CHAPTER 3

Traditional functional food of Sri Lanka and their health significance

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Contents

3.1 Background of Sri Lanka and its diversity of food

Sri Lanka is an island country in South Asia, located in the Indian Ocean to the southwest of the Bay of Bengal and to the southeast of the Arabian Sea. As shown in Fig. 3.1, the country is historically and culturally intertwined with the Indian subcontinent, but it is geographically separated by the Gulf of Mannar and the Palk Strait. The climate of Sri Lanka is tropical and warm, due to the moderating effects of ocean winds. It has an ancient cultural heritage spanning of 3000 years, with evidence of prehistoric human settlements dating back over 125,000 years. Sri Lanka is very similar to many of the other tropical countries possessing a wide range of plant species as well as a significant variability of climatic zones. Although the country is relatively small in size, it has the highest biodiversity density in Asia. In fact, Sri Lanka is part of the Western Ghats biodiversity hot spot that extends southward from Western India (Myers et al., 2000). Between 27 and 33 of Sri Lanka's 453 bird species (Weerakoon and Gunawardena, 2012), 50 of 91 freshwater fish species (De Alwis Goonatilake, 2012) and 95 of 111 amphibian species are endemic (Manamendra-Arachchi and Meegaskumbura, 2012); the existence of such biodiversity is evidence to an abundant natural food supply in the country to cater to all the animal species of diverse diets. The country consists mostly of flat lands with mountains existing only in the south-central part of the island. There is a

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Figure 3.1 Location of Sri Lanka relative to India in the South Asian region.

significant diversity of flora and fauna owing to these geographical and climatic landscapes. It is important therefore for Sri Lanka to balance agricultural development and conservation efforts to meet sustainable development goals while at the same time meeting demands to increase national food production (Horgan et al., 2017).

Being a small country, there is easy access to many of the plant-based food material across the island from wherever the population is located. Despite attempts of deforestation and disappearance of habitat in both the lowlands and hill-country, the country still boasts of luscious greenery and dense forests that provide accommodation for many unique species of plants. For generations, many of the plants of Sri Lanka have been consumed for the purposes of disease prevention, cures for ailments, or for maintaining health and wellness (Waisundara and Watawana, 2014a). Owing to the diversity in the flora and fauna in Sri Lanka, the range of diseases that were treated through administration of plants has been numerous as well. Due to the familiarity of widely available medicinal plants, many Sri Lankans can identify the varieties and types of plants growing within their area of residence that are good in preventing disease conditions. In fact, the local people have the habit of growing at least one or two medicinal plants in their backyards, or any available space within their area of residence. It is this age-old habit coupled with the easy access to diverse plant sources that has led Sri Lankans to be more health conscious even in modern times.

The staple diet of Sri Lanka primarily comprises rice (about 300–400 g) (FBDG, 2011) with some vegetables and typically a small portion (about 15 g) of meat or fish

(Jayawardena et al., 2012), or a chicken egg (whole or half) (Karunaratne, 2012). Although the intake of specific quantities from a variety of food is recommended for Sri Lankans (FBDG, 2011), the bulk of the food consumed by the average Sri Lankan can be considered as rice, vegetables, and fruits (Jayawardena et al., 2012). A well-balanced Sri Lankan diet consisting of rice, spicy vegetable curries, and protein sources (pulses or food of animal origin) at recommended portion sizes (FBDG, 2011) could be considered as enriched with dietary fiber and antioxidants and hence has the potential of being a healthy meal. With the growing rate of urbanization in Sri Lanka as well as the increased awareness on nutrition in playing a crucial role in the prevention of chronic diseases, the population of the country have become very concerned about the functional properties of locally available food products. In this aspect, functional food within a Sri Lankan context is considered as not only food necessary for living but also as a source of mental and physical well-being. A food product can truly be regarded as functional, only if it is satisfactorily demonstrated to affect one or more target functions in the body beyond adequate nutritional effects, in a way that is relevant to either the state of well-being and health or reduction of the risk of a disease (Perera and Li, 2012). The increasing interest in functional food in Sri Lanka reflects the fact that epidemiological studies indicating a specific diet or component of the diet is associated with a lower risk for a disease conditions, especially those that are noncommunicable.

