Chapter 4
A Cross-continental Survey of Traditional Food Systems That Are Based on Wild Food Plants

Sajana Sreedharan, Vaishnav Suresh Babu, Golla Nagaraju Gari Saritha, Sarang Viswanathan Sherly, and Ajay Kumar

Abstract Food systems comprising items derived from local or indigenous and naturally available sources were followed by the human race all over the world. Such traditional food systems (TFS) are generally linked with specific communities and hence are known as the reflection of their culture and symbols of their heritage. The utilization of a food crop and preparation of dishes would not always be similar all over the world, and it depends on various factors such as traditional knowledge and food habits of the communities. Different communities may utilize different edible parts of the same plant, follow different preparation methods, and products may be entirely different in look and taste. Some traditional food crops may be only consumed in a small region or by one or a few communities. In Africa, Asia, and South America, wide diversity of wild traditional food plants, which were part of traditional food systems is found. This diet combination included root and tuber vegetables, cereals, leafy vegetables, pulses, seeds, fruits, tree barks, beverages, and many other plant foods. Healthy and nutritious food were one of the necessary needs humans ever demanded. Indigenous people of various regions in the world faced many challenges in their community history, such as food shortage, nutritional insecurity, crop failure, malnutrition, natural disasters, unfavorable weather patterns, and hunger. They developed a diverse, nutritional, and multipotential dietary system by integrating local food items to ensure their food security for the large populations. Food systems reflect the environmental specialties of the dwelling places; the locally available food crops or traditionally cultivated wild food crops were most apt for the existing climate conditions. In many parts of the world where climatic and edaphic

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conditions were very challenging for agriculture, many of the crops which were part of TFS were cultivated or naturally grown. They nourished and sustained the people over generations. This chapter summarises traditional food systems based on wild food plants from across the globe that are based on wild food plants. It also discusses the preparation, significance and medicinal importance of some of the traditional foods prepared from wild food plants.

Keywords Wild food plants · Traditional food systems · Traditional food crops · Food security

4.1 Introduction

Tradition is a wider term that can be expressed in many ways, as a part of a religious program or an event in a family or as a function of time scale. The traditional food system (TFS) is sometimes related to the local food, indicating their ingredients and how they are made (Cayot 2007). Wide varieties of locally available food plants are the basis of culturally acceptable TFS followed by various indigenous groups across the world (Kuhnlein and Receveur 1996). TFS not only meet the requirement of a healthy diet but also act as medicines due to the presense of important bioactive compounds. According to Indian philosophy, food is the gift of Paramathma (God), and it should be for the survival, strengthening, and nourishment of the body (Bhat 2012). The Siddha system of medicine (a traditional medicinal system in India) was based on the theory that "**Food is Medicine and Medicine is Food**" (Sivaraman and Rajalakshmi 2005). Traditional food systems possess multidimensional aspects, which include cultural and economic significance (Trichopoulou et al. 2006). The usage of wild food plants (WFPs) by humans has a long history (Zohary et al. 2012). With the changing lifestyles and standards, attitude towards food and its ingredients also changes (Sproesser et al. 2019).

The identity and characteristics of the TFS of each indigenous group are preserved by the verbal transfer of traditional knowledge from generation to generation (Kuhnlein et al. 2009). The proper usage of underutilized and orphan wild plants can contribute to the well-being of a society in terms of health, economy, and livelihood (Romojaro et al. 2013). The food culture of a society greatly depends on the locality of origin, and their livelihood depends on the crops they cultivate (Wahlqvist and Lee 2007). Traditional food crops are plants that have historically remained an integral part of the farming system and dietary patterns in the world for long years but were later neglected and underutilized over time (Muthoni and Nyamongo 2010). Being more connected to nature, tribal communities have developed immense knowledge about traditional crops and their uses. There are many tribal communities with vast diversity in their cultures, environments, and in their traditions. These communities and numerous indigenous foods that still exist in their environment showcase and reflect the rich biodiversity which can be used to promote food security, nutrition, and health (Ghosh-Jerath et al. 2016). Nutritional, environmental, economic, and sociocultural values are considered key components of sustainable

food systems (Akinola et al. 2020). Nowadays, wild traditional food crops are greatly accepted by the common people because of their significance in terms of key components of food security. The large variety of wild food crops is part of rural because of their affordability and nutritional security (Ray et al. 2020). Wild food plants are still widely used by indigenous communities across the globe. They prepare special dishes from the wild food plants that comprise their wild food plant based traditional food systems. As the WFPs are directly collected from the wild, these TFSs are not very common in the urban areas. This chapter summarises traditional food systems from across the globe that are based on wild food plants. This chapter is an attempt to provide a glimpse of the huge diversity and richness of the wild food plant based traditional food systems from across the globe. Examples of various TFS are taken from various different countries. This chapter further provides details about the preparation and the significance of the traditional foods (TFs) from the WFPs. This chapter also explores the health benefits of some of the TFs obtained from WFPs with examples.

