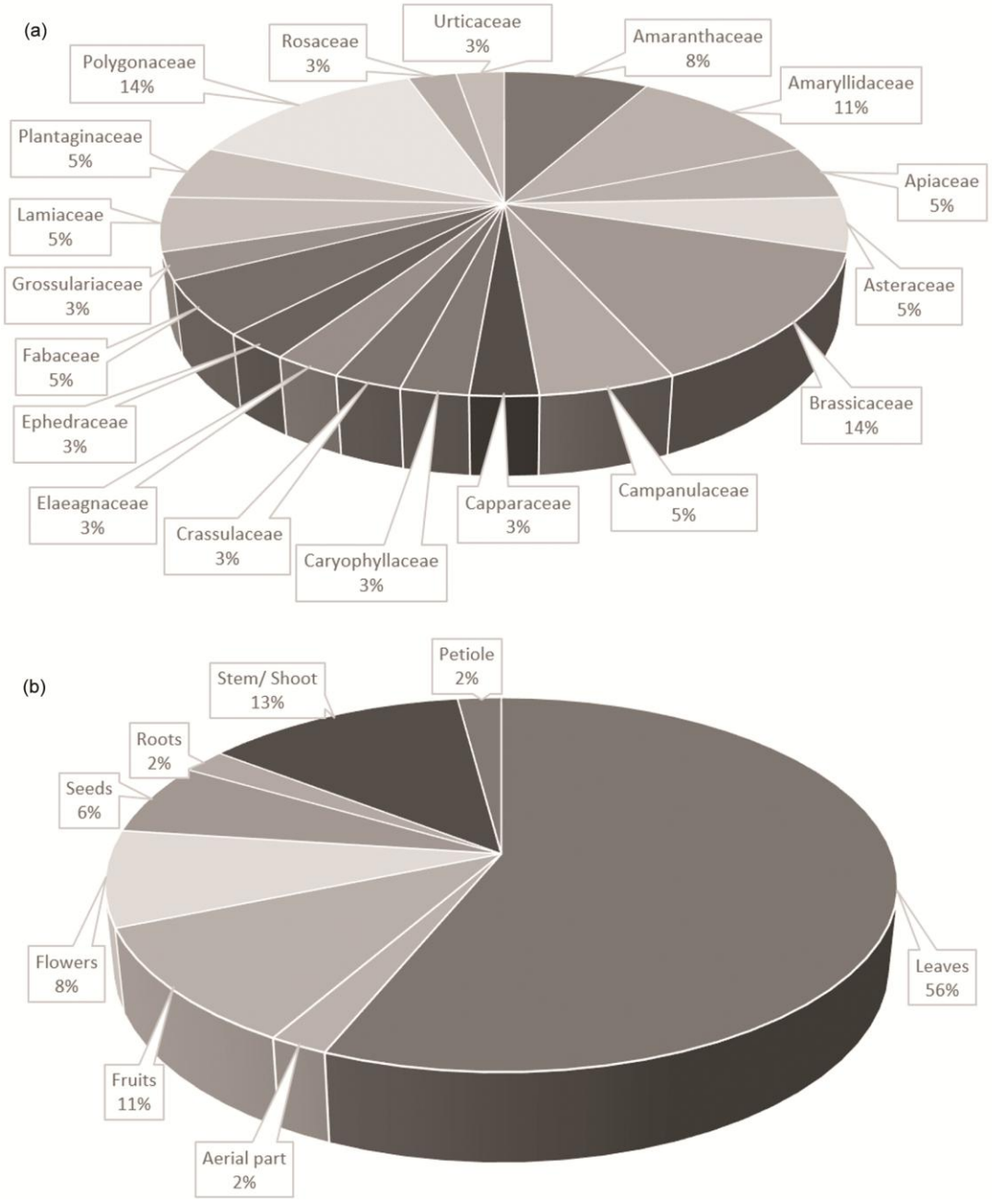

Fig. 4 — (a) Families of different wild edible plants used by the people of Spiti valley, (b) Plant parts used in the food preparation by the people of Spiti valley

categories, namely, vegetable, fruit, flavouring agent, raw food, and local brew. In the majority of the cases, leaves (n= 27 species, 56%) were used, followed by stem/shoots (n=06 species, 13%), fruits (n= 05 species, 11%), flowers (n= 04 species, 8%), and seeds (n= 03 species, 6%). Complete aerial parts, roots, and petioles of one species each (2%) were also used (Fig. 4b).

