



Traditional Food Preparation Practices for Roots and Tubers Among Indigenous Peoples in Northern Philippines

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Abstract

The indigenous peoples of Northern Philippines usually consume roots and tubers as boiled or steamed, roasted, and fried. However, there are various kinds of food preparation that are specific to each kind of root or tuber, and unique to each IP group. This paper aimed to document and update baseline information on the traditional food preparation and processing knowledge and practices on roots and tubers among indigenous peoples in Northern Philippines. Secondary data gathering, market observation, key informant interviews, focus group discussions, and field visits were simultaneously done in selected municipalities/communities. Roots and tubers, are described as functional foods, may improve the livelihoods, diets, and nutrition of indigenous peoples and rural households. However, as innovations were introduced and adopted, indigenous peoples are no longer isolated and have become part of a bigger market-oriented community. There is no shortage of dishes that could be prepared, and these only show the versatility of roots and tubers as functional foods.

Introduction

Root and tuber crops have been identified as food functional crops to feed the world in the coming decades (Scott et al., 2000). Many of the developing world's poorest and most food-insecure households depend on these crops as contributing, if not the principal source of food, nutrition, and cash income; just like in the olden times among indigenous peoples (IP) in the Philippines. Continuing bias towards cash crop food production as well as changes in economic and educational development, in-and out-migration, environment, climatic and lifestyle changes risk the loss of indigenous knowledge and practices.

Indigenous knowledge and practice (IKP) consist of knowledge or practice that people in a given community have developed over time and

continuously developed to adapt to local culture and environment (NGO Association for Agricultural Research in Asia and the Pacific [NAARAP], 2009). The loss of indigenous food preparation and processing knowledge and practices among IPs in Northern Philippines could be also be attributed to the failure to pass on cultural practices and the lack of information.

Instead of reinventing the wheel, development workers, researchers, and scientists can choose from indigenous knowledge databases or combine indigenous knowledge with modern or western technology for feasible solutions (Thiagarajan, 2008). Based on experiences from China, indigenous and foreign innovation efforts are complementary (Fu & Soete, 2011).



At present, documentation of indigenous knowledge and practices on roots and tubers in the Philippines is limited. This paper hopes to contribute not only to the IKSP literature of the Cordillera and Northern Luzon indigenous communities, but also to sustainable food security and nutrition. As reported in a Food and Agriculture Organization of the United Nations forum (FAO, 2003), many traditional methods present the communities with accessible means to achieve medium- and long-term food preservation, a more variable diet and possess an important cultural identification value for communities. Also, several traditional household food-processing and preparation methods can be used to enhance the bioavailability of micronutrients in plant-based diets (Hotz & Gibson, 2007). Specifically, this paper documented the traditional food preparation and processing knowledge and practices on roots and tubers among 13 IPs in Northern Philippines. Results of this study may be used by the younger generation since these indigenous knowledge and practices on root and tubers are valuable information to amplify the country's campaign for food staple sufficiency.

Materials and Methods

Location and Duration

The studies were simultaneously done in selected municipalities/communities (Figure 1), populated by indigenous peoples, namely: Ibalois, Bagos, Ivatans, Isnags, Biga-Kalingas, Masadiit-Tinguians, Applai-Kankana-eyes, Kankana-eyes, Iyattukas, Kalanguyas, Bugkalots, Aetas, and Buhid-Mangyans. The study sites are Tuba and Kibungan, Benguet; Sudipen, La Union; Sugpon, Ilocos Sur; Basco, Batanes; Conner, Apayao; Tanudan, Kalinga; Bucloc, Abra; Bauko, Mountain Province; Asipulo, Ifugao; Ambaguio and Belance, Nueva Vizcaya; Porac, Pampanga; Bamban, Tarlac; and San Jose, Occidental Mindoro. The fieldwork for the main research started from February 2012 to October 2013 although follow-up inquiries and integration write-ups extended beyond 2017. Integration write-ups included not only information gathered from the 13 indigenous peoples and those food preparation practices previously gathered/documentated from other surveyed indigenous peoples surveyed.

Data Gathering and Procedure Methods

Secondary data was gathered from various sources: agriculture, planning and development units of local governments, records or libraries of the National Commission on Indigenous Peoples (NCIP), market observation, and research collaborators.

Around 14 focus group discussions (FGDs)/key informant interview-workshops and field walks were conducted in all sites, with a total of 99 women and 65 men participants (see rootcrops-bsu.hostclink.net for more details of the IPS, selection of key informants and study sites).