4.2 Wild Food Plants

Wild foods have been consumed by humans since prehistoric times (Grivetti and Ogle 2000), but their importance in the human diet declined after the introduction of agricultural practices and the industrial revolution (Łuczaj 2010; Łuczaj et al. 2013). The low presence of wild food crops in urban diet makes their importance less in urban diets (Bharucha and Pretty 2010). Wheat, maize, and rice contribute to majority of the human calorie requirements (Fanzo et al. 2020). Wild food plants are used for many purposes other than a food source in many countries. Khatri et al. (2017) have emphasised the need to recognise the importance of the wild foods for nutritional security. In Nepal, of 62 wild food plants, 80% are used for other purposes like thirst quenchers, flavourants, and honey beers (Shrestha and Dhillon 2006). Many of the wild plants are also used for the treatment of livestock diseases (Mafimisebi et al. 2012). Huge diversity of wild food plants is still consumed by the indigenous communities (Ray et al. 2020). These wild food plants are mostly collected from the wild seasonally and sometimes they are also processed and used offseason. Several studies have documented the wild food plants from various regions of the world. Guarrera and Savo (2016) have documented 276 wild taxa distributed in 40 families in Italy. Another study also reported 357 taxa belonging to 72 families in Tuscany, Italy (Baldi et al. 2022). Wild food plants are also sold in the markets in some countries. A study by Łuczaj et al. (2021) recorded 110 species of wild edible plants being sold in the markets of Luang Prabang, Lao PDR. Several WFPs are also used ad spices and herbs (Motti 2021). Pawera et al. (2020) have documented usage of 106 WFPs in West Sumatra, Indonesia. This study further found that there is a decline in the usage of WFPs in the past. A study by Thakur et al. (2020) recoreded usage of 49 edible plants belonging to 24 families among

Gaddis (ethnic, tribal group spread across Himachal Pradesh and Jammu and Kashmir, India) of Himachal Pradesh.

4.3 Traditional Food Systems Based on Wild Food Plants

A wide variety of TFS based on wild food plants exists among different tribal groups in the world (Devi and Suresh 2012). Traditional foods have their own significance in current dietary patterns (Trichopoulou et al. 2007). By definition, traditional foods mean 'the food product with specific raw materials and recipes which is known for a long time and made through specific processes' (Cayot 2007). The TFS is not only significant due to its health benefits but also plays a pivotal role in socioeconomic and cultural aspects (Kuhnlein et al. 2006). The diversity in the traditional foods among the indigenous group is proportional to their nutrient intake. A study done by Roche et al. (2008) among people of Awajun in the Peruvian Amazon indicates the positive relationship between traditional food diversity and nutrient intake by considering the Traditional Food Diversity Score (TFDS) (Roche et al. 2008). The studies on traditional foods enable the understanding of how much knowledge the tribal groups possess and how much effort they made to make each traditional diet (Inamdar et al. 2005). Women of tribal communities have a significant role in the protection and promotion of their indigenous foods. The production of indigenous foods of Northeast India, like *Kinema, Tungrymbai, Hawaijar, Aakhone, Bekang,* and *Peruyyan* are exclusively done by women of different tribal groups of Northeast India. The indigenous knowledge of the production of these foods is inherited from mother to daughter only (Tamang et al. 2009). In some countries like Nepal, the technologies and methods behind the production of traditional foods are exclusively done by specific ethnic communities (Dahal et al. 2005). Table 4.1 presents a list of traditional foods that are mainly prepared from wild food plants or uses any ingredient of wild food plant origin. This chapter provides traditional food names and their preparation and the ingredients used along with the significance of these traditional foods. Some examples of non wild food plants but greater importance as traditional food systems are also included in the table to emphasise on the importance and diversity of the local traditional food systems that have huge regional importance. Some traditional foods presented in the table also show meat as an important part but uses some plants either as spice or flavour or for any other purposes. This table is not extensive but a representative of the diversity of traditional food systems. There are many such examples from various parts of the world. Many databases can be created to document the wild food plant based traditional foods.

Table 4.1 A cross-continental overview of traditional food systems based on wild food plants

Sl. no.	Country/ state	Traditional food	Preparation	Significance	Reference
Asia					
1	Indonesia	Brongkos	Combination of meat stew with tofu and black-eyed peas, cooked with coconut oil	Important dish of Indonesian cuisine	Harmayani et al. (2019)
		Pecel	A mixture of boiled carrot, spinach, and sprout with peanut sauce	Contain bio-active compounds	
		Sayur Tempe Lombok lijo	The soup consists of tempe, green chili, and coconut oil	An alternative source of protein	
		Gulei rebung	Fermented bamboo shoots are mixed with coconut milk and spices		Tamang et al. (2009)
		Sayur ladeh	Fermented bamboo shoots are mixed with vegetables		
		Lun-pia	Fried fermented bamboo shoots are mixed with vegetables		
2	India	Ushoi	Pieces of the inner core of bamboo soaked in water	Can be used to make other bamboo-based food and can be used in off season by drying	Nongdam and Tikendra (2014)
		Iromba	Chutney made up of processed bamboo shoots		Nongdam and Tikendra (2014)
		Sobium	Fermentation of thin sliced juvenile bamboo shoots	Traditional food of Manipur	Premlata et al. (2020)
		Hawaijar	Fermented soybeans	Alternative source of proteins	Devi and Suresh (2012)
		Ambali	Fermentation of finger millet flour	Rich in calcium and amino acids	Sarkar et al. (2015)
		Tambittu	Made from roasted and milled foxtail	Traditional festival sweet of North Karnataka	Inamdar et al. (2005)

(continued)

Table 4.1 (continued)