Yar (*Chenopodium foliosum*), *shiki* (*C. botrys*), *shoma* (*Rumex patientia* subsp. *orientalis*), *zha* (*Urtica tibetica*), *gandoli* (*Silene vulgaris*), *tharam* (*Plantago depressa*), and *rutupka* (*Codonopsis ovata*) were some of the most commonly used wild vegetables. Flowers of the *pharna* (*Allium jacquemontii*), locally called *gemen*, leaves of *takchi* (*Mentha longifolia*), and seeds of *mawo (Carum carvi*) and *kala zeera* (*Bunium persicum*) were dried and used as flavouring agent (Table 2). Interestingly, *pharna* was also sold in market at the rate of Rs. 500-600 per kg, this provided hard cash to the communities. The use of seeds of *Carum carvi* and *Bunium persicum* as spice and flavouring agents in the traditional foods of the region has been reported for treating gastrointestinal problems such as flatulence, spasms, and inflammatory conditions such as colitis[35]. Another widely used WEP for obtaining refreshing flavour in teas, and dishes such as dips and sauces (*chutneys*) is *Mentha longifolia* (L.). *Allium* species have traditionally been used for treating stomach infections and improving digestion.

People in high-altitude regions such as Spiti valley are exposed to intense radiation including UV rays[19]. Exposure to UV rays and intense radiation results in oxidative stress causing several disease conditions including cancer[36]. Dietary intake of antioxidants has been linked to reduced oxidative stress and related injuries in tissues[37]. Careful evaluation of the WEP consumed by the local population indicates the presence of strong antioxidants, mainly polyphenols in them. *Codonopsis ovata, Dracocephalum heterophyllum, Lactuca tatartica, Mentha longifolia, Plantago depressa,* and *Sonchus oleraceus* have been reported to possess apigenin and its derivatives which have anti-inflammatory and anti-cancerous activities[38]. In addition to apigenin, the other major molecule with anti-radiation properties is rutin/rutinoside[39]. Some WEP containing rutin/rutinoside are *Capparis spinosa*, *Capsella bursa-pastoris*, *Dracocephalum heterophyllum, Mentha longifolia,* and *Urtica tibetica*[40]. These bioactive compounds demonstrate how locally consumed WEP act as preventive resources against oxidative stress and radiation-related health risks in high-altitude settings.

The other major physiological challenge experienced by the population of high altitudes is hypobaric hypoxia[19]. Several health issues, such as myocardial and pulmonary edema and cognitive impairments have been attributed to hypoxic conditions[41]. However, consumption of certain unique plant species such as *Rhodiola heterodonta*, *Potentilla ansernia, Dracocephalum heterophyllum,* and *Hippophae rhamnoides* may attenuate the deleterious effects induced due to hypobaric hypoxia[42]. *Rhodiola heterodonta* is exclusively distributed in the high-altitude Himalayan regions and has salidroside, rosavins, and p-tyrosol. Salidroside has been shown to reverse hypoxia-induced myocardial damage and improve blood oxygen levels[43]. Research shows that salidroside can help protect heart cells from dying due to low oxygen levels by influencing the HIF-1α/VEGF and Akt/GSK-3β signalling pathways indicating its potential as a protective agent against heart damage caused by high altitudes[44].

Another important plant consumed as a raw vegetable in the region is *Potentilla ansernia*. The polysaccharides in *P. ansernia* have been attributed to the reversal of myocardial and pulmonary edema under hypobaric hypoxic conditions[45]. In a rat study focused on high-altitude pulmonary edema, it was observed that *P. anserina* polysaccharide effectively lowered lung water levels, reduced markers of oxidative stress, and inhibited NF-κB and HIF-1α signalling. This offers experimental support for its traditional use[46]. Apart from these two plants, *Dracocephalum heterophyllum* has been attributed with anti-hypoxic properties mainly for treating high-altitude pulmonary edema[47].

Furthermore, one of the most widely consumed berries that supports general health and ameliorates high-altitude disorders is Seabuckthorn (*Hippophae rhamnoides*). The berry is a rich source of antioxidants including flavonoids (quercetin), carotenoids (beta-carotene), ascorbic acid, and tocopherols[48]. Seabuckthorn has protective functions against hypoxia-induced cerebral vascular injury by decreasing oxidative stress[49]. Studies on seabuckthorn seed oil in animals exposed to low oxygen conditions showed that it reduced leakage in brain tissues, and hence enhanced the antioxidant enzyme activities,