It is imperative to mention herein that almost all of the Sri Lankan functional food have had a traditional stance and therefore have been "clinically tested" for years, with their recipes fine-tuned across the generations (Lee et al., 2014); these food products require minimal processing, easing their incorporation into the fast-paced modern lifestyle of urban populations, where diseases related to the diet seem to be comparatively more prevalent. The Sri Lankan functional foods are also mostly plant-based, owing to the geographical features mentioned in the first few paragraphs. There are several categories of traditional food products in Sri Lanka that may be considered as functional. The major types are collectively discussed in this chapter along with their nutritive properties and ability to prevent diseases.

3.2 Rice

Rice is the most commonly consumed cereal and is a staple food by over one-half of the world's population including Sri Lanka. The country holds a rich treasure of agro-biodiversity that harbors many traditional, indigenous, and improved rice varieties containing health benefits (Rajapakse et al., 2000). According to FAOSTAT (2009), in 2008, China was the major rice producer with 187.4 Mio tonnes, followed by Thailand with 32.1 Mio tonnes and Sri Lanka with 3.1 Mio tonnes. Although widely consumed as white rice, there are many special cultivars of rice that contain color pigments, such as black rice, red rice, and brown rice (Sompong et al., 2011). Their names refer to the kernel color (black, red, or purple) that is formed by deposits of anthocyanins in different layers of the pericarp, seed coat, and aleurone (Chaudhary, 2003). Plant pigments as well as other phytochemicals in grains are constantly being attributed to positive nutritional properties, such as prevention of cardiovascular diseases and cancer. In this context, the phytochemical content in Sri Lankan rice varieties is deemed an important aspect of investigation. Premakumara et al. (2013) analyzed the brans of 23 traditional and 12 improved (both red and white) rice varieties in Sri Lanka for antiamylase and antiglycation activities in vitro. It was heartening to observe that the traditional red rice varieties of "Masuran," "Sudu Heeneti," "Dik Wee," and "Goda Heeneti" exhibited significant and dose-dependent antiamylase, antiglycation, and glycation-reversing activities. These varieties had also shown marked antioxidant properties. Studies such as those by Premakumara et al. (2013) could help rice producers in Sri Lanka or food technologists to promote the consumption of rice products by increasing consumer awareness of the health benefits of grains. In this respect, further research could also be directed to the alteration of functional properties through food processing and help find recommended areas for their application in food.

3.3 Leafy greens

Most of the leafy greens that are consumed in vegetable form in Sri Lanka have functional properties. In fact, they have been used in the traditional medicinal system of Sri Lanka for several thousands of years. The traditional medicinal system of Sri Lanka itself, which has more than 3000 years of tested and proven efficacy, is still in use and generally the first approach for disease control by the locals, especially those who have been contracted with the stated diseases (Waisundara and Watawana, 2014b). Recent scientific studies such as that by Lee et al. (2014) have analyzed the antioxidant and starch hydrolase inhibitory properties of many of these leafy vegetables that are also medicinal ingredients of the traditional medicinal system of the country. The contents of antioxidants present in some of the leafy vegetables are shown in Table 3.1. Functional foods are viewed as a novel therapeutic intervention in the West, although food has been viewed as medicine in many of the traditional medicinal systems of the East (Madsen, 2007). Thus many of the leafy vegetables that are presently considered as functional food by definition have in fact been associated with disease prevention for many years in Sri Lanka.

Some of the leafy greens in Sri Lanka are consumed as herbal beverages. Examples of such plants include *Acacia arabica*, *Aegle marmelos*, *Aerva lanata*, *Asteracantha longifolia*, *Cassia auriculata*, *Hemidesmus indicus*, *Hordeum vulgare*, *Phyllanthus emblica*, and *Tinospora cordifolia*. These plants in particular were in fact tested recently by Jayawardena et al. (2015)

Table 3.1 Antioxidant compounds present in 18 selected commonly consumed leafy vegetables in Sri Lanka.