Results

Roots and Tubers Known and Utilized

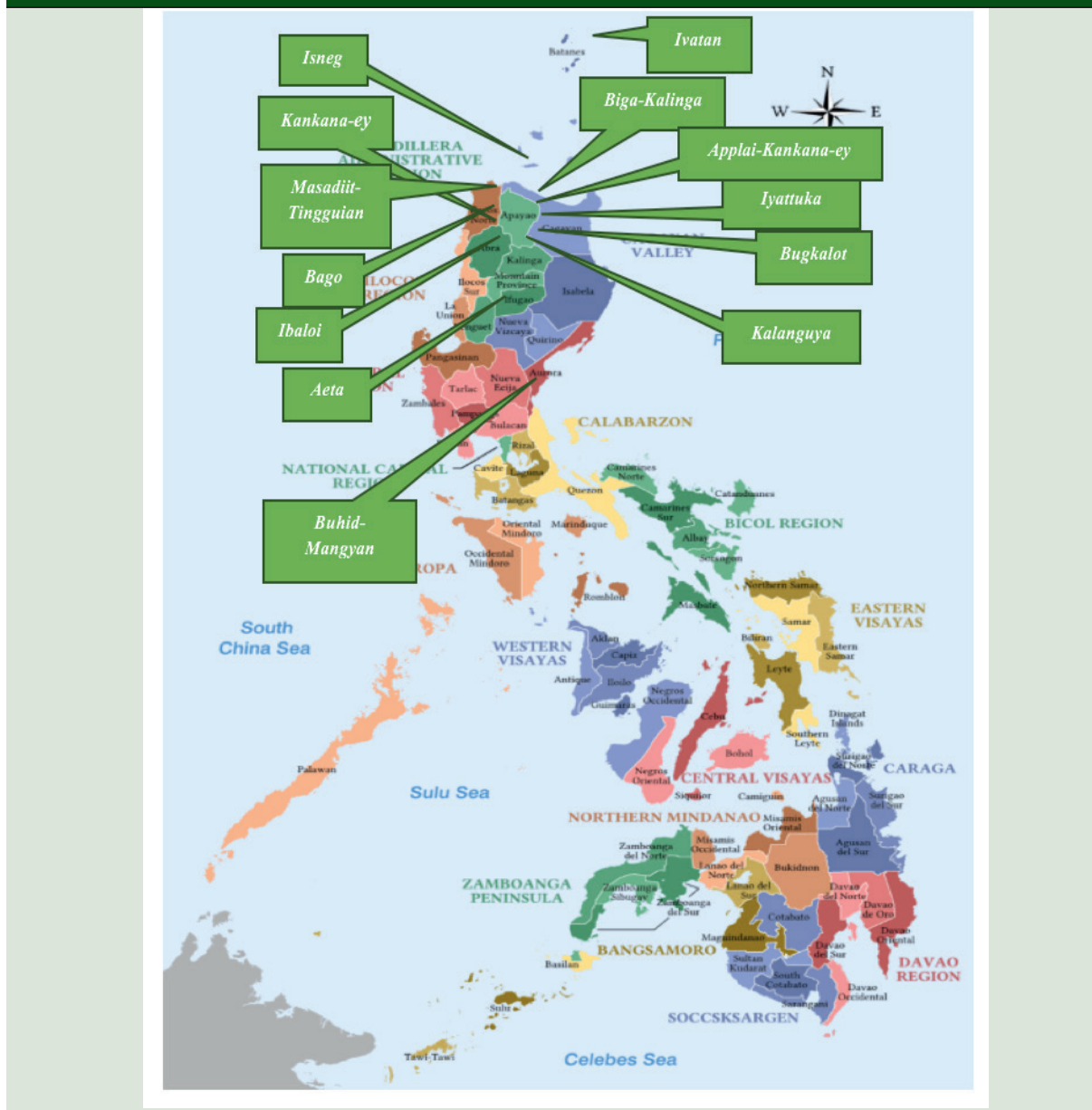
Indigenous peoples (IPs) in Northern Philippines identified more than 20 roots and tubers (Table 1). These consist of five root crops with enlarged or modified roots as well as 12 tubers and six corms with modified underground stems.

The root crops are cassava (*Manihot esculenta*), sweetpotato (*Ipomoea batatas*), yambean (*Pachyrhizus* spp.), yacon (*Smallanthus sanchifolius*), and wild yambean. Cassava and sweetpotato are widely grown and used by all the 13 IPs selected in this study while only few plants of yambean and yacon are grown for household use.

The tuber crops include greater yam (*Dioscorea alata*), lesser yam (*Dioscorea esculenta*), arrowroot (*Maranta arundinacea*), potato (*Solanum tuberosum*), canna (*Cannaceae*), aerial yam (*Dioscorea bulbifera*), nami (*Dioscorea hispida*), elephant yam (*Amorphophallus campanulatus*), wild lesser yam (*Dioscorea* spp.), and three wild species of greater yam. In common, all the 13 IP groups planted greater yam and lesser yam.

The corm crops are taro (*Colocasia esculenta*), tannia (*Xanthosoma sagittifolium* and *Xanthosoma violaceum*), giant taro (*Alocasia macrorrhizos*) and three wild taro species. Taro is more familiar than tannia whose corm is oftentimes mistaken as taro.



Figure 1*The Location of the IPs Respondents in Northern Philippines*

Common Food Preparations Among the Indigenous Peoples in Northern Philippines

Indigenous peoples in Northern Philippines usually consume root and tuber crops as boiled, fried, and roasted or sautéed. Table 2 lists the common versions or innovations on root and tuber crops-based food preparations as substitute staple, as ingredients in vegetable recipes or main dishes, as snack items, desserts, and beverages. Also listed are the versions or innovations

presented during previous vegetables, roots and tubers festivals that the authors participated in.

Staple

Boiled or Steamed Roots and Tubers. The Aeta and Masadiit-Tinguian simply boil the arrowroot. Like most of the IP groups surveyed, the boiled or steamed roots and tubers are usually consumed as a staple or snack.



