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Pacific Islands Food leaflets

Secretariat of the Pacific Community

Introduction

Thanks to their tropical setting and rich agricultural history, the Pacific Islands are home to some unique island foods that not only provide nutrition but also play a special role in the islands' strong cultural heritage. The Pacific Food Leaflets series was produced by the Secretariat of the Pacific Community's Public Health Division, to promote the nutritional and cultural value of island foods, and to encourage their ongoing production and consumption by Pacific Islanders.

The Pacific Islands face the growing burden of non-communicable diseases (NCDs); in particular, type 2 diabetes and heart disease. These NCDs threaten quality of life, take away loved ones too early and hinder development, right across the Pacific. A rapid change in dietary patterns has been a significant contributor to the susceptibility of Pacific Island people to NCDs, as people have turned away from traditional Island foods that are rich in fibre, vitamins and minerals, towards imported and convenience foods that are high in fat, salt and sugar. Not only does this create health problems in the Pacific Islands, but it also leads to agricultural sustainability and development issues, as family farmers struggle to make a living. Import dependency grows, discarded food wrappers and packages litter our pristine beaches, and men, women and children suffer vitamin deficiencies preventing them from reaching their full potential.

The Pacific Food Leaflets aim to create awareness about the inherent value of locally grown produce, create pride in local production, and encourage ongoing production and consumption, through the sharing of information about the protective and energy-providing value of Pacific Islands foods. Each leaflet contains information about nutrient content, functional properties, storage and preservation techniques, and preparation and cooking, as well as easy-to-follow recipes. The leaflets are designed to be culturally relevant for Melanesian, Micronesian and Polynesian people.

Now in their second edition, the Pacific Food Leaflets are available in both English and French. After 20 years of use the leaflets continue to be popular with dieticians, nutritionists, health professionals and agricultural workers around the region and abroad. From harvesting tips to recipes, the leaflets have benefited youth, women, and school and community groups in promoting healthy food production and eating habits.

This booklet contains one complete set of the 19 Pacific Food Leaflets. We hope that it helps you in promoting healthy island foods to your community and to your own family.

Choose Pacific Island foods for healthy island futures!

The Public Health Division Team

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A publication of the Healthy Pacific Lifestyle Section
of the Secretariat of the Pacific Community

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Taro

Leaflet No. 1 - Revised 2012

Introduction

Taro — also known as *talo, dalo, dago, aba, angel, aro, taaro, ma* — is an important staple food crop for Pacific Islanders and has been for thousands of years. Although taro is increasingly being replaced in the diet with processed foods, it remains a prestigious root crop among Pacific Islanders and is used in many social and cultural ceremonies and obligations. The corm, stalk and leaves of taro are consumed and, because they are rich in energy, fibre, vitamins and minerals, can form an important part of a healthy diet.

Major types of taro and propagation

The four main species of taro available in the Pacific Islands are giant swamp taro *(Cyrtosperma chamissonis)*, giant taro *(Alocasia macrorrhiza)*, Chinese taro or tannia *(Xanthosoma sagittifolium)* and true taro *(Colocasia esculenta)*. All four species contain different levels of acroid, which needs to be removed by cooking before the taro is eaten.

Colocasia esculenta, true taro, is the most widespread species with many varieties and is thought to have been brought to the Pacific from South East Asia. In the Pacific alone, about 72 different varieties have been documented and are available. These varieties differ in the colour of corms and stalks, the stickiness of the corm and the shape of leaves. Taro is mainly grown for its corm, but in some areas the stalks and leaves are also grown for consumption because they are rich in nutrients.

Design and layout: Muriel Borderie - SPC Publications Section

Cyrtosperma chamissonis, or giant swamp taro, is a much taller plant with large arrow-shaped vertical leaves and large coarse corms. It is the main root crop on atolls as it can grow in sandy saline soil and can withstand high winds. In other Pacific Islands, it is also known as *babai* (Kiribati), *pula'a* (Samoa), *viakau* (Fiji), *pulaka* (Tokelau and Tuvalu), *simiden* (Federated State of Micronesia). Giant swamp taro has been found to be tolerant to the effects of climate change, and thus could become an essential crop for Pacific Islanders in the future. This crop is mainly grown for its corm.

Alocasia macrorrhiza, or giant taro, is a hardy plant that grows in a wide range of soil types. It also has vertical leaves with long corms that rise above the ground. In Fiji, it is known as *via*. This crop is mainly grown for its corm.

Xanthosoma sagittifolium, Chinese taro or tannia, is an easily grown taro. Tannia originated in tropical America, and later spread to Southeast Asia and then to the Pacific Islands. Tannia resembles true taro in botanical characteristics, but is a more robust plant than true taro in that it grows better in dry conditions. It is mostly grown for its corm as a supplementary staple and the shoots (leaves) are sometimes used as vegetables. There are many varieties of tannia, but the two most common varieties available in the Pacific are white flesh *(X. caracu*) and pinkish flesh (*X. violaceum).* In Fiji, it is known as *dalonitana*.

Propagation

Taro is propagated by its suckers. *Colocasia* is usually grown in rainfed 'dry' land, but some varieties can be grown in irrigated terraces or swamps. *Alocasia* and *Xanthosoma* are grown on dry land while *Cyrtosperma* is grown in poor and flooded land.

Nutrient content

The many species and varieties of taro differ in appearance, taste, use and other functional properties. The different edible parts of the plant contain various amounts of nutrients that are beneficial to our health. Preparing all the edible parts in one dish would provide a nutrient dense meal, generally richer in carbohydrate, calcium and vitamins A, C and E than white rice and white bread, as shown in Table 1

Corm

The taro corm is a fairly good source of energy and fibre as shown in Table 1. Energy is needed by the body for warmth, work and play. The corms, particularly of giant swamp taro (*Cyrtosperma chamissonis*) and true taro (*Colocasia esculenta*), are rich in fibre, which is needed to keep the digestive system functioning properly. Fibre also helps to control blood sugar in people with diabetes and contributes to reducing blood cholesterol levels, which is a risk factor for heart disease. Studies have shown that people who eat foods rich in fibre are less likely to be overweight.

Taro corms are also good sources of essential minerals, such as calcium and non-heme iron. Calcium helps to maintain bone health, and iron helps keep the blood healthy. Women and growing children, in particular, need lots of iron in their diet. Some giant swamp taro (*Cyrtosperma*) varieties are also a rich source of zinc, which is an essential mineral that protects against infection and vitamin A deficiency. Taro is one of the few non-animal sources of zinc.

The corm is also a good source of vitamins A, C and E. Vitamin A is important for good vision and eye health, it helps to fight against infection and it builds blood. Consuming two cups of yellow-fleshed giant swamp taro a day may provide all of the estimated daily requirements for vitamin A. Vitamin E is an antioxidant that helps protect our body against infection and the harmful effect of free radicals.