Scientific name of leafy green	Total phenolics content (mg GAE/g FW)	Neoxanthin (μg/g FW)	Viola xanthin (μg/g FW)	Lutein (μg/g FW)	Zea xanthin (μg/g FW)	Lycopene (μg/g FW)	Carotene (μg/g FW)		Tocopherol (μg/g FW)		
							α	β	α	δ	γ
Coccinia grandis	125.1 ± 13.5	39.63	5.95	13.65	7.31	1.12	0.06	0.25	0.08	0.06	0.05
Asparagus racemosus	118.3 ± 13.6	2.61	1.55	5.26	1.32	ND[b]	0.06	3.58	0.45	0.08	6.55
Costus specious	99.8 ± 14.6	32.25	6.21	12.95	6.18	0.95	0.08	0.38	0.19	0.15	0.18
Amaranthus viridis	90.6 ± 9.8	14.81	5.94	3.46	5.49	1.05	1.15	1.16	2.06	1.95	1.88
Annona muricata	86.5 ± 14.8	20.46	6.51	ND	3.54	ND	0.65	0.28	0.41	0.07	0.34
Sesbania grandiflora	82.6 ± 6.5	12.95	12.66	3.44	3.68	ND	0.54	1.68	0.55	0.52	0.41
Desmodium gangeticum	83.4 ± 5.5	10.84	1.29	0.90	0.29	0.05	0.22	0.28	0.09	0.08	0.06
Mimosa pudica	70.2 ± 5.5	9.86	6.57	7.75	ND	0.62	0.19	0.25	0.25	ND	ND
Momordica charantia	69.6 ± 9.6	18.65	2.58	17.64	0.55	0.36	0.21	0.25	0.08	0.06	0.06
Alternanthera sessilis	56.8 ± 5.9	3.69	4.58	4.20	0.69	0.49	0.35	0.47	0.28	0.04	0.06
Artocarpus heterophyllus	54.3 ± 6.9	4.55	6.48	ND	ND	0.61	0.58	0.34	0.07	0.06	0.06
Adhathoda vasica	52.3 ± 8.6	3.19	3.54	6.58	6.47	0.94	0.64	0.85	0.07	0.06	0.05
Psidium guava	51.3 ± 9.2	8.64	3.67	5.50	6.35	0.84	0.38	0.81	0.07	ND	ND
Solanum americanum	48.1 ± 6.9	5.87	4.31	3.84	0.90	0.55	0.20	0.80	0.10	0.08	ND
Gymnema sylvestre	46.1 ± 7.5	14.38	5.64	2.80	1.24	0.47	0.14	0.61	0.84	0.39	0.41
Centella asiatica	40.6 ± 5.9	17.96	3.22	3.64	1.58	1.47	0.26	0.24	0.81	0.37	0.54
Wattakaka volubilis	40.7 ± 6.8	11.38	10.55	4.28	4.20	1.28	1.24	0.34	0.83	0.71	0.69
Ipomoea aquatica	36.4 ± 6.1	9.64	11.68	2.65	ND	0.82	0.34	0.57	0.88	0.24	0.75

Source: Modified from Lee, Y.H., Choo, C., Watawana, M.I., Jayawardena, N., Waisundara, V.Y., 2014. An appraisal of eighteen commonly consumed edible plants as functional food based on their antioxidant and starch hydrolase inhibitory activities. J. Sci. Food. Agric. 95, 2956−2964.

for their antioxidant capacity and the starch hydrolase inhibitory activities as well as their stability of these two parameters in an in vitro digestion model. These herbal beverages demonstrated noteworthy functional properties in this particular study. Another more common form of consuming leafy greens in Sri Lanka nowadays is to incorporate them into porridge. This is a trend of increasing popularity for health and wellness purposes, especially among the younger generation of the country who tend to find the habit of consuming herbal porridge more palatable. When rice gruel is incorporated with minced leaves of the leafy greens, the bitterness and grassy note present in many of the leaves is concealed. Drinking one glass of herbal porridge is considered as an all-in-one breakfast among Sri Lankans as well. Some of the leafy greens that are consumed in porridge form and their purported therapeutic effects are shown in Table 3.2.