Table 1*Utilization of Roots and Tubers and Plant Parts Used by IPS in Northern Philippines*

Crop		Scientific Name	Use of Plant Part	
Roots			Human Food	Animal Feed
1	Cassava	<i>Manihot esculenta</i>	Roots, Young leaves Shoots	Roots Roots
2	Sweetpotato	<i>Ipomea batata</i>	Young leaves Shoots	Vines Leaves
3	Yambean	<i>Pachyrhizus spp.</i>	Roots	
4	Wild Yambean	<i>Pachyrhizus spp.</i>	Roots Young pods	
5	Yacon	<i>Smallanthus sanchifolius</i>	Roots	
Tubers				
6	Greater Yam	<i>Dioscorea alata</i>	Tubers	Tubers
7	Lesser Yam	<i>Disocorea esculenta</i>	Tubers	
8	Arrowroot	<i>Maranta arundinacea</i>	Rhizome	Rhizomes
9	Aerial Yam	<i>Dioscorea bulbifera</i>	Tubers	
10	Potato	<i>Solanum tuberosum</i>	Tubers	
11	Canna	<i>Cannaceae</i>	Rhizome	
12	Nami	<i>Dioscorea hispida</i>	Tubers	
13	Wild Greater Yam (3 species)	<i>Dioscorea spp.</i>	Tubers	Tubers
14	Wild Lesser Yam	<i>Dioscorea papillaris</i>	Tubers	
15	Elephant Yam	<i>Amorphopallus campanulatus</i>	Young Stalk, Petiole	
Corms				
16	Taro	<i>Colocasia esculenta</i>	Corms, Stalk, Leaves Petiole, Runners	Corms, Stalks, Leaves
17	Tannia	<i>Xanthosoma sagittifolium</i> (white); <i>Xanthosoma violaceum</i> (purple)	Corms, Young Stalks Leaves, Young Stalks	Corms, Stalks, Leaves
18	Wild Taro (3 species)	<i>Colocasia spp.</i>	Leaves Petiole	Stalks Leaves
19	Giant Taro	<i>Alocasia macrorrhizos</i>		Stalks, Leaves

*G.J. Scott, R. Best, M. Rosegrant, and M. Bokanga (2000)

Among the Kalanguya, roots and tubers boiled or steamed in their skins are called *Lommog*, while they are called *Ihibak* if peeled. The Kalanguya also boil or steam *bilagot* (wild taro) as a rice substitute. The *bilagot* corms are placed in net bags, crushed using a wood implement, and then washed thoroughly in flowing water to remove itchiness.

Buku/Bakul (Chips). This is a traditional staple food and regarded as a food insurance or alternate food to rice staple among IPs. Sweetpotato or cassava roots are sliced and sun-dried then stored for future use. These dried chips are crushed or pounded into flour and used in preparing *potapot* and *salapusop*.



Table 2

Common Food Preparations and Innovations for Root and Tuber Crops Among the Indigenous Peoples in Northern Philippines

IP GROUP	STAPLE FOOD	MAIN DISH	SNACKS/ DESSERTS	BEVERAGES
All IPs	Boiled or steamed, roasted roots and tubers, Buku, Bakul or Chips	Omelet, Adobo, Buridibod, Lumpia, Sinigang, Dinengdeng, or Vegetable Stew; Leaf-tips Salad/ Sauteed; Guinataang Pihing, Laing or Gabi Leaves/ Stalk with Coconut Milk; Sinigang with Gabi or Sinigang Gandus	Camote Cue, Chips, Fries, Nilubian/ Nilubyan, Lubi-lubi, Kalamay, Halaya or Nilupak, Suman, Tupig, Salapusop, Calamay, Inis-isna, or Bibingka, Guinataang, Dinakan or Inab-abusang, Chips	-
Kalanguya, Kankana-ey, Ivatan	-	-	Cassava Roll	-
Isnég, Applai-Kankana-ey, Biga-Kalinga, Kankana-ey, Ibaloi, Buhid-Mangyan	-	Versions of Vegetable Dishes	-	-
Iyattuka	-	Burger Pihing	-	-
Kankanaey, Applai-Kanakan-ey, Ibaloi, Ivatan, Ilocano/Kapampangan	-	Gabi Stalks with Tomatoes, Gabi Balls, Gabi-Sayote-Sardines Dish	Glazed Gabi, Gabi with Peanut, Gabi Pastillas, Gabi Cookies, Buku-Gabi Cookies, Gabi Puding, Gabi Butse, Gabi Flour, Bitsu-Bitsu, Pitchi-pitchi, Maruya, Maja, Kutchinta	Camote Juice
Kankana-ey, Ibaloi, Masadiit-Tingguian	-	-	Sadkik	-

Roasted Roots and Tubers. The *Applai-Kankana-ey* roast wild taro 'tayagang' in ash in their nom-a (swidden fields). This *dinamdang* is consumed as viand. The *Biga-Kalinga* roast arrowroot, although their children sometimes eat them raw. So as the *Bago*. The *Aeta* and *Buhid-Mangyan* sometimes roast greater yam and lesser yam tubers, whereas the *Masadiit-Tingguian* simply eat lesser yam raw. On occasions,

however, and if time permits, certain food uses or preparation practices are done.

Main Dish

Omelet, Adobo, Buridibod, Lumpia, Sinigang, Dinengdeng or Vegetable Stew. For these dishes, sweetpotato roots and shoots/tips are prepared in different forms and added to eggs, meat, fish,



and other vegetables. The following examples were noted: squash shoots are added to cassava and cooked in coconut milk (*Isneg*); cassava is stewed with crabs (*agatol*) or shells (*susu*, *bisokol* and *leddeg*) and spiced with hot pepper (*Kalinga*); taro (*gabi*) stalks are mixed with eggs, minced onion, ground pepper, and salt for an omelet; *gabi* or tannia is stewed with meat, minced garlic or onion, black pepper, ginger, and salt to taste and lastly, cabbage or pechay.