Table 1: Nutrient content of 100 g of the edible portion of boiled taro corm of different cultivars compared to 100 g of rice and bread

Food name	Energy	CHO	Protein	Fat	Fibre	Calcium	Iron	Vit A	Vit C	Vit E	Thiamin	Riboflavin	Niacin	Zinc
CORM	(Kcal)	(g)	(g)	(g)	(g)	(mg)	(mg)	(ug)	(mg)	(mg)	(mg)	(mg)	(mg)	(mg)
Xanthosoma taro/ tannia, boiled	94	21.3	1.1	0.4	1.0	33	1.0	3	5.0	1.9	0.08	0.02	0.6	0.2
Cyrtosperma giant swamp taro, boiled	72	16.2	0.5	0.2	2.5	165	0.6	2	7.9	4.7	0.02	0.01	0.3	1.9
Alocasia giant taro, boiled	92	20.4	2.0	0.1	1.7	35	0.8	0	8.5	2.2	0.01	0.01	0.3	1.5
Colocasia taro, white, boiled	99	22.4	0.9	0.6	0.8	34	1.0	3	5.0	2.0	0.08	0.03	0.6	0.8
Colocasia taro, black, boiled	82	18.8	0.8	0.4	0.7	28	0.9	3	4.0	1.7	0.07	0.02	0.5	2.7
Colocasia taro, yellow, boiled	126	29.8	0.7	0.4	1.0	44	1.3	3	7.0	2.6	0.11	0.03	0.8	1.0
Rice, white, boiled	123	28.0	2.3	0.2	0.8	4	0.3	0	0	t	0.03	0.01	0.6	0.6
Bread, white	242	47.2	8.2	2.0	2.7	32	1.1	0	0	t	0.13	0.08	1.2	0.6

Source: Dignan et al. 2004

Abbreviations: CHO, carbohydrate; t, trace; vit, vitamin.

Table 2: Nutrient content of 100 g of boiled taro leaves and stalk

Food name	Energy	CHO	Protein	Fat	Fibre	Calcium	Iron	Vit A	Vit C	Vit E	Thiamin	Riboflavin	Niacin	Zinc
Colocasia taro leaves	28	0.7	3.8	0.6	2.5	214	1.7	414	20	2.2	0.06	0.13	1	0.3
Colocasia taro stalk	26	5.4	0.3	0.2	0.7	114	1.9	8	2	0.1	0	0.05	0.2	0.4

Source: Dignan et al. 2004

Abbreviation: vit, vitamin.

Leaves and stalks

True taro leaves are excellent sources of vitamins A, C and E, as well as fibre and calcium. Vitamin C is important for protecting against infection and helps the body absorb iron for building strong blood. Taro leaves can be made into tasty dishes and are popular on some islands. However, they must be prepared and cooked properly to get rid of the acridity, which can make the throat itchy. Part of this irritation is thought to be due to needle-like crystals of oxalate in taro, which may also contain other chemical irritants.

Functional properties

Apart from the nutritional content discussed above, taro contains other functional properties, including antioxidants, phenols, flavonoids and carotenoids, as well as moderate levels of glycemic responses.

Antioxidants

The functional properties of taro can be easily seen in the range and intensity of colours. The major colours associated with functional properties such as antioxidants are yellow, orange, red and purple. Eating foods rich in these colours helps protect against diabetes, heart disease and cancer. Yellow and orange colours are associated with carotenoids and pink to purple colours are associated with polyphenols, especially flavonoids. Deeper shades of these colours provide an increased amount of antioxidants and thus greater health benefits. Carotenoids, polyphenols, flavonoids and the total antioxidant capacity have been found to be present in certain varieties of taro and are especially high in the leaves, as shown in Table 3 below. Eating coloured taro corm is more beneficial than eating the white variety (Figure 1).

Table 3: Antioxidant, polyphenol and carotenoid contents of 100 g boiled taro corm of different cultivars

Food name	Total Antioxidant Capacity* (mg)	Total Polyphenols (mg)	Total Carotenoids** (mg)	Total Flavonoids*** (mg)
Colocasia taro, white	13	12	0.05	nd
Colocasia taro, yellow	25	20	nd	3
Xanthosoma taro/tannia, red	10	12	0.02	nd
Colocasia taro leaves, steamed	100	120	19.6	3

Source: Lako et al. 2006.
*Notes: *TEAC (Trolox equivalent capacity) method; **total of lycopene, a- and b-carotene; ***total of myricetin, fisetin, morin, quercetin, kaempferol and isorhamnetin.*
Abbreviation: nd, not detected.

Vitamins C and E are also strong antioxidants, which help remove free radicals from cells in different parts of the body; vitamin C, being a water soluble vitamin, removes free radicals from the hydrophilic (water) components of the cells, while the fat soluble vitamin E removes free radicals from the lipophilic (fat) components of cells. New findings show that varieties of giant swamp taro with yellow-fleshed corms contain significant amounts of ß-carotene, a type of carotenoid that is converted to vitamin A in the body and that helps protect eye health.

Cooking food at moderate temperatures and for a reasonable period does not destroy carotenoids and flavonoids but limits some antioxidants, such as vitamin C. Cooking helps the body to metabolise carotenoids more easily.

Figure 1: Taro (*Colocasia esculenta*) varieties

a) peeled (raw) cut sections **b) cooked**

Glycemic responses

Carbohydrate rich foods have been ranked according to their glycemic responses, i.e. how fast or slow carbohydrates break down in our body. Carbohydrates that break down quickly during digestion have a high glycemic index (GI 70 and above). Their blood sugar response is fast and high. Carbohydrates that break down slowly, releasing glucose gradually into the blood stream, have a low glycemic index (GI 55 and less).

Consumption of low glycemic food is associated with a lower risk of developing diabetes and coronary heart disease than consumption of high glycemic foods. The glycemic index of boiled *Colocasia* taro is 54 and that of boiled *Xanthosoma* taro is 63, compared with white bread (GI 77), Jasmine rice (GI 109) and Calrose rice (GI 83). Thus taro is a healthier option than white rice or bread.

Storage and preservation

Corms

After harvesting, most varieties do not keep well. They are best left growing in the ground until ready to be used. However, if *Xanthosoma* taro is kept in a cool, dark, dry place, it will stay fresh for several weeks.

One traditional method of preserving *Colocasia* corms is to store them in a pit lined with coconut husks or banana leaves, cover them with the same material, and then seal the pit with soil. Taro will keep about one month when stored like this. Another method is to bake *Colocasia* corms in an earth oven until a crust is formed. These corms will keep for about a week. Yet another method of preservation is to partly boil the corm, slice it thinly and then dry the pieces in the sun.

Freezing is also a very good method of preserving peeled corms, or corms can be grated and then frozen in clean plastic bags. This method is useful for some recipes and also cooks quickly. Grated frozen taro is marketed in several Pacific islands.

Leaves

Taro leaves are best if picked fresh. If you need to keep the leaves for a short period, it is important to make sure that they do not get too warm or dry. They should be picked with the stalks, then put in a bowl of water and kept in a cool place. That way, they will keep for a few days. Taro leaves can also be kept in a refrigerator or cooler, using a clear plastic bag with a few holes in it. Leaves can be blanched in water and then, when the water is removed, the blanched leaves can be stored in a clean plastic bag and frozen.

Value addition

Taro corm can be made into many different types of food. For example, *Colocasia, Alocasia* and *Xanthosoma corms* can be made into taro flour that makes very good scones and bread. Some varieties of *Colocasia* corms are ideal for extrusion into taro products such as pasta and noodles, poi and taro dessert, while all four species can be made into taro chips and taro flakes. It is important to note that the appropriate variety of taro needs to be selected in order to make high quality, value-added products, due to the different composition of starch in the different varieties.

Preparation and cooking

Corms

Cooking taro whole and unpeeled will help preserve important nutrients. Taro may be roasted on hot stones, baked in an earth oven or boiled. As mentioned earlier, however, different types of taro, including *Colocasia* and *Alocasia* varieties, have varying levels of acridity and can cause uncomfortable itchiness in the mouth and throat if not cooked properly. To avoid this problem, the corms must be prepared properly.

Leaves

When choosing leaves of *Xanthosoma* taro, pick only young leaves and pick only green or pink (not brown or purple) stalks *of Colocasia* leaves. Cook on high heat in a pan without a lid and do not turn while cooking. Turning leaves encourages the release of acroid that causes itchiness.