Table 2 — Wild edible plants consumed in Spiti valley

Sr. no.	Botanical Name	Local Name	Family	Part Used	Time of collection	Uses
1	*Allium carolinianum* Redouté	Lavodh	Amaryllidaceae	Flower, Leaf	July-August	Flavouring agent
2	*Allium humile* Kunth.	Gogpa Zimger	Amaryllidaceae	Leaf	July-August	Flavouring agent
3	*Allium jacquemontii* Kunth	Pharna/Kotse (Leaves)/ *Gemen* (Flower)	Amaryllidaceae	Flower	July-August	Flavouring agent
4	*Allium przewalskianum* Regel	Gogparukpa	Amaryllidaceae	Leaf	July-August	Flavouring agent
5	*Atriplex crassifolia* Ledeb.	Phaltora/ Rudhog-pa	Amaranthaceae	Leaf, shoot	June-August	Vegetable
6	*Barbarea intermedia* Boreau	Shangtse	Brassicaceae	Leaf	June-August	Vegetable
7	*Bunium persicum* (Boiss.) B. Fedtsch.	Kala zeera	Apiaceae	Seed	September	Flavouring agent
8	*Campanula latifolia* L.	Zatrika	Campanulaceae	Leaf	July-August	Vegetable
9	*Capparis spinosa* L.	Kabra	Capparaceae	Leaf, fruits	June- September	Vegetable, fruit
10	*Capsella bursa-pastoris* (L.) Medik.	Sogkapa	Brassicaceae	Aerial parts	July-August	Vegetable
11	*Carum carvi* L.	Mawo	Apiaceae	Seed	September	Flavouring agent
12	*Chenopodium botrys* L.	Shiki	Amaranthaceae	Leaf	July-August	Vegetable
13	*Chenopodium foliosum* Asch.	Yar	Amaranthaceae	Leaf	July-August	Vegetable
14	*Chorispora sabulosa* Cambess	Shomfli	Brassicaceae	Leaf	July- September	Vegetable
15	*Christolea crassifolia* Cambess	Sanak	Brassicaceae	Leaf	June-August	Vegetable
16	*Codonopsis ovata* Benth.	Rutupka/Ruchupka/ Nyuva	Campanulaceae	Leaf, fruits	July-September	Vegetable
17	*Dracocephalum heterophyllum* Benth.	Jipsi Karpo	Lamiaceae	Flower, root	July-September	Vegetable, raw food
18	*Ephedra intermedia* Schrenk & C.A.Mey.	Tse	Ephedraceae	Fruit	July-October	Fruit
19	*Hippophae rhamnoides* L.	Tirku	Elaeagnaceae	Fruit	August-October	Fruit
20	*Lactuca* tatarica (L.) C.A.Mey.	Khala	Asteraceae	Leaf	July-August	Vegetable
21	*Lepidium latifolium* L.	Tagtogpa	Brassicaceae	Leaf	June-August	Vegetable
22	*Mentha longifolia* (L.) L.	Takchi, churp	Lamiaceae	Leaf	July-September	Flavouring agent
23	*Oxyria digyna* (L.) Hill	Chumcha/ lugsho	Polygonaceae	Leaf	July-August	Vegetable
24	*Plantago depressa* Willd.	Tharam	Plantaginaceae	Leaf	June-August	Vegetable, raw food
25	*Plantago himalaica* Pilg.	Tharam	Plantaginaceae	Leaf	July-August	Vegetable, raw food
26	*Polygonum aviculare* L.	Byinasa	Polygonaceae	Leaf	July-September	Vegetable
27	*Potentilla anserina* L.	Dolosazim/ doma	Rosaceae	Stem	June-August	Raw food
28	*Rheum emodi* Wall.	Lichu/ chhurtsa	Polygonaceae	Leaf, flower, petiole	June-August	Vegetable, raw food
29	*Rhodiola heterodonta* (Hook.f. & Thomson) Boriss.	Solo	Crassulaceae	Leaf, shoot	June-August	Raw food
30	*Ribes orientale* Desf.	Nyange/Yangaya	Grossulariaceae	Fruit	August-September	Fruit
31	*Robinia pseudoacacia* L.	Kikar	Fabaceae	Seed	July-August	Vegetable
32	*Rumex nepalensis* Spreng.	Chuldi	Polygonaceae	Leaf	June-August	Vegetable
33	*Rumex patientia* subsp. *orientalis* (Bernh. ex Schult. & Schult.f.) Danser	Shoma	Polygonaceae	Leaf	June-August	Vegetable
34	*Silene vulgaris* (Moench) Garcke.	Gandoli, lugsug	Caryophyllaceae	Leaf, shoot	July-August	Vegetable
35	*Sonchus oleraceus* L.	Khurmang	Asteraceae	Leaf	July-August	Raw food
36	*Trigonella emodi* Benth.	Tuljima	Fabaceae	Leaf, shoot	July-August	Vegetable
37	*Urtica tibetica* W.T. Wang ex C.J. Chen	Zha/ sah	Urticaceae	Leaf, shoot	June-August	Vegetable