Leaf-tips Salad/Sautéed. An appetizer or main dish, the tips or leaves of sweetpotato are blanched or sautéed and seasoned with fresh sliced tomato, salted fish sauce, and calamansi or lemon. Among the *Ibaloi*, only the unopened young leaves of tannia are gathered, chopped, and sautéed in garlic and oil and seasoned with fish sauce or salt. The *Masadiit-Tinguian* however, eat the raw violet stalks as *sasaladen*, i.e. salad garnished with vinegar, salt, pepper, and ginger. On the other hand, the *Kankana-ey* eat thinly sliced green stalks. Generally, cassava leaves are blanched, strained, and sautéed with coconut milk as a vegetable dish.

Ukoy/Okoy (Deep-fried Fritters). This is a deep-fried patty which is served either as an appetizer or as main dish. Two preparations were noted: the first combines grated cassava tuber with grated green papaya, small shrimps, onions, pepper, and salt, while the second combines mashed cassava with minced green onions, chopped red pepper, ground meat, egg, flour, and salt and black pepper.

Laing, Guinataang Pihing (Gabi Leaves/Stalk with Coconut Milk). *Laing* is a local vegetable dish originating from the Bicol Region. It is made of gabi stalks, leaves, and chopped corms boiled in coconut milk and seasoned with fish sauce, minced ginger and garlic, hot chili, and dried fish (optional).

Similar to *laing*, *guinataang pihing* (taro leaves and/or stalks in coconut milk) is a Filipino traditional dish made simply of taro stalks and leaves cooked in coconut milk. Variations include the addition of peanuts, vegetables, banana and smoked fish. In one main dish version, the taro stalks are cooked using coconut milk (second extraction) along with bananas, squash, and eggplant, and seasoned with fish sauce. Another version has a different flavor profile with the

addition to taro stalks and leaves of *tinapa* (smoked fish), fish sauce, minced ginger, and ground pepper. The dish can be cooked as the previous version or a bite-sized mixture is wrapped in clean taro leaves, arranged on a bed of taro stalks, and steamed in coconut milk.

Sinigang with Gabi or Sinigang Gandus. This popular sour soup generally consists of seafood or meat with gabi corms and string beans, seasoned with garlic, onions, black pepper, and salt or *patis* (fish sauce). The soup is soured by fresh green tamarind juice. The *Aeta* use *pingol bato*, a wild begonia plant growing in rocks or forests, to sour stewed taro stalks and leaves.

Versions of Vegetable Dishes. IPs prepared taro as a vegetable dish in varied ways. The *Isneg* use *ateng* (taro) mixed with shoots of squash and cooked in coconut milk, whereas the *Biga-Kalinga* cook stalks of *lidoy* (taro) with fish sauce (*bagoong*), coconut milk, and hot pepper. The *Ibaloi* sauté the stalks and leaves of *bitajon* or *bitayon* and *pikaw* (taro and wild taro) in little oil before adding to meat stew. *Buhid-Mangyan* prefer to roast taro leaves without the stalks.

The *Applai-Kankana-ey* have a more diverse menu where they mix the stalks and leaves with seed legumes (*bukel*) and meat; cook the taro with legumes or pechay, endey, chayote tops, or water cress and meat; or cook the corms and stalks with sabeng (sweetpotato vinegar). *Kankana-eyes* of Benguet similarly describe varied preparations for taro. Stalks are sautéed with peanuts or *karing* (dried anchovies), cooked in *gata* (coconut milk) or with noodles, or mixed with *etag* (smoked meat) or *bukel* (seed legumes). Sometimes, stalks are sliced and sun-dried to eliminate the itchiness.

Respondents mentioned other preparations for taro as a main dish. These include mixing taro leaves, egg, chopped onion, cornstarch, and salt to make burgers, which are then fried and used either as sandwich filling or served as a main dish. Another is a salad-like dish where cooked gabi stalks are mixed with sliced medium ripe tomatoes, minced ginger, and salt. Additionally, mashed boiled gabi, flour, finely diced carrots, minced onion and garlic, egg, ground pepper, and salt are mixed, formed into balls and deep fried. Finally, boiled *gabi* is diced then sautéed with sliced onion, canned sardines, diced chayote and seasoned with curry powder and salt.



Similarly, the *Masadiit-Tingguian* use yam tubers as an ingredient in *guinataan* snack and as a vegetable dish when mixed with sardines or pork.

Snacks and/or Desserts

Camote Cue. This delicacy is a common snack item in the Philippines. Big sweetpotato roots are peeled and sliced (no need to slice small roots) and deep-fried. When already soft or cooked, the camote is coated with sugar or molasses and finally served hot or cold. A similar food preparation is the glazed *gabi*, which involves cooking the root in water and mixing it with brown sugar and margarine.

Nilubian/Nilubyan, Lubi-lubi, Halaya or Nilupak. This is a custard-like dessert and a favorite snack item made of sweetpotato or cassava, taro, or tannia. These are boiled, then mashed or grated and mixed with sugar, coconut milk or milk, and butter or margarine. Others make the halaya with glutinous rice or marshmallow.

Suman, Tupig, Salapusop, Kalamay, Inis-isna, or Bibingka. Similar to the popular rice cake, this is served as a snack or dessert, and is primarily made of fresh grated sweetpotato or cassava roots. The grated roots are mixed with various combinations of sugar, coconut milk/milk, and butter or margarine and can be with or without glutinous rice or wheat flour. The mixture is then wrapped in banana leaves and steamed or baked. The Cassava Roll, is also made from grated boiled roots of cassava, which are flattened and sprinkled with ground peanuts or spread with jam and margarine then rolled.