Table 3.2 Selected health benefits of some of the most popular leafy greens that are used to prepare porridges in Sri Lanka.

Scientific name of leafy green	Health benefits elucidated through scientific studies
Aerva lanata Linn	Antioxidant (Hara et al., 2018), antiproliferative and apoptotic activity (Anusha et al., 2016), antidiabetic (Akanji, Olukolu and Kazeem, 2018)
Alternanthera sessilis Linn	Antioxidant (Lee et al., 2014), antiinflammatory (Muniandy et al., 2018)
Asparagus racemosus Wild	Antioxidant and starch hydrolase inhibitory activity (Lee et al., 2014)
Astercantha longifolia	Antioxidant (Jayawardena et al., 2015), starch hydrolase inhibitory activity (Jayawardena et al., 2015), and antidiabetic (Fernando et al., 1991; Ediriweera and Ratnasooriya, 2009)
Atlantia ceylanica Linn	Hepatoprotective (Oh et al., 2002), antidiabetic (Senadheera and Ekanayake, 2012)
Centella asiatica Urb	Antioxidant (Lee et al., 2014; Waisundara and Watawana, 2014), starch hydrolase inhibitory activity (Lee et al., 2014), antidiabetic (Ullah et al., 2009), anticancer (Ullah et al., 2009)
Hemidesmus indicus Linn	Antioxidant and starch hydrolase inhibitory activity (Jayawardena et al., 2015)
Lasia spinosa Linn	Antiinflammatory (Deb et al., 2010)
Murraya koenigi Spreng	Antioxidant (Tachibana et al., 2003), hepatoprotective (Gupta and Singh, 2007), anticancer (Kok et al., 2012)
Sesbania grandiflora Pers	Antidiabetic (Ediriweera and Ratnasooriya, 2009; Kumar et al., 2015), antioxidant (Lee et al., 2014; Waisundara and Watawana, 2014), starch hydrolase inhibitory activity (Lee et al., 2014), anticancer (Pajaniradje et al., 2014)

3.4 Spices

Sri Lanka is well known for its plethora of spices—a trade that commenced by their sale to merchants traveling along the ancient Silk Road (Siriweera, 1994). There was great commercial importance placed upon spices as a trade commodity, and Sri Lanka has been identified since ancient times as a hub of high quality spices that carry medicinal value. The key spices, which were traded during the days of the ancient Silk Road were cinnamon, cardamom, and cloves, while pepper, nutmeg, and gamboge were also sold to overseas merchants. These spices were used as flavoring agents both locally as well as overseas, and they also carried therapeutic properties. Pictures of these major spices are shown in Fig. 3.2. The medicinal properties of the Sri Lankan spices are an aspect that was known to the traditional medicinal practitioners of the country since ancient times. However, it should be noted that the establishment and popularity of the traditional medicinal system of Sri Lanka since ancient times was independent from the commercial exchanges made during the ancient Silk Road days, although it is possible that the recognition of certain spices with medicinal value as an agricultural crop was imparted due to the influence of international traders visiting the country. In the present day, in terms of foreign exchange earnings to the country, spice exports reached US$ 214 million in 2011 indicating a 11.73% growth within the next decade or so. Some of the therapeutic properties of the major spices being exported by Sri Lanka are summarized in Table 3.3.