Stalks

The green stalks of *Colocasia* are also eaten but it is not a common practice in the Pacific. Like the leaves, the stalks also need to be cooked properly. See the recipe for taro salad (*baseisei*) below.

Recipes

A. Taro corm

1. Stir-fried taro with vegetables

Number of servings: four

Nutrition facts
One serving size: 306 g

Amount per serving

Energy:	843 (211 cal)
Fat:	2.6 g
Carbohydrate:	36.6 g
Protein:	5.8 g
Iron:	3.2 mg
Sodium:	14.3 mg

2 medium-sized taro corms (*Colocasia*)
3 cups washed green leaves or other vegetable
1 large onion, chopped
2 small spring onions, chopped
1 teaspoon cooking oil

1. Peel taro and cut into serving-size pieces.
2. Arrange in a saucepan and add enough water to cover.
3. Boil for around 30 minutes or until cooked (soft when pricked with a sharp knife).
4. Steam vegetables separately until cooked. Take care not to overcook. The vegetables should be still bright in colour.
5. Heat the oil and lightly fry the onions.
6. Add the cooked taro, vegetables, and spring onion, cook for 1 to 2 minutes and serve.

2. Taro with seafood

Number of servings: two

Nutrition facts
One serving size: 688 g

Amount per serving
Energy: ..... 3293 kJ (787 kcal)
Fat:..... 51.4 g
Carbohydrate:..... 38.0 g
Protein:..... 41.0 g
Iron: .....7.7 mg
Sodium:..... 147 mg

2 cups peeled (*Colocasia)* taro cut into cubes
1 cup shellfish or small fresh fish
1½ cups coconut milk
½ cup water
1 onion, chopped
1 tablespoon butter, margarine or oil
Taro leaves
Pepper, optional

1. Cook the taro cubes in boiling water until soft. Drain the water and set the cooked taro aside.
2. Remove the shells from the shellfish or wash and prepare the small, fresh fish for cooking.
3. Heat the butter, margarine or oil in a saucepan. Fry the onion for 4 to 5 minutes.
4. Add the water and coconut milk and stir the mixture until it boils. Add the shellfish or fresh fish and cook gently for 5 minutes.
5. Add the chopped green leaves and cooked taro and cook gently for 5 to 10 minutes.
6. Add pepper to taste and serve hot.

B. Taro stalk

3. Taro salad (*Baseisei* from Fiji)

Number of servings: four

Nutrition facts
One serving size: 250 g

Amount per serving
Energy: .....857kJ (205 kcal)
Fat:..... 15.9 g
Carbohydrate:..... 12.9 g
Protein:..... 32.6 g
Iron: .....4.3 mg
Sodium:.....8.0 mg

20 taro stalks (*Colocasia*)
2 tablespoons lemon juice
1 cup thin coconut cream
1 tablespoon chopped spring onion
Chopped chilli to taste

1. Choose only taro stalks that are pinkish and white. Peel off the outside skin of the stalk.
2. Cut the stalks into pieces 10 cm (4 inches) long.
3. Drop the stalks into a saucepan of boiling water, cover with a lid and boil for 2 minutes.
4. Strain the stalks and throw out the cooking water. Put the cooked stalks into a bowl of cold water. When they cool, drain the water off.
5. Shred the stalks lengthways into thin strips, using a fork.
6. Mix together the lemon juice, coconut cream, spring onion and chilli and pour the mixture over the taro stalks. Fresh or tinned fish can be added to this recipe. This makes a tasty dish to serve with cooked taro root, sweet potato, yam or other root vegetable.

4. Taro cakes (Parkinson et al. 1995)

Number of servings: six

Nutrition facts
One serving size: 116 g

Amount per serving
Energy: .....607 kJ (145 kcal)
Fat:.....3.9 g
Carbohydrate:..... 25.1 g
Protein:.....2.4 g
Iron: .....1.3 mg
Sodium:..... 11.6 mg

3 cups of mashed or grated taro
2 teaspoons grated onion
2 teaspoons chopped parsley
1 egg, beaten
Salt and pepper
Flour
Vegetable oil

1. Mix taro with onion, parsley, egg, salt and pepper.
2. Shape into cakes and roll into flour.
3. Fry in hot oil on both sides until golden brown.
4. Serve hot as a starter with a spicy sauce.

C. Taro leaves

5. Taro leaves in coconut cream (*Palusami* from Samoa)

Number of servings: 28 parcels

Nutrition facts
One serving size: 135 g

Amount per serving
Energy: 1083 kJ (258 kcal)
Fat:..... 23.6 g
Carbohydrate:.....5.0 g
Protein:.....6.0 g
Iron: .....2.5 mg
Sodium:..... 15.0 mg

8 coconuts
12 bundles *Colocasia* taro leaves – about 120 leaves
6 onions, chopped
7 banana leaves
28 breadfruit leaves

1. Grate the coconuts.
2. Add one cup of water. Using a fine cheese cloth or coconut fibre, squeeze out the coconut milk. Season with a pinch of salt and set aside.
3. Choose firm, clean banana and breadfruit leaves.
4. Hold each banana leaf over a flame to soften it. Carefully remove the back of the centre stalks from all the banana leaves, taking care not to tear the leaves. Divide each banana leaf into 4 pieces.
5. Take 4–6 clean, washed taro leaves and shape them into a cup. Into the centre, put a half tablespoon of chopped onion and one cup of coconut milk. Fold the leaves in carefully, without spilling the coconut milk.
6. Wrap each taro leaf parcel in a piece of softened banana leaf, and then cover with a breadfruit leaf. Make a secure parcel by tucking the stem underneath the leaf. The taro leaf bundle can be wrapped in aluminum foil instead of leaves.
6. Cook the parcels in an earth oven or steam for 30 minutes. Chopped pieces of meat or fish may be added to the taro leaf parcel as well. If this is done, the cooking time must be increased to at least 1 hour.

Note: It is best to limit the use of salt for health reasons.

6. Taro leaf souffle' (Parkinson et al. 1995)

Number of servings: four

Nutrition facts
One serving size: 189 g

Amount per serving
Kilojoules: ..... 1270 (302 kcal)
Fat:..... 22.6 g
Carbohydrate:.....9.2 g
Protein:..... 16.3 g
Iron: .....1.7 mg
Sodium:..... 487 mg

4 tablespoons butter or margarine
3 tablespoons flour
1 teaspoon salt
1 teaspoon dry mustard
1 cup milk, standard or low fat
½ cup grated Cheddar cheese
½ cup cooked, well-mashed taro leaves
5 eggs

1. In a large saucepan, make a basic white sauce using the first 5 ingredients.
   a. Melt the butter.
   b. Add the flour, salt and dry mustard and mix.
   c. Gradually add the milk and stir until sauce thickens.
2. Remove from heat and stir in cheese and mashed taro leaves. Set aside.
3. Separate eggs. Beat egg whites until stiff. Beat egg yolks until thick and creamy and blend into the sauce.
4. Gently fold the beaten egg whites into the sauce until fairly evenly mixed.
5. Spoon into lightly greased 6-cup souffle or straight-sided dish.
6. Bake in a pre-heated, 190°C (374°F) oven for 30–35 minutes. Do not open oven door while baking.
7. Serve immediately.

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Yam

Leaflet No. 2 - Revised 2012

Introduction

The yam, a member of the genus *Dioscorea*, is also known as *uvi, iaam, ufi* and *nufi*. In the Pacific, yam is a very important root crop and has great cultural significance. In some places, yams are eaten every day when in season, but in other places they are eaten only on special occasions. Yams are appreciated for their delicious flavour and cultural value, and they have many other good qualities: they can be easily stored for many months after harvesting, they are nutritious, they can be cooked in a variety of ways, and they can be mixed with many other types of food to make tasty dishes. Special varieties are important in some cultures as a valuable food for ceremonial occasions.