In other cases, cassava or yam chips flour (i.e., *buku*) is mixed with water and sugar then steamed or cooked in a clay pot. Respondents describe *gabi* cake cooked in milk and garnished with ground peanuts. The *Ibaloi* make sundried chips from arrowroot and canna, which are then stored in plastic sacks and could last for three months. Depending on need, the dried chips are pounded into flour and cooked as rice substitute or wrapped in banana leaves and boiled or steamed as snack food called *tupig*.

Guinataan, Dinakan or Inab-abusang. *Guinataan* is a famous native snack among

Filipinos. It consists of any of a combination of roots or tubers (cassava, taro, sweetpotato, greater yam), which are then cooked in coconut milk with sticky rice balls, banana, sago, and sugar. The *Aetas* version of *guinataan* is made of boiled and pound taro corms mixed in coconut milk. Arrowroot and canna could also be mixed with other roots and tubers as ingredients in *guinataan*.

Sadkik ("Hotcake" or pancake) and Maruya (Fritter). *Sadkik* is a pancake-type item for breakfast or for snacks made from cassava chips flour. Arrowroot and canna flour when mixed with wheat flour improve the texture and there is no need to add baking powder to the pancake batter. *Maruya* is a popular snack or dessert among *Ivatans* and other IPs in the Philippines. Strips of sweetpotato roots are coated with flour then deep fried and dipped in sweet and sour condiment for a more flavorful taste.

Steamed Preparations. Steaming of the variously prepared roots or tubers produces *pitchi-pitchi*, *maja*, or *kutchinta*. For *pitchi-pitchi*, grated cassava is mixed with coconut milk and sugar then cooked over a low fire stirring constantly until thick. The mixture is formed into balls, rolled in grated young coconut or grated cassava mixture and then steamed. *Maja*, on the other hand, consists of mashed sweetpotato or *gabi* with coconut milk or milk, cornstarch, white and brown sugar, and vanilla. The mixture is placed in pans and then steamed, producing a creamy, gelatinous pudding-like dessert. Finally, *Kutchinta* is made of sweetpotato flour, ground sticky rice, sugar, baking powder, and all blended in coconut milk. It differs slightly from *maja* in its flavor and texture with a chewy, jelly-like consistency.

Mashed Gabi-Based Preparations. A variety of food preparations can be made with mashed *gabi*. These include *pastillas*, cookies, pudding, *butse*, *bitsu-bitsu*, and chips. To make *pastillas*, mashed *gabi* is mixed with condensed/evaporated milk, sugar, and flavored with vanilla. The mixture is set in pans and then cut into bite sizes and wrapped in cellophane. Two cookie variants are produced by the IP respondents: (1) plain cookies consisting of mashed *gabi* with butter sugar, egg yolks, and vanilla; and (2) *buku-gabi* cookies for which mashed *gabi* is mixed with sifted flour, shredded *buko* (young coconut), baking powder, sugar, beaten eggs, and fresh milk.



Gabi pudding is considered a treat and easy to make using mashed gabi with common pastry ingredients like flour, milk (thick) or evaporated milk, sugar, egg, and shredded *buko* (young coconut). *Gabi butse* is a deep-fried pastry snack or dessert with a filling of mashed gabi mixed with sugar, flour, baking powder, powder milk, and eggs.

Additionally, *bitsu-bitsu* can be made using *gabi* flour mixed with the usual pastry items (salt, egg, and milk). *Bitsu-bitsu* is a deep-fried twisted pastry traditionally made with either wheat flour or rice flour.

Beverages

Camote Juice. This beverage is made of sweetpotato leaf broth and flavored with calamansi and sugar.

Unique Root and Tuber Crops-Based Food Among the Indigenous Peoples in Northern Philippines

Most indigenous peoples consider roots and tubers healthy foods and a special food for the sick, pregnant women and infants. Table 3 shows the unique root and tuber crops-based food among the different indigenous peoples in Northern Philippines, classified as staple food, main dish, snacks and desserts, and beverages.

Staple Food

Tnumi. This is a native delicacy of the *Ivatan* in Batanes which is a mixture of mashed sweetpotato, and taro. The *Ivatan* eat 'tnumi' with fish and sweetpotato tops as vegetable.

Kisa. This *Aeta* delicacy is similar to the *Masadiit-Tingguians'* where cubed cassava and sweetpotato roots are placed at the bottom of uncooked rice and brought to boil. This serves as

Table 3

Unique Food Preparations for Root and Tuber Crops Among the Indigenous Peoples in Northern Philippines

IP GROUP	STAPLE FOOD	MAIN DISH	SNACKS/ DESSERTS	BEVERAGES
<i>Ivatan</i>	<i>Tnumi</i>	<i>Winakajapa, Rinakan, Vunes or Venes</i>	-	-
<i>Aeta</i>	<i>Kisa</i>	<i>Sukit</i>	-	-
<i>Masadiit-Tingguians</i>		<i>Siang-it, Sauteed Pikaw</i>	<i>Saloksok</i>	
<i>Iyattukas</i>	<i>Pukupok</i>			
<i>Ivatan</i>	<i>Dukay</i>			
<i>Biga-Kalinga, Iyattuka</i>	-	<i>Nawnaw or Laplap, Dinukdok</i>		-
<i>Applai-Kankana-ey</i>	<i>Pinallak</i>	<i>Kinkinalot, Bassa</i>	<i>Salupusop Potapot, Pinallak</i>	<i>Bakkay</i>
<i>Kalanguya</i>	-	<i>Baksay, In-utom</i>	<i>Hiit or In-inte</i>	-
<i>Ilocano</i>	-	-	<i>Incalte</i>	
<i>Kalanguya, Ibaloi, Kankana-ey, Applai-Kankana-ey</i>	-	-	-	<i>Hebeng, Sabeng, or Tengba</i>
<i>Applai-Kankan-ey, Kankana-ey, Ibaloi, Bago, Iyattuka</i>	-	-	-	<i>Tapay/Tapuey or Binubudan</i>
<i>Isneg</i>	-	<i>Sinorsor or Binasal</i>	-	-
<i>Kalanguya, Ibaloi, Kankana-ey</i>	-	-	<i>Binubodan</i>	-
<i>Kalanguya</i>	-	-	<i>Bakkay</i>	-



rice extenders, especially among the *Aeta* since their rice crop harvest is not enough to sustain their consumption.