thereby increasing the survival time in rats. This indicates its potential in alleviating cerebral damage at high altitudes. Other major WEP are *Rheum emodi*, *Rumex nepalensis*, and *Rumex patientia* which exhibit a wide range of health benefits that include antioxidant, anti-inflammatory, and neuroprotective properties and also, reversal of chronic kidney disease-associated symptoms such as renal fibrosis. The major bioactive molecules in these plants are anthroquinones[50].

Beverages

A variety of traditional alcoholic and non-alcoholic beverages are prepared and used by the community. Some of the popular alcoholic beverages include *chang*, *arak*, and *dhechang*, which are prepared from fermented barley and rice. *Chang* is a general word for alcohol prepared locally. For its preparation, the cereal grains are boiled in water, and a local fermenter called *phab* (purchased from the market) is mixed with boiled grains and left for fermentation. *Arak*, on the other hand, is made through distillation, wherein the vapors are collected. Barley, the staple cereal of the area finds application in preparing coffee "*Yoe"* (roasted barley grain). To make barley coffee, roasted barley grains are ground into a smooth powder and mixed with boiling water. *Saja* or *Chatang* (Salty tea) is made by adding tea leaves to boiling water, then the brew is added to a churning cylinder along with butter/ghee, salt, and milk. At times, a piece of *dongpo* (*Acacia catechu*) is added to impart a pink colour to the tea. *Chapshul/chirul* (*Sattu* tea) is made by blending *sattu* in salty tea, with added *ghee* (clarified butter) and *churship* (local cottage cheese). *Tirku* (seabuckthorn tea) is prepared by using juice or dried powder of seabuckthorn berries (*Hippophae rhamnoides*) and sugar. Making traditional beverages is not only a source of income for the local people in the hill regions, but it is also a significant household and community beverage connected to religious activities (Fig. 3). They are offered to the local deities for peace and prosperity.

Conclusions

Traditional foods and wild edibles are among the key provisioning services that the native people of Spiti derive from the surrounding ecosystems. The study provides details on the various categories of food consumed by the inhabitants based on their traditional knowledge and also highlights the significance and reliance on them. Despite being a cold desert, the diversity of food prepared is high and so is the use of WEP. Most of the food products consumed by the residents are distinctive because of the characteristic climate of Spiti and are important to the native communities to meet their nutritional requirements, especially during harsh winters. We noted that a few of the WEP, in addition to being locally used, were also sold in the market; prospects of developing a value chain around them must be explored. Further, the cultural significance of some of the traditional foods is also evident as they are prepared during festivals or special occasions. This indicates the social relevance and the rich knowledge base that the community holds. Thus, to preserve the cultural identity of the region, not only the resources but also the time-tested food production systems and the associated traditional knowledge must be conserved.

Limitations of the study

The present study primarily focused on the importance of traditional foods and WEP in Spiti Valley. Seasonal food consumption comparison and dietary food preferences at specific times during the year have not been addressed in this study. These provide clues for future research targeting spatio-temporal patterns of food habits.

Supplementary Data

Supplementary data associated with this article is available in the electronic form at https://nopr.niscpr.res.in/jinfo/ijtk/IJTK_24(11)(2025)1043-1054_SupplData.pdf

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Conflict of Interest

The authors declare having no conflict of interest.

Author Contributions

AS: Survey, Data collection, and analysis, Literature review, Manuscript first draft preparation, AB: Survey, Data collection, and analysis, Literature review, Map and manuscript editing, SG: Nutritional analysis, Literature review, Tabulation, and Manuscript preparation, KS: Nutritional analysis,

Literature review, Tabulation, and Manuscript preparation, TD: Manuscript editing, Literature search, Analysis, VS: Manuscript preparation, Data analysis, Tabulation, Overall guidance, and funds acquisition, SKU: Concept, Manuscript editing, Overall guidance, and Funds acquisition.

Prior Informed Consent

Prior informed consent was obtained from all respondents after explaining the study aims.

Ethics Statement

The Research was carried out following the guidelines of the Institutional Ethics Committee (IEC/OR/Him_SKU/0523).

Data Availability

The data and materials were acquired through a survey for the study. The survey data have been incorporated into the body of this article and the supplementary material.

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