Major types of yam and cultivation

Yams are climbing vines with large roots, or tubers, which grow up to ten feet (3.3 metres) long. These roots have many shapes and may be white, off-white or purple inside, as shown in Figure 1.

The genus *Dioscorea* consists of about 600 species with many varieties that grow throughout the humid tropics, differing in shape, size and colour. Edible yams are derived mainly from about ten varieties. The most economically important species worldwide, especially in Africa and Asia, are the white yam, the yellow yam, the water yam and the bitter yam.

White yam, *Dioscorea rotundata*. This species originated in Africa. The tuber has a rough cylindrical shape, the skin is smooth and brown and the corm is usually white and firm. There are many white yam cultivars, which differ in production and post-harvest characteristics.

Design and layout: Muriel Borderie - SPC Publications Section

Yellow yam, *Dioscorea cayenensis.* This species, which originated in West Africa, derives its common name from the yellowness of its corm, which is caused by the presence of carotenoids. The yellow yam is very similar in appearance to the white yam, but has a much firmer and rougher skin.

Water yam, *Dioscorea alata.* The tuber shape is generally cylindrical, but with variations. Tuber flesh has a white, watery texture. This species originated in South East Asia.

Bitter yam, *Dioscorea dumetorum.* The major characteristics of the tuber are its bitter flavour and undesirable hardening of the flesh if not cooked soon after harvest. Some wild cultivars are highly poisonous. The bitter yam originated in Africa, where wild cultivars also exist.

In the Pacific region, five major species of yam and more than 60 varieties are grown and eaten. The widely grown and commonly consumed species is *Dioscorea alata* (water yam). The other four species are *D. esculenta, D. pentaphylla, D. nummularia* and *D. bulbifera.*

Successful cultivation requires good, fertile soil and great care. The soil should be deep, loose and well drained. Yams do not grow on atolls, where there is not enough soil. Small yams or the cuttings from the top of a large yam are used as planting material. The cultivated area must be kept free of weeds for the first three months. The vines are usually trained to grow on long poles. In smaller gardens, where space is limited, they may be trained onto fruit trees. After 9–12 months, the yams are ready for harvesting. They are harvested when the leaves are dry. Up to a hundred times more yams may be harvested than the number that was planted. Eating local foods such as yams can save money for families who are able to grow their own food.

Nutrient content

Yams are starchy root crops so they are a good source of energy, which the body needs to stay active. Yams also contain reasonable amounts of vitamins A and C. Vitamin A helps protect eye health and Vitamin C helps to keep the body tissues strong, helps the body to use iron, and aids chemical actions in the body. Yams also provide bulk and some fibre, which are needed to make the intestines and bowels work properly.

Figure 1: Yam (*Dioscorea* spp.) varieties

a) *D. alata* unpeeled, raw

b) *D. alata veiwa*, peeled, raw (red)

c) *D. alata veiwa,* peeled cooked (red)

d) *D. esculenta* sweet yam *(kawai)*, raw

e) *D. nummularia* wild yam, raw *(tivoli)*

Table 1: Nutrient content of 100 g of boiled yam compared with 100 g of cooked rice

Food name	Energy	CHO	Protein	Fat	Fibre	Calcium	Iron	Vit A	Vit C	Vit E	Thiamin	Riboflavin	Niacin	Zinc
	(Kcal)	(g)	(g)	(g)	(g)	(mg)	(mg)	(ug)	(mg)	(mg)	(mg)	(mg)	(mg)	mg
Yam, composite, baked	101	22.1	2.5	0.1	1.8	9	0.8	10	22.5	5.1	0.05	0.03	0.4	0.5
Yam, composite, boiled	84	18.3	2.0	0.1	1.5	7	0.6	8	17.4	4.2	0.04	0.03	0.4	0.4
Yam, tuber, baked	196	44.8	3.7	0.4	0.3	22	1.5	10	10	5.0	0.15	0.04	0.6	0.9
Rice, white, boiled	123	28.0	2.3	0.2	0.8	4	0.3	0	0	t	0.03	0.01	0.6	0.6

Source: Dignan et al. 2004
Abbreviations: CHO, carbohydrate; t, trace

When eaten in large quantities, as they usually are in the Pacific, yams also provide a fair amount of iron and niacin. Iron helps to keep blood healthy and niacin helps the body to use energy foods.

No single food can provide all the essential nutrients needed by the body for good health. Yams are good sources of some nutrients, as shown in Table 1, but for a balanced diet they should be eaten with protective foods, such as dark green, leafy vegetables, and body-building foods, such as fish, meat, peanuts and milk.

Functional properties

Yam tubers come in three major colours: white, yellow and purple. In addition to the nutritional content, they have other functional properties, especially the yellow and purple varieties. These functional properties include antioxidants, polyphenols and carotenoids in the form of ß-carotene, which can provide health benefits such as protecting cells from damage and lowering the risk of cardiovascular disease.

Antioxidants

The yam's functional properties can be easily seen in the range and intensity of colours. The major colours associated with functional properties such as antioxidants are yellow, orange and purple. Eating foods rich in these colours helps protect against diabetes, heart disease and some cancers. Yellow is associated with carotenoids, and purple is associated with polyphenols, especially flavonoids. Deeper shades of these colours provide an increased amount of antioxidants and thus greater health benefits. Carotenoids, polyphenols, flavonoids and the total antioxidant capacity have been found to be present in the major types of yam, as shown in Table 2 below.

Table 2: Antioxidant, polyphenol and carotenoid contents of 100 g of boiled sweet potato

Food name	Total Antioxidant Capacity* (mg)	Total Polyphenols (mg)	Total Carotenoids** (mg)	Total Flavonoids*** (mg)
Yam, *veiwa*, red, boiled (*D. alata)*	33	26	nd	2
Yam, *vurai*, white, boiled (*D. alata)*	3	8	nd	nd
Yam, sweet, red, boiled (*D. esculenta)*	27	38	nd	1
Yam, sweet, white, boiled (*D. esculenta)*	10	17	nd	nd
Yam, *tivoli*, white, boiled (*D. nummularia)*	26	47	nd	6

Notes: *TEAC (Trolox equivalent antioxidant capacity) method; **total of lycopene, a- and b-carotene; ***total of myricetin, fisetin, morin, quercetin, kaempferol and isorhamnetin.
Source: Lako et al. 2007
Abbreviation: nd, not detected

In addition, vitamins C and E are strong antioxidants, which help remove free radicals from different parts of the body cells. Vitamin C, being a water soluble vitamin, removes free radicals from the hydrophilic (water) components of cells while the fat soluble vitamin E removes free radicals from the lipophilic (fat) components of cells. Cooking food at moderate temperatures and for a reasonable period does not destroy carotenoids and flavonoids but does limit some antioxidants, such as vitamin C. Cooking food helps the body to metabolise carotenoids more easily.

Glycemic responses

Carbohydrate foods have been ranked according to their glycemic responses, i.e. the rate at which carbohydrates break down in our body. Carbohydrates that break down quickly during digestion have a high glycemic index (GI 70 and above). Their blood sugar response is fast and high. Carbohydrates that break down slowly, releasing glucose gradually into the blood stream, have a low glycemic index (GI 55 and less). Consumption of low glycemic food is associated with a lower risk of developing diabetes and coronary heart disease than consumption of high glycemic foods. The glycemic index of boiled yam is 56 compared with 77 for white bread, 109 for Jasmine rice and 83 for Calrose rice. Yam, however, is a carbohydrate rich food so it is recommended that guidance on appropriate portion sizes be followed because of the effect of the glycemic load (GL), which depends on the amount of carbohydrate consumed per meal. This in turn affects blood glucose and insulin levels. One portion is roughly equivalent to the size of a closed fist.