Pinallak. This is a traditional meal or snack item among IPs. It is a mixture of *buku* or cassava chips and rice then cooked in a clay pot.

Pukupok. The cooked tuber called *pukupok* is a unique practice of *Iyattukas* where the lesser yam tubers are placed in the *alang* (rice granary) after boiling to prolong shelf life. They claim that the cooked tubers will not spoil and this practice makes the *luktoh* or lesser yam sweet after two weeks of storage.

Dukay. The *Ivatans* cut the boiled lesser yam into cubes and used these in salad preparation.

Main Dishes

The *Biga-Kalinga* and *Iyattuka* cook a healthy soup called *nawnaw* or *laplap*. The soup is made of boiled sweetpotato that is either mashed or cubed. Moreover, the *Biga-Kalinga* cook *dinukdok* – a vegetable dish of boiled sweetpotato leaves with mashed black beans, *sili* (hot pepper), *gata* (coconut milk), and *agatol* (crabs) or shells (*susu*, *bisokol*, and *leddeg*).

The *Applai-Kankana-ey* make a traditional one-dish meal called *kinkinalot* from fresh sweetpotato roots and leaves plus taro corms and stalks mixed with glutinous or plain rice. This is cooked as porridge and seasoned with *bakkay* (fermented mixture of arrowroot, cassava, corn or rice along with wild mushrooms) or *tengba* (fermented sweetpotato non-alcoholic fermented drink). The same IP group cooks *bassa* using rolled taro (*pising* or *pikaw*) stalk or leaves, including corms (optional), which is then boiled or sautéed in oil and flavored with *tengba*.

The *Aeta*, on the other hand, traditionally mix *gabi* and camote with *patani* (lima beans) or *sitaw* (long/string beans) in a vegetable stew called *Sukit*, which is flavored with *baokok* leaves. The *Isneg* prepare the stalks and leaves of *ateng* (cultivated taro) and/or *lanipog* (wild taro) for *Sinorsor* or *Binasal*. They season the stew with *sili* (hot pepper), *bagoong* (fish sauce), tomato, and onions; sometimes, adding canned sardines when available.

Traditionally, the *Kalanguya* and *Ibaloi* roll or chop the leaves and stalks of *pihing/ava* (cultivated taro) or *bita-jon/pikaw* (wild taro), then steam them on top of boiling sweetpotato. This dish is called *baksay*. During *cañao*, the prepared taro is added to the boiling meat. The *Kalanguya* have a unique dish called *In-utom*, in which taro stalks and leaves are wrapped with banana or rono leaves and placed inside bamboo, then roasted.

The *Masadiit-Tinguian* describe two unique dishes: *sinag-it* and sautéed *pikaw*. For *sinag-it*, the stalks and corms of both the *lapa* (dasheen type) and *loko* (eddoe type) taro varieties are roasted, mixed with *kuhol* (golden snail), and cooked in coconut milk. The *Tinguian* remove the itchiness of the *gabi* by roasting them and continuously stirring the stew while it is cooking. For sautéed *pikaw* (wild taro), the stalks and leaves are rolled and then sautéed with sardines or squid.

The *Ivatan* described three unique vegetable dishes: *winakajapa*, *rinakan* and *venes* or *vunes*. The first is the *Ivatans'* version of salted *gabi* stalks and is consumed as viand or main dish. The second is a dish using *gabi* stalks alone (no meat or fish). Finally, the last vegetable dish consisted of dried *sudi* (taro) stalks gathered only during the dry season or summer months.

Snacks and Desserts

Most of these snacks are based on flour from either sweetpotato or cassava. *Salapusop* is made from sweetpotato flour, which is mixed with water and sugar then steamed or cooked in a clay pot. The *Applai-Kankana-ey*, prepare *Potapot*, which is a native snack made from wet sweetpotato flour that is molded and wrapped in camote leaves then steamed. Another native snack is made from *buku* or cassava chips flour (sometimes mixed with wheat flour), baking powder, and sugar then wrapped in banana leaves and steamed. Then there is the *pinallak*, made from pound or unpound sweetpotato chips that are mixed with rice and cooked in clay pot; or from cubed roots that are mixed into boiling rice or glutinous rice. Among the *Masadiit-Tinguians*, *saloksok* is a snack item made from grated cassava mixed with flour then fried.

Desserts listed include *hiit* or *in-inte* and *incalte*. The former is a jelly or jam prepared from left-over sweetpotato broth, while the latter is a



traditional sticky dessert made from sweetpotato roots, coconut milk, and molasses.

Beverages/Condiments

Hebeng, *sabeng*, or *tengba* refer to a traditional sweetpotato non-alcoholic fermented drink. The water left after boiling sweetpotato roots is first salted then fermented for 15 days to one month or longer. It is used as a substitute for vinegar and believed to prolong human life if regularly consumed.