Sl. no.	Country/ state	Traditional food	Preparation	Significance	Reference
		Vatte pudi/Esluli pudi	Fine powder of *Artocarpus gomezianus* Wall. ex Trecul (Monkey Jack) with 2–3% of cooking salt	Powder is used as an alternative to Tamarind	Sarala and Krishnamurthy (2014)
		Rabdi	A mixture of flour of barley, pearl millet, and corn with buttermilk	A cereal-based fermented food, rich in lactic acid bacteria	Blandino et al. (2003)
		Sinki	Fermentation of radish roots	Traditional local food of Sikkim	Sundriyal et al. (2004)
		Kinema	Fermented soybean seeds	Traditional food prepared by women of *Limboo* and *Rai* caste of Sikkim	Tamang et al. (2009)
		Aakhone	Fermented soybean seeds	Traditional food of Nagaland	Mao and Odyuo (2007)
		Anishi	Dried cakes made by grinding fermented *Colocasia* leaves	Traditional food of *Ao* tribe of Nagaland	Mao and Odyuo (2007)
		Dawl rep	Air or fire dried leaves of Taro (*Colocasia esculenta*)	Traditional foods of Mizoram	Lalmuanpuii (2021)
		Antumbu Mung	Young shoots and leaves of *Brassaiopsis hainla* are boiled in water for about 15–30 min, water removed, served along with chilies and salt		
		Tawkte buhpawk	Green fruits of *Solanum indicum* is mixed with boiled rice, along with salt and baking soda		

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Table 4.1 (continued)

Sl. no.	Country/ state	Traditional food	Preparation	Significance	Reference
		Hulhu Zeu	Boiled tender leaves and shoots of *Aganope thyrsifolia* is deep fried and mixed with salt, onion, and garlic		
		Meihle Tlak	Boiled tender shoots of *Caryota mitis* are mixed with smoked roselle leaves, and served along with salt and chili		
3	China	Sufu	Prepared from fermented soya milk by using *Actinomucor elagans*	High amount of vitamin B12	Li et al. (2004)
		Douchi	Fermentation of steamed soybean	Antioxidant activity	
4	Nepal	Masyaura	Sun-dried fermented vegetable balls made with black gram and *Colocasia* tuber	Legume and tuber-based fermented food. Rich in vitamin B complex	Dahal et al. (2003)
		Mesu	Pickle made from tender edible bamboo. Mixing of sliced and fermented bamboo shoots with chilies and salt	Sour taste and strong ammonical odor	Tamang et al. (1988)
5	Turkey	Boza	Millet semolina is boiled with water, added sugar and fermented to obtain a thick yellow liquid	Nutritious and healthy beverage useful in digestion	Arici and Daglioglu (2002)
6	Japan	Miso	Soya beans or rice or barley are fermented with *Aspergillus oryzae* (koji mold) and salt is added to make a thick paste	Traditional and staple food of Japanese diet	Murooka and Yamshita (2008)
7	Thailand	Kapi	Small fish or shrimp is mixed with salt in a bamboo basket and left overnight and later dried in broad	Healthy traditional and low calorie dish	Yongsmith and Malaphan (2016)

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Table 4.1 (continued)

Sl. no.	Country/ state	Traditional food	Preparation	Significance	Reference
			daylight on a bamboo mat. It is then grinded to fine paste and fermented in clay pot for about 4 months		
8	Sri Lanka	Kiribath or milk rice	Rice is cooked with coconut milk until a thick paste is formed. It can be made into shapes and cut into pieces	Traditional and ethnic food	Mihiranie et al. (2020)
9	South Korea	Chungkookjang	Soaked soybeans are steamed for 5–7 h. After cooling, it is fermented for 2 days with boiled rice straw by covering on the soybeans	Traditional Korean food with high amounts of fatty acids and essential amino acids	Hong et al. (2012)
10	Philippines	Bagoong	Shrimp or fish fry is mixed with salt and fermented for 3–-12 months to obtain a fine paste	Traditional and regular dish	Montaño et al. (2001)
11	Vietnam	Thit lon chua	Grilled pork is chopped into thin slices to which roasted rice powder, salt, sugar and spices are added and fermented for 3–5 days at 30 °C to obtain a sour tasting yellowish brown product	Traditional fermented meat product	La Anh (2015)
12	Singapore	Laksa	Thick vermicelli made of rice is cooked with a gravy curry containing laksa leaves, coconut milk, tiny dried prawns and spices	Traditional and popular dish	Catherine Henderson (2014)
13	Malaysia	Otak	Fish flesh added with tapioca flour, eggs, little coconut milk, sugar, salt, kaffir lime leaves and other spices is	Traditional orange colored fish cake which is nutritious and has antioxidant properties	Harmayani et al. (2019)

(continued)

Table 4.1 (continued)

Sl. no.	Country/ state	Traditional food	Preparation	Significance	Reference
			wrapped in a banana leaf and grilled		
14	Pakistan	Barian	Meat, gram flour, and salt are mixed with spices and air dried followed by sun drying	Local dish popular in rural areas	Mushtaq et al. (2012)
15	Maldives	Rihaakuru	Gutted tuna fish is boiled in salt water for 45 min and after removing cooked fish the leftover soup is cooked until a thick a paste is obtained	Traditional side dish	Naila et al. (2011)
16	Qatar	Laban or leben or lban	Fermented milk is churned to separate butter and the left-over liquid is consumed as laban	Traditional dairy product	Hassan et al. (2018)
17	Iran	Shir-Berenj	Washed rice is boiled with water, sugar, milk, and cardamom seeds for 20–30 min and then cooled and served	Traditional rice pudding	Gharibzahedi (2018)
18	Bangladesh	Jilapi	Curd fermented wheat flour is put in hot oil in spiral shape and deep fried followed by soaking in sugar syrup	Traditional dessert	Hossain and Kabir (2016)
19	Myanmar	Laphet	Steamed tea leaves are packed in clay pots and fermented with limited air for 3–4 months	Traditional snack and side dish	Bo et al. (2020)
20	Iraq	Khobz	Wheat flour dough is added with starter culture (ripened dates soaked in water overnight) and fermented overnight and then baked to form a sour bread	Traditional thick and sour bread	Muhialdin et al. (2022)
21	Bhutan	Datshi	Fermented milk/dahi is churned to obtain	Traditional dairy product	Rai et al. (2016)