Storage and preservation

The basic principles of successful yam storage are the provision of adequate ventilation, access for regular inspection and protection from direct sunlight.

Yams keep well if left in the ground and harvested when needed. After harvesting, store in a dry, dark, cool and well-ventilated place. Yams may be kept for several months if stored properly, following these basic principles.

To preserve yams for longer periods of time, freshly harvested tubers may be packed in ashes and covered with soil or simply covered with a few inches of soil and grass mulch. Yams may also be stored in heaps

on the floor or on shelves in sheds or in a yam house. Yams stored this way need to be checked occasionally to remove any that are beginning to go bad and to pinch off any growing shoots.

Yam house

Planting many different kinds of yam, to mature at different times, extends the time they are available during the year. Once harvested, yams will keep well if stored in a dry and well ventilated place. Storage huts are built for this purpose in many different designs and sizes in the Pacific Islands.

Drying

Yams may also be preserved for later use by drying them. Use only firm, smooth roots. Steam them whole and unpeeled for 30–40 minutes until cooked, but not too soft. Peel and cut them into thin slices, then dry them in the sun or in a solar drier until the slices are extremely leathery. This will take about three days. Once dried, the yam slices may be stored in an airtight container, ready to be added to soups or stews. Dried yam may also be ground and used as flour or as a thickener in stews or casseroles.

Value-addition

Yams can be made into a variety of products, including yam flour — which makes delicious scones and bread — yam chips, yam flakes and extruded products such as pasta and noodles.

Preparation and cooking

Yams can be boiled, baked or fried in much the same way as potatoes. In the Pacific, fresh yams are usually peeled and boiled, or baked in an earth oven without peeling. When peeling yams, the corm starts to turn brown, so peeling should be done quickly and the yams soaked in water. Wash away the brown colour before cooking.

Yams are also cooked with other foods such as fish, chicken or shellfish, along with coconut cream. Yams can be used as a substitute for potatoes in stews, casseroles and curries. Yams also make an excellent complementary baby food when cooked and mashed with fish and green leafy vegetables.

Some kinds of yams are poisonous and must be prepared very carefully. Normally, these varieties are not cultivated for food but are mainly used during famine. They are found in the wild. It is very important to check with agricultural experts if you are unsure whether or not a variety of yam is poisonous. Traditional methods of preparing these varieties for food include washing the peeled yam several times in cold water, and repeatedly cooking it in water with added lemon juice. In some areas, poisonous yams are used to make the glue that holds pieces of bark cloth together.

Recipes

Yam salad

Number of servings: six

Nutrition facts
One serving size: 287 g

Amount per serving
Energy: ..... 738.6kJ (176 kcal)
Fat: ..... 3.3 g
Carbohydrate: ..... 28.3 g
Protein: ..... 7.2 g
Iron: ..... 1.4 mg
Sodium: ..... 55.4 mg

5 cups cooked yam
2 onions, chopped
1 cup salad dressing
1 lettuce
2 medium tomatoes
2 hard-boiled eggs

1. Cut the cooked yam into cubes.
2. Mix together in a dish the yam, onion and salad dressing (see below for recipe).
3. Serve cold with lettuce and tomatoes and sliced hard-boiled eggs.

Salad dressing (makes one cup)

2 hard-boiled egg yolks
½ cup instant skim milk powder
4 teaspoons sugar (optional)
5 teaspoons lemon juice
½ cup water
4 teaspoons coconut oil

1. Mash the cooked egg yolk with the instant milk powder.
2. Add the sugar (optional).
3. Add the lemon juice and water very slowly. Mix in well.
4. Slowly add the cooking oil.
5. Serve with yam salad or any fresh green salad.

2. Boiled yam in coconut cream

Number of servings: four

Nutrition facts
One serving size: 411 g

Amount per serving
Energy: ..... 2252 kJ (538 kcal)
Fat: ..... 13.1 g
Carbohydrate: ..... 94.6 g
Protein: ..... 9.4 g
Iron: ..... 1.4 mg
Sodium: ..... 21.6 mg

2 cups diluted coconut cream (from 2 coconuts)
8 pieces of yam (about 150 grams each)
16 taro or slippery edible hibiscus *(bele)* leaves

1. Prepare coconut cream.
2. Peel yams and chop into average size pieces.
3. Fill pot with yam pieces until they fill about three-quarters of the pot.
4. Pour in coconut cream.
5. Cover with taro leaves before putting the lid on.
6. Boil for 30–45 minutes or until yams are cooked.
7. Serve hot as a breakfast dish.

Note: Soft varieties of yams are best cooked this way.

3. Stuffed yam with cheese

Number of servings: four

Nutrition facts
One serving size: 230 g

Amount per serving
Energy: ..... 1457kJ (348 kcal)
Fat: ..... 21.4 g
Carbohydrate: ..... 23.3 g
Protein: ..... 15.5 g
Iron: ..... 2 mg
Sodium: ..... 143 mg

1 small yam
1 cup flaked cooked fish
1 large tomato, chopped
1 cup milk or coconut cream
½ cup grated cheese

1. Bake the yam with the skin on until cooked.
2. Cut it in half while still hot. Scoop out the yam, leaving the skin whole in the shape of a boat, and mash it with a fork.
3. Add the flaked fish, chopped tomato and milk or coconut cream to the yam and mix.
4. Put the yam mixture back into the skin.
5. Sprinkle grated cheese on top.
6. Bake for about 15–20 minutes or until the cheese melts.
7. Serve hot.

4. Yam and vegetable curry

Number of servings: four

Nutrition facts
One serving size: 298 g

Amount per serving
Energy: ..... 1202 kJ (286 kcal)
Fat: ..... 7.8 g
Carbohydrate: ..... 43.8 g
Protein: ..... 7.2 g
Iron: ..... 3.7 mg
Sodium: ..... 43.7 mg

4 cups chopped yam
2 tablespoons cooking oil
1 onion, sliced
2 chillies, chopped (optional)
2 teaspoons curry powder
2 cloves garlic, crushed (optional)
2 cups chopped vegetables, e.g. green beans, tomatoes, pumpkin, carrots
1½ to 2 cups water

1. Wash and peel the yams and cut into pieces.
2. Heat the oil in a pot. Add sliced onion and chillies (optional) and cook until browned.
3. Add curry powder and crushed garlic (optional) stirring all the time. Cook for one minute.
4. Add yam pieces and vegetables, stirring well. Add the water. Cover.
5. Cook slowly for about 15 minutes until the yam is soft. If the yam is still hard, then add more water as required and cook for a few more minutes.
6. Serve hot with fish and fresh, dark green salad.

5. Baked yam and pawpaw savoury

Number of servings: six

Nutrition facts
One serving size: 250 g

Amount per serving
Energy: ..... 1015 kJ (242 kcal)
Fat: ..... 10.5 g
Carbohydrate: ..... 31.5 g
Protein: ..... 4.5 g
Iron: ..... 1.9 mg
Sodium: ..... 13.4 mg

4 cups chopped yam
1 cup coconut cream
1 ripe pawpaw
1 onion
1 large soft banana leaf

1. Wash and peel the yam. Cut into thin slices and wash again.
2. Peel onion and pawpaw. Slice thinly.
3. Place the yam, pawpaw and onion in layers on a banana leaf that has been softened over a fire, or on aluminium foil paper. Finish with a layer of pawpaw on top.
4. Pour coconut cream over the layers.
5. Wrap and tie into a bundle.
6. Bake in an earth oven or steam until done, for about 1 hour.
7. Serve hot.