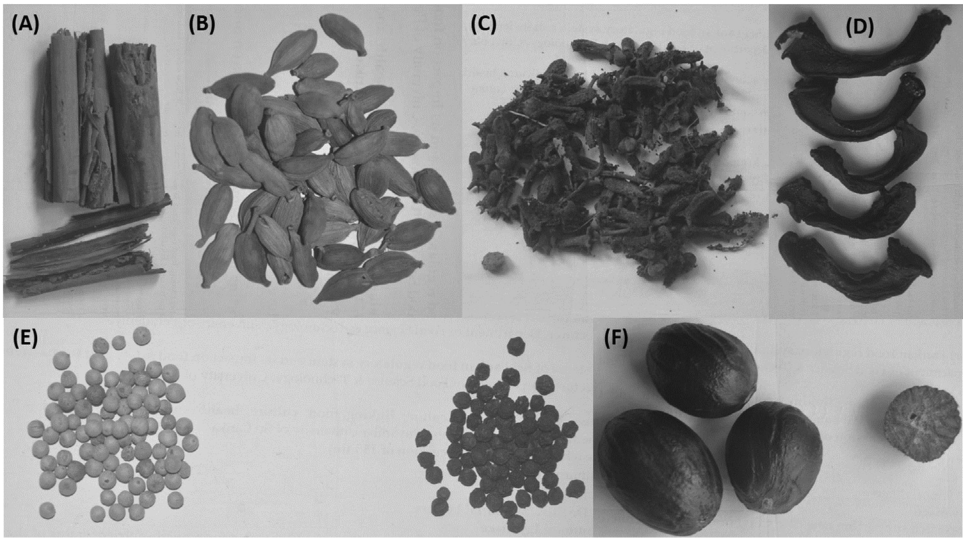

Figure 3.2 Some of the major Sri Lankan spices in the local as well as global market with medicinal properties: (A) cinnamon, (B) cardamom, (C) cloves, (D) gamboge, (E) black and white pepper, and (F) nutmeg.

Table 3.3 Therapeutic properties and selected studies demonstrating the beneficial effects of the commonly consumed spices in Sri Lanka.

Common name of spice	Scientific name of the spice variety with a higher commercial value	Therapeutic property
Cinnamon	*Cinnamomum zelanicum* Blume	Anticancer (Lu et al., 2010), antidiabetic (Cao et al., 2007), antiinflammatory (Yu et al., 2012), antioxidant (Dhuley, 1999)
Cloves	*Syzygium aromaticum*	Antimicrobial (Sofia et al., 2007), antioxidant (Pérez-Jiménez et al., 2010)
Cardamom	*Elettaria cardamomum*	Antibacterial (Kaushik et al., 2010), antioxidant (Badei et al., 1991), antiinflammatory (Sharma et al., 2011)
Black pepper	*Piper nigrum*	Thermonutrient and bioavailability enhancer (Srinivasan, 2009)
Nutmeg	*Myristica fragrans*	Antioxidant, antiinflammatory analgesic, antidiabetic (Asgarpanah and Kazemivash, 2012), anticancer (Piras et al., 2012)
Gamboge	*Gambogia morella*	Antioxidant and anticancer (Choudhury et al., 2016)

Waisundara (2018) mentions the evaluation of antioxidant and starch hydrolase inhibitory activities of cardamom, cloves, coriander, cumin seeds, curry leaves, fenugreek, mustard seeds, nutmeg, sweet cumin, and star anise extracts in an in vitro model of digestion mimicking the gastric and duodenal conditions. The total phenolic contents in all spice extracts had statistically significantly ($P < .05$) increased following both gastric and duodenal digestion. In addition, with the exception of the cumin seed extract, none of the spice extracts showed statistically significant ($P < .05$) changes in the initial starch hydrolase enzyme inhibitory values before gastric and duodenal digestion. In conclusion, the study by Waisundara (2018) was able to prove that the 10 Sri Lankan spices were a significant source of total phenolics, antioxidant, and starch hydrolase inhibitory activities.