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Table 4.1 (continued)

Sl. no.	Country/ state	Traditional food	Preparation	Significance	Reference
			mohi which is then boiled till formation of clumps to obtain datshi		
Africa					
22	Ethiopia	Injera	Cooking the batter made up of primary and secondary fermented teff flour (*Eragrostis tef* Zucc) in a hot clay plate	Source of minerals and vitamins	Neela and Fanta (2020)
23	Nigeria	Efo riro	Soup made up of Spinach (*Amaranthus hybridus*) and Tomatoes (*Solanum lycopersicum*)	Antioxidant capacity	Tchokouaha et al. (2015)
		Akara	Cowpea flour is pasted and deep fried into ball like shape	Source of micronutrients like iron and zinc	McWatters (1983)
		Ayaraya oka	Mixture of corn, pigeon pea, vegetables, and palm oil	Contain vitamin A, iron, and zinc	Okeke et al. (2008, 2009)
24	Algeria	Klila	Fermented cheese prepared by mild boiling of Lben (a fermented milk beverage) until it becomes curdled and then drained using a cotton cloth	Popular, authentic and traditional cheese made by artisanal processes	Leksir et al. (2019)
		Smen/Dhan	Fermented butter made either by salting Zebda (butter) or by modera	Ethnic and traditional dairy product, flavoring agent, also used for therapeutic purpose for treating flu, burns, headache, migraine, and eczema	Boussekine et al. (2020)
		Traditional couscous or seksu	Durum wheat semolina is steamed and dried which is then	Traditional and staple food of north African regions usually	Chemache et al. (2018)

(continued)

Table 4.1 (continued)

Sl. no.	Country/ state	Traditional food	Preparation	Significance	Reference
			cooked with oils and vegetables	made during festivals and gatherings	
25	Libya	Fasolia	White beans are boiled with onion, garlic, tomato sauce, few spices, and sandwiched in wheat bread	Traditional fast food	Buzgeia et al. (2021)
26	Morocco	Bubanita/ boubanita	Small cut pieces of lamb meat is seasoned with spices and dried and fermented in the lumen of lamb in shade	Traditional meat product eaten along with pasta or vegetables	Benkerroum (2013)
27	Tunisia	Kadid	Small slices of beef are added with olive oil, salt and garlic, and sun dried	Traditional meat product usually used in winters	Essid et al. (2007)
28	Egypt	Falafel	Faba beans, onion, garlic, cumin seeds, and salt are made into paste balls and deep fried	Traditional and staple diet	Hefni and Witthöft (2014)
		Rayeb	Raw milk of buffalo is fermented at room temperature until it is coagulated	Traditional milk product especially in rural areas	Abd El Gawad et al. (2010)
29	Ghana	Yakayake	Cassava roots are grated, dried, sieved, salted and made into a spongy ball or cake by steaming	Traditional food of Ghana	Lancaster et al. (1982)
30	Namibia	Oskikundu	Flour of pearl millet and sorghum malt are cooked and fermented to obtain a faintly viscous greenish-brown beverage	Nutritious and nonalcoholic beverage	Taylor and Emmambux (2008)
31	Niger	Kilichi	Thin and flat straps of boneless meat is sun dried and marinated with spices and coloring agents which is followed by	Popular and valued meat product both in urban rural areas	Boubacar Seydou et al. (2021)

(continued)

Table 4.1 (continued)

Sl. no.	Country/ state	Traditional food	Preparation	Significance	Reference
			another round of sun drying and at last grilled in wood fire		
32	Chad	Kawal	A paste made by pounding leaves of *Cassia obtusifolia* is put in a clay pot and covered with leaves of sorghum. The pot is tucked under ground except for neck and left for fermentation for 14 days (hand stirring once in 3 days) and then sundried	Substitute or replacement for meat	Mbaiguinam et al. (2005)
33	Sudan	Kisra	Flat, thin bread made from fermented sorghum, roasted/ pounded chickpeas and sugar/salt	Staple and traditional food of Sudan and nutritious for infants	Badi et al. (1990)
34	South Africa	Mahewu (Magou)	Maize flour is made into thin porridge and boiled. After cooling, a small amount of wheat flour is put and left for fermentation in a sunny place	Traditional, fermented and nonalcoholic beverage	Hesseltine (1979)
35	Kenya	Kimyet (ugali)	Maize or sorghum or millet flour is mixed with water and boiled to make a thin porridge	Staple and traditional food and recommended for pregnant women	Riang'a et al. (2017)
36	Zambia	Munkoyo	Maize flour is boiled with water for several hours and roots of *Rhynchosia* are added and left for fermentation for about 2 days	Traditional, fermented and nonalcoholic beverage	Chileshe et al. (2020)
37	Uganda	Inya	Inyaasa (dried and powdered fermented cassava) is boiled in water and stirred until it becomes a hard cake	Traditional food of Lughbara ethnic group of Uganda	Amone (2014)

(continued)

Table 4.1 (continued)