Variations: A green or half-ripe pawpaw could be used.

6. Yam delicious

Number of servings: six

Nutrition facts
One serving size: 174 g

Amount per serving
Energy: ..... 897 kJ (214 kcal)
Fat: ..... 9.1 g
Carbohydrate: ..... 27.5 g
Protein: ..... 5.2 g
Iron: ..... 1.2 mg
Sodium: ..... 24.6 mg

6 pieces of yam (about 5 oz or 150 grams each)
2 eggs
1 onion, chopped
Seasoning (optional)
¼ Cup oil for frying

1. Boil the yam. Mash well.
2. Add eggs, onion and seasoning. Mix well.
3. Form into small balls.
4. Fry in the hot oil until golden brown.
5. Serve hot.

Note: Makes a delicious snack for children.

7. Yam fritters

Number of servings: four

Nutrition facts
One serving size: 131 g

Amount per serving
Energy: ..... 757 kJ (180 kcal)
Fat: ..... 4.1 g
Carbohydrate: ..... 30 g
Protein: ..... 5.4 g
Iron: ..... 1.1 mg
Sodium: ..... 18.5 mg

2 cups grated yams (raw)
1 egg, beaten
½ cup flour
½ teaspoon baking powder
½ cup water
2 cups oil (for frying)

1. Mix together yam, flour, beaten egg and water.
2. Drop in spoonfuls into the hot oil.
3. Fry till golden brown.

Variations: Sweet potatoes, mashed breadfruit, pounded boiled tapioca, or mashed boiled green bananas can be used instead of yams.
Use milk instead of water.

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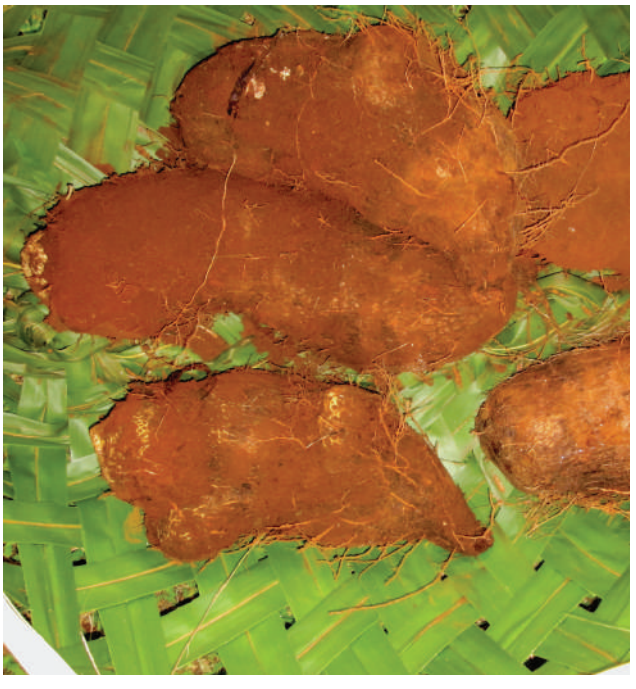

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Sweet potato

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Introduction

The sweet potato, or *Ipomoea batatas,* is also known as *kumara* or *kumala.* It is a very valuable food in tropical and subtropical countries, where both the tubers and leaves are eaten. The plant has long, trailing stems, with dark green leaves. The flowers are either white or pink and funnel-shaped. The colour of the tuber skin ranges from light yellow to purple, and the flesh may be white, pink, purple or yellow.

Sweet potato is a versatile crop in that it can be planted and harvested at any time of the year. When mature, it is often used as an emergency crop during natural disasters such as cyclones and floods as it can be easily harvested, stored and prepared. These advantages are especially important today due to the impact of climate change in the Pacific.

Major types of sweet potato and cultivation

Many varieties of sweet potato are available in the Pacific. These vary in size, shape and colour of tubers, taste, nutritional value, maturity period, yield, resistance to pests and diseases, and leaf structure. The two types of sweet potato are dry-fleshed and moist-fleshed. Popular moist-fleshed varieties include Beauregard, Hernandez, Jewel, Carolina Ruby, Cordner, Porto Rico 198, and White Delight. In Fiji alone, about 17 varieties are available, although only four major varieties are commonly eaten. These include *vulatolu, papua, carrot* and *honiara*.

Basically, the different varieties can be distinguished by the colour of the flesh and skin of the tuber. The major colours associated with the tuber flesh are white, yellow, pink, orange and purple, while the skin colour ranges from light yellow to purple.

Design and layout: Muriel Borderie - SPC Publications Section

Figure 1: Major varieties of sweet potatoes

a) Skin colours

b) Flesh colours

Sources: www.farm-fresh-produce.com/spvarieties.html

The sweet potato is cultivated from stems or tubers. When planting sweet potato, choose good quality, disease-free plant material. Sweet potatoes are normally grown during the drier months. Stem cuttings about 46 centimetres (18 inches) long are generally used. Pieces of the tuber may also be used. The planting hole should be 15–30 centimetres (6–12 inches) deep. After planting, make a mound around the cutting for the tubers to grow. Make sure that the sweet potatoes are not under shade. The tubers are harvested 3–7 months after planting, when the leaves turn yellow. For more information on growing sweet potatoes, contact your local agricultural officer.

Nutrient content

The parts of the sweet potato that are consumed are the tubers and the leaves.

Tuber

Sweet potato is a starchy food so it is a good source of energy, which the body needs to stay active and alive. Yellow and orange varieties of sweet potato tubers contain a large amount of vitamin A, as shown in Table 1. Other pale-fleshed varieties contain much less of this important vitamin, and potato has limited or no vitamin A at all.

Leaves

Sweet potato leaves, or tips, are a health-giving, protective food (as are all green leafy vegetables). They are excellent sources of vitamins A and C and contain good amounts of riboflavin. Vitamin A is needed for proper growth, healthy eyes, and protection against infections. Vitamin C keeps the body tissues strong, helps the body use iron, and assists chemical actions in the body. Vitamin B2 (riboflavin) is necessary for normal growth and healthy eyes. It is found in fair amounts in sweet potato leafy tips.

Eating dark green leaves every day is recommended for good health as they are excellent sources of essential vitamins and minerals. Table 1 shows how sweet potato leaves provide more nutrients, particularly vitamin A, than European cabbage. The darker the leaves, the more Vitamin A they contain.