Bakkay is a substitute of oil or *bagoong* (fish sauce), and is used as a condiment in cooking vegetables. Water, garlic or ginger, salt, and other additives are added to ground rice, corn kernels, and sweetpotato. This mixture is then fermented for one month or more. Among the *Applai-Kankana-ey*, *bakkay* can be made with Cassava roots. These are mixed with pounded arrowroot, sweetpotato, corn or rice, and dried mushroom with salt, garlic, ginger, chili pepper (*sili*), and then stored or fermented for one to two months. Just like the *sabeng*, *bakkay* is considered medicinal.

Tapay/*tapuey* and *binubodan* is usually served as an appetizer. This is made from boiled cassava roots that are treated with *benekbek* (yeast made from fermented ground rice with pepper and *angwad* (weeds)), and then fermented in a covered winnower. Those consumed after 3 days of fermentation are served as snack food or appetizer and called *binubudan*. Those transferred to a jar to continue fermentation are called *tapay*. If a sweeter taste is desired, fermentation is ended at two weeks. For a stronger alcohol content, fermentation can take up to one month.

Food-Based on Lesser-Known Roots and Tubers

Lesser-known roots and tubers that are gathered from the farm or from the wild include arrowroot, canna, and wild yam, and are known by various names among the indigenous peoples as *araro*, *sugod*, *wikan*, *kulintas*, *galumaca*, *boga*, *lugiman*, and *karot* or *kalot*.

In addition to using sweetpotato and cassava, arrowroot can also be the main ingredient in making *bakkay* (*Applai-Kankana-ey*) especially in replacing sweetpotato. In making *bakkay*, arrowroot

rhizomes and cassava tubers are pounded and mixed with corn, rice, dried mushroom (*kuwat* or *kodi*), garlic, ginger, *sili*, and salt, then fermented for 1-2 months.

Unlike the more common tubers and roots, the wild yam (*karot* or *kalot*) must be processed to become edible. The IP groups have different ways of processing the tubers. For example, the *Buhid-Mangyan* peel and slice the tubers and then sundry them for 2-3 days. They then soak the dried chips in water for two days, and wash them three times before either broiling or pan roasting them to doneness. The processed yam can be eaten alone or mixed with camote tips or *gabi* leaves. From one author's experience in childhood (Gayao, 2016a), processed *karot* is stir-fried in butter and eaten as a snack.

Among the *Aeta*, the *kalot* tubers are grated then placed in a *buslo* or bamboo basket, then washed and soaked in flowing water (in the river) for three days. To test if already edible, the *Aeta* squeeze a little juice of the treated tubers into their eyes. If it stings, then the tubers are still poisonous.

The *Ibaloi* on the other hand, slice the *kalot* tubers, rub salt into the tubers, soak for 24 hours in flowing water then wash them well while stepping on it. The tubers thus washed are then air-dried for three days. The processed chips are boiled or steamed with sugar and coconut milk.

Among the *Masadiit-Tingguian*, the wild lesser yam '*boga*' can be a viand if mixed with sardines, or can be added to boiled pork as a soup thickener.

Discussion

The establishment of the root crops center in the Northern Philippines was based on the knowledge that sweetpotato and other rootcrops and tubers are staple food of the indigenous peoples in the hinterlands of the Caraballo and the Gran Cordillera mountain ranges. However, the focus in root crops research and development has shifted towards commercial uses to meet industry demands for starch, feed and energy, and for the export market. For example, potato varieties are now developed for farmers to plant



to meet the demands of potato chips and fries manufacturers, importers and fast-food chains. In the case of cassava, high-yielding varieties needed by the feed industry and alcohol distillers are prioritised.

In the Cordillera Region, however, indigenous peoples still use roots and tubers as primary foods, and whatever is not eaten, such as peelings, is fed to pigs, chicken, ducks, rabbits, and even fish (Gayao et al., 2013-2014). But more support is needed to improve this kind of indigenous food system. The food sovereignty activists are fighting for the people's right to decide what they eat and what they produce (Coulibaly, 2011). Food sovereignty gained momentum because of the 2008 global food price crisis and calls for fundamental change in food and agricultural policy so that risks and benefits of food systems are shared equitably. It is about the right of people to healthy and culturally appropriate food produced through ecologically sound and sustainable methods, and their right to define own food and agriculture systems (Shawki, 2012).

The diversity of roots and tubers utilized as food by the indigenous peoples consulted in this study reflects their food security practices and coping mechanisms at times of food insecurity. This strengthens the conclusions of Gayao et al. (2016a, 2016b, 2018) that roots and tubers meet household food needs and are traded, used for medicine, and given as gifts and offerings. Further, they point out monetary and nonmonetary benefits of roots crops. These findings connect with Scott et al. (2020) who predicted that root and tuber crops will feed the world in coming decades, even as over 2 billion people in Asia, Africa and Latin America will depend on these crops for food, feed, or income. Moreover, many of the developing world's poorest and most food insecure households will continuously consider these crops as contributing, if not the principal, source of food, nutrition, and cash income (Janardanan & Charles, 2022).

The value of roots and tubers worldwide diets and economies has been thoroughly documented as early as 1997 (FAO). As globally recognized sources of dietary carbohydrates, proteins, and vitamins, they are the second group of cultivated species, after cereals, in tropical countries. Among such countries are Sri Lanka, Nepal, Bangladesh, Pakistan and Iran (Prakash et al., 2020); China and Brazil (Caballero et al., 2016); Thailand,

Congo, Rwanda, and Malawi (FAO, 2003); Nigeria (Nanbol & Namo, 2019); India, Indonesia, and the Philippines (Prain & Naziri, 2020).