Sl. no.	Country/ state	Traditional food	Preparation	Significance	Reference
		Akalo	Cassava and millet flour mixed in hot water in a pan and then served in baskets	Energy food of Banyoro and Batooro groups in Uganda	Tumuhe et al. (2020)
38	Zimbabwe	Masau	The ripened fruits of *Ziziphus mauritiana* (buffalo thorn) are pounded and left for fermentation after adding some water	Traditional fruit-based fermented beverage	Gadaga (1999)
39	Tanzania	Porridge	Whorl pearl millet flour, salt, water or Whorl finger millet flour, sugar, water	Less fat comparatively good fiber content	Kulwa et al. (2015)
Australia					
40	Fiji	Duruka	Unopened flower of sugarcane is cooked with coconut milk	Traditional Fijian dish	Lim (2014)
41	Papua New Guinea	Mone	Sago starch is made into dumpling and cooked with coconut cream	Traditional dessert or dumpling	Macintyre (1987)
42	New Caledonia	Bougna	Meat, yam, coconut milk and sweet potatoes are wrapped in banana leaves and cooked in a pit	Traditional dish of kanak community	Anderson (2013)
Europe					
43	Germany	Sauerkraut	White cabbage leaves are sliced into pieces, salted and fermented	Traditional fermented vegetable dish	Peñas et al. (2010)
44	Ukraine	Uzvar	Fruits like apples, plums, and cherries are dried and boiled with water and honey	Traditional fruit based dish	Costa et al. (2013)
45	France	Camembert	After adding rennet to cow milk, whey is drained and coagulam is collected which is then added with salt and *Penicillium*	Traditional cheese from cow milk	Boisard (1991)

(continued)

Table 4.1 (continued)

Sl. no.	Country/ state	Traditional food	Preparation	Significance	Reference
			candidum and left for ripening for 2 weeks		
46	Austria	Krautfleckerl	Cabbage, noodles, onions, and bacon are cooked with added flavors of caraway and white wine	Traditional noodle recipe	Weichselbaum et al. (2009)
47	Bulgaria	Dko ot rozi	Rose petals are dried and boiled with water, sugar and citric acid	Traditional rose jam	Albuquerque et al. (2013)
48	Georgia	Churchkhela	Walnuts are put on a string and dipped in paste made out of white grapes and wheat flour and dried	Traditional sweet dish	Costa et al. (2013)
49	Russia	Kefir	Milk is added with kefir grains and fermented for 1 day	Nonalcoholic beverage having wound healing and anti-cancerous properties	John and Deeseenthum (2015)
50	Italy	Brasato al Barolo	Ox meat soaked for 12 h in 2 L of Barolo wine is cooked with herbs and vegetables	Traditional cuisine of Italy	Weichselbaum et al. (2009)
51	Romania	Socata	Elderberry flowers are fermented with sugar, yeast, water, and lemon juice	Traditional fruit based beverage	Albuquerque et al. (2013)
North America					
52	Mexico	Sopes	Corn flour dough cake deep fried and topped with meat and vegetables	Traditional snack	Chiu et al. (2021)
53	Canada	Poutine	Potato fries and cheese curd are mixed with a special gravy and tossed	Traditional Canadian recipe	Fabien-Ouellet (2016)
54	New York	Pastrami	Beef brisket is cured for 6 days and smoked for 4 h and flavored with black pepper	Traditional meat dish	Cardoso et al. (2020)

(continued)

Table 4.1 (continued)

Sl. no.	Country/ state	Traditional food	Preparation	Significance	Reference
South America					
55	Venezuela	Arepa	Corn flour is mixed with water and salt, dough either baked at 400 °C for 4 min or fried in soybean oil	Traditional food of Venezuelans	Alvarez (1981)
56	Brazil	Feijoada	Bacon, garlic, and onions are fried until brown and ingredients such as black beans, different types of meat, orange slices, and cassava flour are added and cooked for about 4 h	Traditional dish rich in protein	Faller et al. (2012)
57	Chile	Curanto	Nalca leaves are layered with ingredients like shellfish, chicken, potatoes, and other spices and cooked slowly for hours in a clay vessel	Traditional fish recipe	Daughters (2016)
58	Argentina	Asado	Different types of meat cuts are grilled with sausages	Traditional meat dish usually prepared by men	Zycherman (2008)

4.4 Wild Food Plant-Based Traditional Foods as a Source of Healthy and Nutritious Diets

The transition from traditional foods to fewer nutrient-based foods significantly increased the percentage of people who have been suffering from noncommunicable chronic diseases (Batal et al. 2005). The addition of a small number of traditional foods to the diet can considerably increase the nutritional quality of the diet (Schuster et al. 2011). Many wild food plants are also used as medicines (de Medeiros et al. 2021). The traditional foods which are produced by microbial fermentation have their own nutritional benefits because of higher concentrations of proteins, amino acids, and vitamins (Sha et al. 2013). Traditional fermented foods effectively work against diarrhea through their antimicrobial properties (Watson et al. 1996). The underutilization of traditional foods among indigenous people created many health issues like malnutrition, underweight, stunting, and

micronutrient deficiencies (Kuhnlein et al. 2009). Even though traditional foods function as a source of a healthy and nutritious diet, the environmental contaminants in traditional foods create problems related to health. The contaminants like heavy metals reach traditional foods mainly through local and long-range transport avenues (Kuhnlein and Chan 2000). Table 4.2. provides examples of the health benefits of some of the wild food plants that are part of traditionall foods. This table also provides the part of the plant used and the important nutritional component of the plant. Figure 4.1 provides an overview of the various activities associated with the wild food plants such as collection, marketing and processing. This figure also depicts the major roles of WFPs and the WFP based traditional food systems.