Table 1: Nutrient content of 100 g of boiled sweet potato compared with 100 g of cooked potato

Food name	Energy	CHO	Protein	Fat	Fibre	Calcium	Iron	Vit A	Vit C	Vit E	Thiamin	Riboflavin	Niacin	Zinc
	(Kcal)	(g)	(g)	(g)	(g)	(mg)	(mg)	(ug)	(mg)	(mg)	(mg)	(mg)	(mg)	mg
Sweet potato, konime, baked, earth-oven	128	28.6	1.9	0.1	1.2	33	2.1	5	48	5.4	0.10	0.04	0.6	0.4
Sweet potato, konime, baked, salted	128	30.3	1.3	0.1	1.2	33	2.1	5	48	5.4	0.10	0.04	0.6	0.4
Sweet potato, konime, boiled	106	25.0	0.8	0.2	1.0	29	1.8	5	42	4.0	0.08	0.04	0.6	0.3
Sweet potato, orange, peeled, boiled	69	14.1	1.9	0.1	2.3	26	0.5	480	23	3.5	0.02	0.05	1.0	0.5
Sweet potato, seyspen, baked, earth-oven	114	25.8	2.0	0.1	1.8	30	2.0	5	44	5.4	0.09	0.04	0.6	0.3
Sweet potato, white, peeled, boiled	79	17.3	1.4	0.1	2.0	13	0.5	1	19	3.8	0.04	0.03	1.1	0.4
Sweet potato, composite, baked	129	30.1	1.4	0.2	1.7	28	0.5	5	25	5.6	0.09	0.04	0.7	0.4
Sweet potato, composite, boiled	91	20.5	1.4	0.2	1.7	29	0.5	5	18	4.0	0.07	0.03	0.6	0.3
Sweet potato, composite, steamed	95	21.3	1.4	0.2	1.7	27	0.5	5	18	4.6	0.07	0.03	0.6	0.3
Potato, fries, commercial, deep fried	250	26.2	4.0	13.9	3.7	9	1.1	1	10	0.3	0.1	0.04	1.5	0.5
Potato, hash brown, McDonald's	312	27.3	2.4	21.7	1.4	23	2.6	1	6.0	0.5	0.01	0.03	1.2	0.4
Potato, pale skin, peeled, baked	108	17.2	3.0	2.8	1.5	4	0.7	0	18	0.1	0.08	0.02	1.2	0.3
Potato, pale skin, peeled, boiled	66	13.0	2.6	0.2	1.1	2	0.5	0	21	0.1	0.07	0.02	1.0	0.3
Sweet potato, **leaves,** boiled	23	0.8	1.9	0.7	3.0	125	1.2	59	3.0	1.0	0.06	0.15	0.6	0.1
Cabbage, European white, boiled	30	4.6	1.6	0.3	1.3	55	0.8	1	41	0.2	0.03	0.03	0.3	0.3

Source: Dignan et al. 2004
Abbreviation: CHO, carbohydrate; vit, vitamin.

Table 2: Antioxidant, polyphenol and carotenoid contents of 100 g of boiled sweet potato

Food name	Total Antioxidant Capacity* (mg)	Total Polyphenols (mg)	Total Carotenoids** (mg)	Total Flavonoids*** (mwg)
Sweet potato, boiled, composite of four varieties	26.5	23	15.1	6
Sweet potato leaves, composite of four varieties	650	270	15.1	136

*TEAC (Trolox equivalent antioxidant capacity) method; **total of lycopene, a- and b-carotene; ***total myricetin, fisetin, morin, quercetin, kaempferol and isorhamnetin.
Source: Lako et al., 2007

Functional properties

Sweet potato tubers have four major colours: white, yellow, orange and purple. In addition to the nutritional content discussed above, deep coloured sweet potato tubers also have antioxidant functions, which protects cells from damage.

Antioxidants

The functional properties of sweet potato can easily be seen in the range and intensity of its colours. The major colours associated with functional properties such as antioxidants are yellow, orange, red and purple. Eating foods rich in these colours helps protect against diabetes, heart disease and cancer. Yellow and orange colours are associated with carotenoids, and pink to purple colours are associated with polyphenols, especially flavonoids. Deeper shades of these colours provide an increased amount of antioxidants and are thus associated with greater health benefits. Table 2 presents the total antioxidant capacity of sweet potato tubers and leaves.

Cooking food at moderate temperatures and for a reasonable period does not destroy carotenoids and flavonoids but does limit some antioxidants, such as vitamin C. Cooking helps the body to metabolise carotenoids more easily.

Glycemic responses

Carbohydrate foods have been ranked according to their glycemic responses, i.e. the rate at which carbohydrates break down in our body. Carbohydrates that break down quickly during digestion have a high glycemic index (GI 70 and above): blood sugar response is fast and high. Carbohydrates that break down slowly, releasing glucose gradually into the blood stream, have a low glycemic index (GI 55 and less). Consumption of low glycemic food is associated with a lower risk of developing diabetes and coronary heart disease than consumption of high glycemic foods. The glycemic index of boiled sweet potato is 57 compared with UK baked white potato with skin (GI 69) and without skin (GI 98), Jamaican baked Irish potato (GI 83), and peeled and baked Australian Pontiac (GI 93), thus making sweet potato a healthier starchy energy food choice.

Storage and preservation

Sweet potatoes can be stored for long periods of time if proper care in handling is taken during harvesting. The potatoes must be free from any cuts or bruises. Store sweet potatoes in a cool, dry, well-ventilated container at approximately 13°C or 55°F and use within a week or two after harvesting or purchase for best flavour and freshness. Stored this way, the tubers will keep for several weeks. In some places in the Pacific, sweet potatoes are stored by putting them in ashes. Do not store sweet potatoes in the refrigerator as this will produce a hard core in the centre.

Drying is another way of preserving sweet potatoes. Use only firm, smooth tubers. Steam or boil them in their skin for about 30 to 40 minutes until cooked, but not soft. Peel and cut into thin slices. Dry in the sun or in a solar drier until the slices are extremely leathery. This will take about three days. Dried sweet potato slices may be stored in airtight containers and later used in soups or stews. They may be pounded into flour and used with ordinary flour in baking.

Freezing sweet potatoes also preserves them for later use. Dry them after they are harvested. Wash and cook the tubers by boiling, steaming, or baking with the skin on. Cook until they are almost tender. Cool, peel, and slice them. Dip the slices into a mixture of one part lemon juice to four parts of water to

keep them from discolouring. Freeze in airtight containers.

Value addition

Sweet potato can be made into many products, including sweet potato flour — which makes very good scones and bread — extruded potato products such as pasta and noodles, sweet potato chips, and sweet potato flakes.

Selection, preparation and cooking

In selecting sweet potatoes, follow the instructions below.

- Select firm, fairly evenly-shaped sweet potatoes with even skin colouration.
- For the most nutrition value, select sweet potatoes with a deep purple or orange colour.
- Avoid sweet potatoes with any signs of decay.
- Handle sweet potatoes carefully to prevent bruising.
- When cutting sweet potatoes, always use a stainless steel knife.
- Sweet potatoes are more nutritious if cooked in their skin. Wash and dry thoroughly before cooking.
- Cooked sweet potatoes freeze well. Wrap unpeeled cooked sweet potatoes individually in aluminium foil or freezer wrap. Place in plastic freezer bags, label, date and freeze.

The tubers

Sweet potatoes that are dry and hard are best boiled. The soft, sweet, watery kinds with a darker colour are best baked or roasted.

Cooking sweet potatoes with the skin on helps retain the vitamins and minerals. If peeling is preferred, peel just before cooking in order to prevent oxidation and discolouration. Boiling them straight away for about 20 minutes after peeling will keep their colour and help retain the nutritional value.

Baked: Prick the skin and bake at 200°C (400° F) for 40 to 50 minutes or until done.

Microwaved: Choose sweet potatoes that are uniform in shape and size. Wash them and pierce with a sharp skewer or knife. Cook on high, turning each potato halfway through cooking time. Remove cooked sweet potatoes from the oven, wrap in aluminium foil and allow them to rest for at least five minutes.

***Steamed*:** Bring 3.5 cm (1½ inches) of water to boil in a steamer. Place whole, unpeeled sweet potatoes in a steam basket; steam until tender. Allow 40 to 50 minutes for a 227 gram (8 oz) sweet potato. When peeled and cut into 2.5 cm (1 inch) cubes, sweet potatoes will cook in about 30 minutes.

Boiled: Place whole sweet potatoes (can be peeled or not) in boiling water and cook for 35 to 45 minutes, depending on their size.