3.5 Fruits and vegetables

Given the biodiversity of Sri Lanka, it is not surprising that the country houses many endemic as well as nutritious fruits and vegetables that have several functional properties. These health benefits are mostly seen in the ethnobotanical uses of these fruits and vegetables. In the ethnobotanical survey conducted by Marwat et al. (2014), the following fruits that are readily available in Sri Lanka were found to be used for antidiabetic effects: *Benincasa hispida*, *Psidium guajava*, *Xanthium strumarium*, *Averrhoa bilimbi* L., *Artocarpus heterophyllus* Lam., *A. marmelos*, *Anacardium occidentale* L. *Citrullus lanatus* (Thunb.) Mats. & Nakai, *Lycopersicon esculentum* Miller, *Pyrus malus* L. *Spondias dulcis*. The following vegetables were also seen to be administered to diabetics according to this survey: *Allium sepa*, *Allium sativum*, *Cucumis sativus* L. Bittergourd is a popular vegetable in Sri Lanka that is typically consumed by those with diabetes. It has also been known to possess antioxidant effects (Choo et al., 2014). As a tropical country, Sri Lanka has been gifted with a myriad of fruits: some of which are rare and endemic and consumed by locals for generations for their associated therapeutic properties. Given their extensive and historical usage as traditional medicines, it is to be expected that many of these fruits are considered as "superfoods." Waisundara (2018) reported the stability of the antioxidant and starch hydrolase inhibitory activities of the following endemic fruits when subjected to pancreatic and duodenal digestion: *Elaeocarpus serratus*, *Flacourtia indica*, *Flacourtia inermis*, *Pouteria campechiana*, and *Solanum nigrum*. These two functional properties were found to be noteworthy in these fruits. It must be mentioned that the antioxidant and starch hydrolase inhibitory activities of these five endemic Sri Lankan fruits were reported in this study for the first time.

3.6 Roots and tuber crops

Starchy roots and tuber crops are an important source of carbohydrates in the Sri Lankan diet, apart from rice. They provide a substantial part of the country's food supply and are also an important source of animal feed and processed products for human consumption and industrial use. Tubers and root crops are generally considered as a significant source of a number of compounds, namely saponins, phenolic compounds, glycoalkaloids, phytic acids, carotenoids, and ascorbic acid (Chandrasekara and Kumar, 2016). Additionally, they provide a variety of nutrients as shown in Table 3.4. Several bioactivities, namely antioxidant, immunomodulatory, antimicrobial, antidiabetic, anti-obesity, and hypocholesterolemic activities, among others, are reported for tubers and root crops (Chandrasekara and Kumar, 2016). Although processing methods used for the preparation of these starches may affect the overall bioactive components, flavonols such as rutin that are not heat-labile may remain in the roots and tubers during the cooking process (Navarre et al., 2010). Many of the starchy tuber crops in Sri Lanka, except the common potatoes, sweet potatoes, and cassava, are not yet fully explored for their nutritional and health benefits (FAO, 1990). This is a significant void given that some of these edible tubers have also been used as medicines in the Sri Lankan traditional medicinal system. For instance, *Ipomoea batatas* (L.) Lam. or sweet potato has been administered to diabetics by local traditional medicinal practitioners (Marwat et al., 2014).

Table 3.4 Chemical composition of some of the commonly consumed roots and tubers in Sri Lanka.