4.5 Traditional Food Systems and Food Security

"Food security exists when all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food that meets their dietary needs and food preferences for an active and healthy life" (FAO 2002). Physical availability of food, economic and physical access to food, food utilization, and stable food access are four dimensions of food security. The disturbance of any of these or all results in food insecurity (FAO 2008). The utilization of indigenous knowledge of the TFS, and its in integration with the current food systems, can effectively improve food security (Elliott et al. 2012). For the survival of human beings, the consideration of agricultural biodiversity along with the conventional systems is very critical (Millennium Ecosystem Assessment 2008). Several countries are very rich in their traditional foods. For example, South Korea's Kimchi is very famous traditional food. Nutritionally, kimchi is rich in vitamins, fiber, minerals and other important nutrients (Cheigh et al. 1994).

The TFSs are getting more attention nowadays, which contributes to food nutrition and health (Chyne et al. 2019). Compared with common cultivars, traditional food serves as a good source of macro and micronutrients (vitamins A, D, C, and minerals such as iron, calcium, and zinc) (Ghosh-Jerath et al. 2015). The reports state that traditional foods have a higher nutritional value than market foods (Elliott et al. 2012). According to the FAO (Food Agricultural Organization), the world produces sufficient amounts of food for the global population. Wheat, barley, and rice are the main food crops in the international market. A comparison of modern dietary guidelines and agricultural production statistics reveals that although we are consuming energy rich crops, they lack micro and macronutrients (Borelli et al. 2020a, b). Diversification of the diets with traditional plant-based foods is one way to address the challenges of rapidly emerging diet- and lifestyle-related noncommunicable chronic diseases (NCDs) in indigenous communities around the world. Indigenous communities must rebuild native ecosystems, use traditional food crop cultivation methods, and revitalize traditional knowledge of food preparation, processing, and preservation in order to combat an NCD epidemic. A number of

Table 4.2 Health benefits of wild food plants that are used for the preparation of traditional foods

Sl. no.	Country	Wild food plant	Parts used	Health benefits	Remarks on nutritional/ phytochemical composition	References
Asia						
1.	Indonesia	*Arenga pinnata* (Wrumb) Merr.	Fruit	Beneficial to gastrointestinal tract function	High fiber content	Harmayani et al. (2019)
		Arachis hypogaea L.	Seeds	Reduce cholesterol level, prevent bacterial infections	Omega fatty acids, arginine	Harmayani et al. (2019)
		Cyclea barbata Miers	Leaves	Treatments for fever, gastric inflammation, nausea, and hypertension. Antioxidant and anticancer property	Carotenoids and flavonoids	Harmayani et al. (2019)
		Kaempferia galanga L.	Rhizome	Prevent dry cough, fungal infections, diphtheria, and gonorrhea	Pinostrobin, hydroxy panduratin A, panduratin A	Wang et al. (2021)
2.	Thailand	*Alpinia galanga* L.	Rhizome	Used for osteoarthritis, has antitumor and anti-inflammatory property	Acetoxychavicol acetate, ρ-hydroxycinnamaldehyde	Pengseng et al. (2010)
		Centella asiatica L.	Leaves	Wound healing, skin treatment, and antimicrobial	Pentacyclic terpene derivatives, asiaticoside, and madecassoside	Brinkhaus et al. (2000)
		Aegle marmelos L.	Leaves, root and fruit	Used for gastrointestinal diseases, gynecological dysfunctions	Steroids, terpenoids, flavonoids	Patkar et al. (2012)
		Parkia speciosa Hassk	Seeds	Antioxidant	Polyphenol, phytosterol, and flavonoids	Kamisah et al. (2013)
3.	India	*Solanum spirale* Roxb.	Leaves and fruits	Treating fever and stomach ache	Rich in vitamin C and crude lipid	Kalita et al. (2014)
		Acacia catechu (L. f.) Willd	Bark	Antibacterial, antidiabetic and antioxidant properties	Polyphenol and flavonoids	Aryal et al. (2021)
		Oxalis corniculata L.	Leaves	Antiepileptic, antioxidant and antitumorigenic		Kathiriya et al. (2010)

(continued)

Table 4.2 (continued)

Sl. no.	Country	Wild food plant	Parts used	Health benefits	Remarks on nutritional/ phytochemical composition	References
		Basella rubra L.	Leaves	Antidiabetic, hypoglycemic, and antioxidant	Rich in fiber	Mensah et al. (2008); Nirmala et al. (2011)
		Cocculus hirsutus (L.) W.Theob.	Leaves	Antidiabetic and antihepatotoxic	Isoquinoline alkaloids and triterpenes	Badole et al. (2006); Sangameswaran and Jayakar (2007)
Africa						
4.	Kenya	*Vigna unguiculata* L. Walp.	Seed and leaf	Used for gastrointestinal disorders 21, cardiovascular diseases, hypercholesterolemia	High protein content	Jayathilake et al. (2018)
		Cajanus cajan L.	Seed	Flower used for treating ailments such as bronchitis, coughs, and pneumonia	Rich in protein calcium and iron	Singh (2016)
5.	Morocco	*Opuntia ficus-indica* (L.) Mill.	Seeds and fruits	Antioxidant activity	Rich in macroelements and minerals	Ghazi et al. (2015)
		Opuntia dillenii (Ker Gawl.) Haw.	Seeds and fruits	Antioxidant activity	High Zn and linoleic acid content	Ghazi et al. (2015)
6.	South Africa	*Kedrostis africana* (L) Cogn	Tuber	Antidiuretic	Rich with minerals	Unuofin et al. (2017)
Australia						
7.	New zealand	*Sonchus asper* (L.) Hill	Leaves and stem	Protection against infectious disease	High vitamin C and phenolic compounds	Rush et al. (2010)
8.	Papua New Guinea	*Pandanus brosimos* Merr. & L. M.Perry	Nut	Antidiuretic, antidiabetic, and antioxidant	Isoflavones and coumestrol	Borelli et al. (2020a, b); Gurmeet and Amrita (2015)
9.	Fiji	*Colacasia esculeta* (L.) Schott	Tuber	Antimicrobial, antioxidant, and anticancer		Chand et al. (2018)
			Fruit	Anxiolytic, antioxidant, and antidiabetic		Chand et al. (2018)