The key informants from the *Kankana-ey* appreciated root crops consumption because it has been their source of life. Among IPs in general, root crops are also an emergency food that can substitute for rice during difficult times (droughts, typhoons, joblessness, etc.). Hence, the maintenance and conservation of root and tuber crops are ingrained in their culture. Although traditional dietary habits have been changing due to modernization, indigenous peoples still maintain root and tuber crops for food security and household consumption.

Earlier literature in the Philippines have mentioned the importance of root and tuber crops, particularly sweetpotato, as survival crops among resource-poor families to weather the ill effects of food crises caused by typhoons and other natural calamities such as earthquakes (Sano et al., 1991); or brought about by major/unforeseen events such as war (Solimen et al., 1998). Other researchers point out the swidden farming of sweetpotato by marginal farmers who don't own rice terraces in Ifugao (Balaki & Solimen, 1991; Verdonk, 1991; Gayao et al., 2013-2014). Dayo et al. (1998) describe the year-round cultivation of sweetpotato (*Ipomoea batatas*), *ubi* (*Dioscorea alata*), and *tugui* (*Dioscorea esculenta*) as subsistence crop in the Batanes Island Province, the consumption of wild yams '*nami*' (*Dioscorea hispida*) by upland farmers in Mindanao due to crop losses resulting from the El Nino, and the consumption of wild yam '*kamangege*' (*Dioscorea* spp.) by fishermen or farm laborers in the coastal village of Ilocos Sur before the harvest of the wet rice cropping.

Root and tuber crops are processed in a number of ways before they are consumed and these include hydrothermal treatments such as boiling, frying, baking and roasting, dehydration, and fermentation (Chandrasekara & Kumar, 2016). Similarly, the IPs describe simple preparation and cooking methods for many of the roots and tubers that they consume. However, they report procedures that can be complex especially when preparing "itchy" roots or tubers. Some of these steps include any combination or all of the following: peeling, grating, frying, fermentation, smoking, roasting, soaking in water overnight (or longer). Many of these practices seem to be



widespread among IP communities, as reported for wild yam in Ilocos Norte (Raras & Malinnag, 2004), for gabi across the country (Institute of Crop Science, College of Agriculture and Good Science-UPLB, 2023), and for taro in many global IP communities (Ferdaus et al., 2024).

Processing is limited, mostly to convert the short storage life of roots and tubers to more stable products through drying, fermentation, and detoxification by soaking and drying (Lancaster & Coursey, 1984). Cassava, yams, and sweetpotato, for instance, are harvested when needed or buried in pits, or covered with mud paste, soaked in water, or pounded and fermented as *'fufu, fuba, gari, or farinha'* in Africa and Brazil; sun-dried or dried over a fire just like the chips called *'gaplek'* in Indonesia and later on ground into flour for bread or porridge. Sweetpotato chips help provide year-round access to the nutritious crop, thereby helping household food security (Global Forum on Food Security and Nutrition, 2013).

Sometimes, there may be various ingredients added either because the food is to be a dessert or fermented, or because the cooks are innovating as influenced by their integration into the mainstream of society. As described by the respondents, desserts are boiled and then mashed, baked, fried or steamed and traditionally include sugar and/or coconut milk. These may be topped with grated coconut, corn kernels, or whole or crushed peanuts. This may be where the influence of the "outside world" comes in, bringing more complicated recipes with more ingredients than traditionally done. Before this influence from the mainstream community, IPs often boiled the roots and tubers and then dipped them in sugar just before eating. Nowadays, there is no shortage of dishes that could be prepared and these only show the versatility of roots and tubers as functional foods and as a major ingredient in many recipes or delicacies (Chandrasekara & Kumar, 2016; Liu et al., 2014).

Traditional food preparation practices for roots and tubers among Indigenous Peoples (IPs) in Northern Philippines are simple on the whole, but unique differences among each tribe were described which depend on availability of local food resources and ingredients, and to some extent the purpose for said food preparation. Many of these unique dishes are prepared and served during *cañao*, Christmas celebration, and these are cooked occasionally as specialty dishes.

Thus, playing a significant role in the social and cultural life of the indigenous people, as mentioned earlier (Gayao et al., 2018; Diop, 1998a, 1998b).

The use of bamboo as a cooking vessel is not common to all IPs interviewed but reflects similarities across the country with other IP groups. Likewise, the incorporation of snails and/or crabs is unique to some IP groups. The diversity in food preparation practices reflect the adaptation of the IPs to their respective environments, as well as to the availability of resources within these sites. While the food preparation practices are built into the food systems of the IPs (Kuhnlein, 2009), these are shaped by their diverse cultural traditions (FAO, Bioversity International, & Centro Internacional de Agricultura Tropical, 2023).

Conclusion

The indigenous peoples of Northern Philippines hold a wealth of knowledge in traditional food preparation of roots and tubers. Thus, the need to document and update the baseline information on the traditional food preparation and processing. Most food preparation practices are simple with the simplest of ingredients. However, the availability of other resources, use of the food (e.g., main dish or dessert, home consumption or ceremonial use, etc.), and influence of the outside world have engendered variation or innovation. Also, the specific IP group may have certain practices unique to them.

Recommendations

There is a need to share indigenous practices on roots and tubers utilization and raise awareness on the value of indigenous knowledge as well as enhance knowledge in the area of nutrition and health value of root and tuber crops. To further strengthen indigenous knowledge especially among the youth, baseline data gathered may be disseminated in partnership with the Local Government Units. These actions may contribute to ensuring that root and tuber crops may be the food of future generations and to amplifying the country's campaign for food staple sufficiency.



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