Root/tuber	Chemical properties	Composition	References
Cassava	Moisture content	9.40% ± 0.48%	Emmanuel et al. (2012)
	Protein	2.93% ± 0.45%	
	Fat	0.74% ± 0.27%	
	Crude fiber	2.22% ± 0.63%	
	Ash	2.26% ± 0.24%	
	Carbohydrate	84.67% ± 0.81%	
	Energy	1491 kJ/100 g DM	
Sweet potato	Moisture content	70.0%	Antonio et al. (2011)
	Protein	1 g/100 g	
	Total lipids	0.3−0.8 g/100 g	
	Cholesterol	0.0 g/100 g	
	Carbohydrates	28.0 g/100 g	
	Dietary fiber	2.6 g/100 g	
	Ash	0.9 g/100 g	
	Energy	114.0 kcal/100 g	
Yam	Moisture	82.19 ± 0.41 g/100 g	Shajeela et al. (2011)
		9.47% ± 0.12%	Obadina et al. (2014)
	Crude protein	7.57% ± 0.11 g/100 g	Shajeela et al. (2011)
		1.51% ± 0.01%	Obadina et al. (2014)
	Crude lipids	5.28 ± 0.18 g/100 g	Shajeela et al. (2011)
	Crude fiber	3.96 ± 0.11 g/100 g	Shajeela et al. (2011)
		1.93% ± 0.21%	Obadina et al. (2014)
	Ash	3.56 ± 0.02 g/100 g	Shajeela et al. (2011)
		1.67% ± 1.15%	Obadina et al. (2014)
	Energy	1655.30 kJ/100 g (dry matter)	Shajeela et al. (2011)
	Fat	1.77% ± 0.20%	Obadina et al. (2014)
	Carbohydrates	83.96% ± 0.21%	Obadina et al. (2014)

Source: Modified from Waisundara, V.Y., & Obadina, A.O., 2018. Asian and African starches: health properties and food applications. Niger. Food J. 36, 109−123.

3.7 Other traditional functional food of Sri Lanka

Cereals play a vital role in the human diet as an important source of energy, protein, and micronutrients among others for most people in the world. This is so for the Sri Lankan diet as well. Recommendations in Sri Lanka as well as worldwide emphasize the significance of cereals in a balanced diet. Furthermore, cereals have been proven to provide additional health benefits while satisfying the energy and nutritional needs of humans (Kumari et al., 2016). Several studies have demonstrated that the regular consumption of whole grains and whole grain products are helpful to prevent and to reduce the prevalence of noncommunicable diseases (Okarter and Liu, 2010). Millet is a commonly consumed grain in Sri Lanka, and its chemical composition is shown in Table 3.5.

Table 3.5 Chemical composition of some of the commonly used Sri Lankan starches with a low GI.

Type of starch	Chemical properties	Composition	References
Kithul	Moisture	10.1% ± 2.1%	Wijesinghe et al. (2015a,b,c)
	Crude protein	1.0 ± 0.2 g/100 g	
	Total fat	0.33 ± 0.08 g/100 g	
	Crude fiber	1.0 ± 0.5 g/100 g	
	Ash content	0.8 ± 0.6 g/100 g	
Finger millet	Protein	7.3%	Devi et al. (2014)
		5%–12.7%	Singh and Rajhuvanshi (2012)
	Fat	1.3%	Devi et al. (2014)
	Crude fiber	3.6%	Devi et al. (2014)
		12%	Ramulu and Udayaekhara Rao (1997)
	Total dietary fiber	19.1%	Devi et al. (2014)
		18.6%	Singh and Rajhuvanshi (2012)
	Ash	3%	Devi et al. (2014)
		1.7%–4.13%	Singh and Rajhuvanshi (2012)
	Starch	59%	Devi et al. (2014)
	Total carbohydrates	72%–79.5%	Singh and Rajhuvanshi (2012)
	Dietary fiber	18.6%	Singh and Rajhuvanshi (2012)
		18%	Thapliyal and Singh (2015)
Chickpea	Moisture	10.35% ± 0.31%	Chandrasekara (2002)
	Protein	23.64 ± 0.50 g/100 g	
	Nonprotein nitrogen	1.82 ± 0.10 g/100 g	
	Fat	6.48 ± 0.08 g/100 g	
	Crude fiber	3.82 ± 0.13 g/100 g	
	Ash	3.72 ± 0.04 g/100 g	
Lotus root (cooked)	Protein	1.58 g/100 g	Sheikh (2014)
	Fat	0.07 g/100 g	
	Dietary fiber	3.1 g/100 g	
	Carbohydrates	16.02 g/100 g	
	Sugars	0.52 g/100 g	
	Energy	278 kJ/100 g	
Sorghum	Moisture	8–12 g/100 g	Dicko et al. (2006)
	Proteins	7–15 g/100 g	
	Fat	1.5–6 g/100 g	
	Ash	1–4 g/100 g	
	Carbohydrates	65–80 g/100 g	

Source: Modified from Waisundara, V.Y., 2018. Assessment of bioaccessibility: a vital aspect for determining the efficacy of superfoods. In: Shiomi, N. (Ed.), Current Topics in Superfoods. InTech Open, Rijeka, Croatia.