Europe						
10.	Italy	*Achillea erba-rotta* All.	Flower	Anti-inflammatory and antibacterial		Mattalia et al. (2013)
		Malva sylvestris L.	Flower and leaves	Used for digestive problems		di Tizio et al. (2012)
		Parietaria judaica L.	Aerial parts	Used for treating hemorrhoids		di Tizio et al. (2012)
11.	Ukraine	*Helichrysum arenarium* (L.) Moench	Flower	Antiseptic, used in the treatment of tuberculosis and hepatitis		Stryamets et al. (2015)
12.	Russia	*Vaccinium myrtillus* L.	Fruit	Treatment of eyes and stomach diseases	Vitamin rich	Stryamets et al. (2015)
13.	Poland	*Corylus avellana* L.	Nuts	Antioxidant, cardioprotective, anti-inflammatory and hypolipidemic	Rich in flavonoids and polyphenols especially *p*-coumaric acid	Król et al. (2020)
14.	Spain	*Anchusa azurea* Mill.	Leaves	Antidiarrheal and used in treatment of urinary tract infections		Rivera et al. (2005)
15.	Portugal	*Foeniculum vulgare* Mill.	Leaves	Helps in digestion		Carvalho and Morales (2010)
16.	Greece	*Origanum dubium* Boiss.	Aerial parts	Antistress, antipyretic and good for digestion		Della et al. (2006)
17.	Austria	*Rubus idaeus* L.	Twigs and leaves	Good for hematopoiesis, cold, and fever		Sõukand and Kalle (2013)
North America						
18.	Mexico	*Portulaca oleracea* L.	Leaves, stem and flowers	Antifungal, antibacterial, antiscorbutic, and contraceptive properties	Ascorbic acid and iron content is present	Angelica et al. (2011)
		Anoda cristata (L.) Schltdl	Leaves	Reduce balding, heal lacerations, and stomach infections	Rich in iron, retinol, and ascorbic acid	Angelica et al. (2011)
19.	Canada	*Acer pensylvanicum* L.	Bark	Cold, cough, and bronchitis treatment	Allantoin phytochemical	Arnason et al. (1981)

(continued)

Table 4.2 (continued)

Sl. no.	Country	Wild food plant	Parts used	Health benefits	Remarks on nutritional/ phytochemical composition	References
		Juglans cinerea Liebm.	Nut	Emetic and purgative	High amounts of iron	Arnason et al. (1981)
20.	Cuba	*Bromelia pinguin* L.	Fruit	Anthelmintic		Volpato and Godinez (2006)
21.	Panama	*Chamaedorea tepejilote* Liebm.	Male inflorescence	Antidiabetic and anti tussive	Rich in vitamin C and iron	Andrews et al. (2018); Michon (2012)
South America						
22.	Argentina	*Citrus aurantium* L.	Fruit	Used in treating respiratory infections		Kujawska and Łuczaj (2015)
23.	Brazil	*Anredera cordifolia* (Ten.) Steenis	Leaves	Heals intestinal and stomach ailments		de Medeiros et al. (2021)
24.	Chile	*Sarcocornia neei* (Lag.) M.A. Alonso & M.B. Crespo	Leaves	Antioxidant properties	Rich in proteins and poly-unsaturated fatty acids	Riquelme et al. (2016)
25.	Peru	*Bejaria resinosa* Mutis ex L.f.	Leaves	Anti-inflammatory and used in controlling female matrix infections		Torres-Guevara et al. (2020)

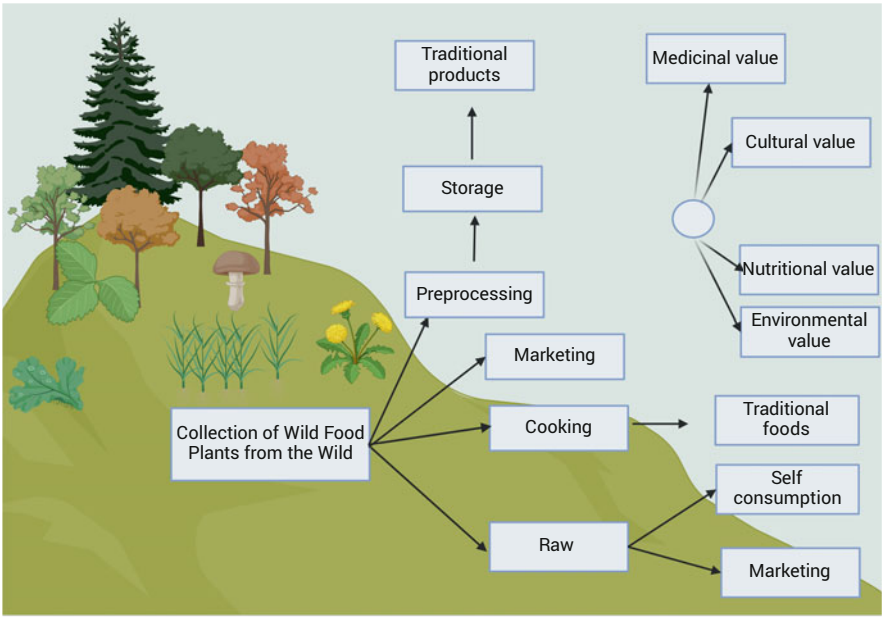

Fig. 4.1 Main activities associated with wild food plants such as collection, processing and marketing and the roles of the wild food plants and the traditional food systems based on them

traditional plant-based foods are rich in bioactive compounds with diverse health benefits that are relevant to human health (Sarkar et al. 2020).