Kumari et al. (2016) analyzed the soluble and bound phenolic compounds from different varieties of millet types, namely finger millet, foxtail, and proso millet cultivated at dry and intermediate climatic zones in Sri Lanka. Finger millet showed the highest phenolic content and antioxidant activities compared to proso and foxtail millets. The phenolic content as well as antioxidant activities of soluble and bound phenolic extracts of millets were affected by variety and cultivated location. The highest phenolic content and antioxidant activities were reported for millet samples cultivated in areas belonging to the dry zone in Sri Lanka.

Although the most popular source of starch in the world is corn, there are many other types of starches such as potato, cassava, rice, sweet potato, and yam that are produced largely throughout the world for human consumption. The production of a specific starch depends on the geographical location and availability. Starches do have functional properties; although they vary in physicochemical properties (such as retrogradation, gelation and viscosity), their potential health benefits (such as preventing gastrointestinal cancer and arthritis) could be promoted among consumers as healthier choices, especially for those who are obese and/or diabetic. Some of the commonly consumed Sri Lankan starches and their chemical compositions are shown in Table 3.5. These starches are low in their glycemic index as well (GI).

There are lots of traditional foods in Sri Lanka that are being improved through incorporation of functional ingredients, for instance through addition of soybean flour. Soybeans (*Glycine max*) are native to Asia, although this plant is cultivated and consumed worldwide. It is a popular food item in Sri Lanka as well. Soybean flour has many important nutritious components, such as protein (29.8 g%), including all essential amino acids, fats (19.5 g%), carbohydrates (36.1 g%), fibers (3.8 g%), water-soluble vitamins particularly B1 (0.45 g%), B2 (0.21 g%), and minerals particularly calcium (189 mg%), phosphorus (540 mg%), and iron (7.5 mg%) (Food Composition Tables for South East Asia, 1972). Perera et al. (2013) conducted an initial study to evaluate the feasibility of incorporating soy flour into traditional Sri Lankan breakfast foods such as roti, pittu, wandu, thosai, hoppers, and string hoppers. That way, the food products could be used as a vehicle to impart protein, fiber, and polyunsaturated fat in addition to being low in the GI. Except string hoppers, all the other preparations with soy flour had not changed the sensory attributes of these tested products, and thus could be seen as an alternative flour to be used in the preparation of these items.

3.8 Conclusions

Sri Lanka has much to offer in terms of functional food. It has lots of endemic plants that may be considered as unexplored territories of bioactive compounds with a multitude of disease-preventing properties. When conducting studies on these traditional food products though, it is important to simulate the customary methods of preparation, especially the temperature and processing conditions. There have been instances where the preparation methods have deviated or were modified owing to the usage of modern laboratory and culinary equipment, resulting in the complete destruction of the bioactivity of the phytochemicals and leading to inaccurate conclusions. Although they may appear primeval, the traditional processing methods have been tested and made perfect across generations through inadvertent "clinical trials," making it virtually impossible to match the level of optimization and accuracy through modern scientific interpretations. Additionally, it has to be borne in mind that many of the Sri Lankan food products that are consumed for disease prevention have not been traditionally used in isolation. They were combined with food products and ingredients of the like, hinting at the synergistic effects of bioactive compounds that may exist in these items. Nevertheless, the gap existing between the traditional knowledge of Sri Lanka and scientific proof is a matter that requires resolution before propagation and promotion of the traditional and functional food of Sri Lanka to the global consumer market.

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