4.6 Cultural Importance of Traditional Food Systems

The food available from local resources that are culturally accepted are termed traditional foods; they may contain a wide range of plants and animals (Kuhnlein and Receveur 1996). These foods provide the essential nutrients for the sustainability of that community. Traditional food can be accessed by the indigenous people through their local resources. The knowledge about the TFS arises by various means like folk taxonomy, folk medicine, and sociocultural activities (Kuhnlein and Receveur 1996). Activities like harvesting and preparation of foods enable social relationships and knowledge transfer through the gathering of individuals in a community; it also facilitates a spiritual connection with the land (Lambden et al. 2007). TFS allows us to identify the major food in a culture which is obtained through local resources and their importance within the indigenous people. They play an important role in the health of indigenous people. The cultural identity of indigenous people can be identified through their traditional food system (Kwik 2008). Knowledge regarding traditional food systems had a greater role in sustaining

a society in particular geographic areas and building up a healthy group (Bhat 2012). There is a very strong correlation between the type of traditional crops grown in a particular geographical region and the climate in that area. When the balance between these two gets lost, it will lead to the disarray of crop production, resulting in a change in the lifestyle of indigenous people paving the way to remodeling of tribal lifestyle and culture (Maldonado et al. 2014).

4.7 Environmental Importance of Traditional Food Systems

Food systems are complex entities that are not only related to human health and diet but also related to environment (Fanzo et al. 2021). Traditional agricultural food practices show positive signs in the regeneration of biodiversity and make healthy ecosystems (Deaconu et al. 2021). Traditional food crops are capable of growing in poor soil and show environmental plasticity (Chivenge et al. 2015). Considering the environmental adaptability of some traditional food crops, roots and tuber crops are capable of growing in high humidity conditions (Pearce 1990), cowpea is widely adapted to poorly fertile soil (Carvalho et al. 2017) and adapted to high temperature and drought conditions (Hall 2012). Indigenous traditional crops such as cowpea and pigeon pea can improve and restore the fertility of the soil by biological nitrogen fixation (Elowad and Hall 1987). Coarse cereals can be referred to as a good alternative crop for cultivation in stressed climatic and edaphic conditions (Rai et al. 2008; Kaur et al. 2014; Eliazer Nelson et al. 2019). Therefore, we can say that traditional food plants are important in the context of increasing environmental stresses.

4.8 Traditional Food Systems and Climate Change

Climate change makes adverse impacts that have cascading effects on various sectors of human life (Lawrence et al. 2020). The climate change negatively affects the lives of indigenous people around the globe. The disappearance of plant species, alternation of water quality and quantity, and changes in weather and soil all create visible impacts on the traditional food systems of indigenous people (Guyot et al. 2006). Indigenous people depend on a wide variety of plants, animals, and fungi as their food source, and they are also used for medicine, ceremony, and economic benefit. Even the water is also held as sacred by indigenous people. Climate change, along with other unfavorable conditions, affects the relationship between tribes and traditional foods. Traditional food production declines when the ecosystem and water resources are excessively used for other purposes. The ecosystem gets exploited through the pollution and introduction of invasive species and

poor management. Climate change affects the total life cycle of traditional crops - by the affecting pollinators, timing in flowering time, and shift in harvesting time. These changes not only affect the production but also impact the food web (Maldonado et al. 2014).

4.9 Conclusions and Future Prospects

Rural communities across the world are generally identified by their locality, lifestyles, culture, and traditional beliefs they follow. But when considering eating habits, clear differences are visible even in different tribal groups in the same country or nearby states. As we all know, human civilization is closely related to agriculture, and it arises on land suitable for agriculture. It is clear evidence that our ancestors were aware of how food is essential for the our survival. Likewise, the indigenous communities depended on various food crops suitable for cultivating in their locality or available in their forests to balance their energy needs for their hard work. Though the used traditional crop species vary, it can be concluded that all the groups were capable of including proximate components, antioxidants, and various protective secondary metabolites through a diverse diet of tuber, legumes, leaves, fruit, oil seeds, flowers, and other edible parts in their diets. Knowingly or unknowingly, the diet they followed made them healthy, and these natural resources kept away the lifestyle diseases such as diabetes, cancer, increased blood pressure, and cholesterol among them. According to WHO reports in 2005, lifestyle diseases or internationally so-called chronic diseases is the main cause of 61% of global death. An unhealthy diet is one of the reasons for this. So, healthy diet sources are very much important. In the recent years, we have witnessed the increasing importance of traditional foods. Identification, documentation, and improvement of these food crops and integrating them into our diet can be helpful for improving our existing food systems and making it more diverse. Identification of the plants with significant properties such as anti-cancer, anti-inflammatory, and antimicrobial can open new opportunities for drug development. In the future, more studies on the nutritional and pharmacological properties of these wild plants and the traditional foods based on them are needed.

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