Mashed: Place whole potato (unpeeled) in boiling water and cook 35–45 minutes, or until it gives easily when pricked with a fork. Drain immediately and peel. Mash with a potato masher, fork or electric mixer.

Barbecued: Wrap medium-size sweet potatoes individually in heavy duty aluminium foil. Place on the grill about 13 cm (5 inches) from the coals. Cook for about 45 minutes or until tender. Alternatively, boil for ten minutes before wrapping in foil and burying in the coals. This reduces the cooking time.

Fried: Boil sweet potatoes for about ten minutes. Peel, if desired, and cut into slices. Heat oil to 185°C (365°F) in a skillet. Fry the slices until golden. Turn and fry the other side. Drain on a paper towel. Season with a little sprinkled salt, brown sugar, or ground nutmeg if desired.

Oven chips: Scrub the sweet potatoes. Cut into ½ cm (¼ inch) thick slices. Brush each side lightly with olive oil. Season with salt and pepper if desired. Place the slices on a baking sheet and bake in a preheated 180°C (350°F) oven for 15 minutes. Turn the chips and bake for another 15 minutes or until both sides are lightly roasted.

Deep-fried: In a large, deep skillet, heat 3.5 cm (1½ inches) vegetable oil to 185°C (365°F). Add sweet potato strips (in a chip basket if possible). Cook for five minutes or until brown and tender. Remove from hot oil and drain on paper towels. Sprinkle with salt or powdered sugar.

Sweet potato

The leaves

The young leaves are prepared by steaming for a short time in a small amount of water. Serving or cooking sweet potato leaves with coconut cream helps the body use the vitamin A in the leaves. The leaves may also be fried in a covered pot in cooking oil. Onion and garlic may be added for flavour. They are a good addition to soups and are an excellent food for babies, pregnant women and breast-feeding mothers.

Recipes

Baby's delight

Number of servings: one

Nutrition facts
One serving size: 160 g

Amount per serving
Energy: .....514 kJ (122 kcal)
Fat: .....6.0 g
Carbohydrate:.....9.0 g
Protein: .....7.6 g
Iron: .....1.1 mg
Sodium: .....25.2 mg

3 sweet potato leaves
1 small piece pumpkin (approximately ½ cup)
1 tablespoon fresh or tinned fish
1 tablespoon coconut cream
¼ cup water

1. Put all ingredients in a pot.
2. Cook slowly for about ten minutes until pumpkin is soft.
3. Mash well.
4. Serve warm.

Sweet potato leaf soup

Number of servings: four

Nutrition facts
One serving size: 160 g

Amount per serving
Energy: .....514 kJ (122 kcal)
Fat: .....6.0 g
Carbohydrate:.....9.0 g
Protein: .....7.6 g
Iron: .....1.1 mg
Sodium: .....25.2 mg

2 cups sweet potato leaves
1 cup water
3 tablespoons butter or cooking oil
1 tablespoon chopped onion
3 tablespoons flour
3 cups milk

1. Wash sweet potato leaves thoroughly in clean, fresh water.
2. Cook the leaves in the water for about ten minutes until soft.
3. Remove the leaves and mash them. Save the cooking water.
4. Heat butter or cooking oil in a pot. Add onion and fry for one minute.
5. Mix in three tablespoons flour. Heat for one minute, stirring while it cooks.
6. Remove from the heat and add milk. Mix well. Return to the heat and bring to the boil.
7. Add the mashed sweet potato leaves and the water they were cooked in.
8. Simmer for five minutes, stirring all the time.
9. Serve hot.

Meal in a coconut shell

Number of servings: two

Nutrition facts
One serving size: 380.5 g

Amount per serving
Energy: .... 1555.5 kJ (370.5 kcal)
Fat: .....19.6 g
Carbohydrate: .....39.6 g
Protein: .....7.9 g
Iron: .....3.2 mg
Sodium: .....87 mg

1 good-sized clean, mature coconut
4 small sweet potatoes
¼ cup coconut milk
½ cup green leaves
1 tomato
2 spring onions

1. Prepare the coconut milk, and keep the two half-coconut shells in a clean place. They will be used for cooking the meal.
2. Peel and wash the sweet potatoes.
3. Cut into small pieces.

4. Wash and chop the onions and tomato and green leaves. Keep the green leaves separate.
5. Place half of the chopped green leaves inside one of the half-coconut shells.
6. Put all the other vegetables on top.
7. Pour coconut milk over the vegetables.
8. Cover with the rest of the green leaves.
9. Put the other half of the shell on top and tie tightly in place using string.
9. Boil for about 45 minutes in a pan of water.

To serve: Open the shell and serve hot or, when cool, serve cold with slices of pineapple.

Hoho with meat and vegetables (Tonga)

Number of servings: four to six

Nutrition facts
One serving size: 338 g

Amount per serving
Energy: ..... 1686 kJ (401 kcal)
Fat: ..... 16.4 g
Carbohydrate: ..... 43.2 g
Protein: ..... 19.9 g
Iron: ..... 3.3 mg
Sodium: ..... 124 mg

6–8 taro leaves
2 coconuts for the coconut cream
1 cup water
4 cups chopped sweet potatoes
1 onion
1 cup chopped pumpkin or carrot
1 cup fresh or tinned meat

1. Clean the taro leaves and arrange on banana leaves that have been softened over the fire.
2. Scrape the coconuts, add water and squeeze out the cream.
3. Wash and peel the pumpkin or carrots, onions, and sweet potatoes.
4. Chop the meat, onion, pumpkin or carrots, and sweet potato into small pieces. Put them on the taro leaves. Pour coconut cream on top.
5. Wrap up and bake in an earth oven or steam for about 1 hour.
6. Serve hot.

Variations: Use aluminium foil instead of softened banana leaves.

Sweet potato buns

Number of servings: twelve

Nutrition facts
One serving size 94 g

Amount per serving
Energy: ..... 629 kJ (150 kcal)
Fat: ..... 2.2 g
Carbohydrate: ..... 27.8 g
Protein: ..... 4.5 g
Iron: ..... 0.49 mg
Sodium: ..... 197 mg

3 cups sweet potatoes (cooked and mashed)
1 cup milk
2 cups self-raising flour
1 teaspoon lemon juice

1. Add milk to the cooked and mashed sweet potatoes in a large bowl. Mix.
2. Add the flour a little at a time and mix well. Sprinkle in lemon juice.
3. Mix into a firm dough. Shape into balls the size of an egg.
4. Place on a greased baking tin.
5. Bake in a hot oven (425°F or 220°C) for about 15–25 minutes until done.
6. Cool before serving.

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Cassava

Leaflet No. 4 - Revised 2012

Introduction

Cassava, or *Manihot esculenta*, is also known as *manioc, manioke, tavioka, mendoka, tapioca, katiawa* and *ava*. The edible, starchy, tuberous roots are a staple food in some Pacific Islands and the leaves are also eaten in some places. Because planting and growing cassava is simpler than growing other root crops, it has become a very popular food crop. Cassava is also an important livestock feed, especially for pigs in Samoa, Niue, Tonga and Solomon Islands.

In other parts of the world, cassava is used to make glue, starch and fuel. The plant is thought to have been brought to the Pacific from Mexico by the Spanish and from Brazil by the Portuguese.

Major types of cassava and cultivation

The cassava plant belongs to the very large and diverse Euphorbiaceae family, which includes useful plants that give us castor oil, rubber, laxatives and ornamental shrubs. There are many different cultivars of cassava. These are categorised into two major groups; bitter and sweet cultivars. The sweet varieties are known to contain lower levels of cyanogenic glucosides in the tubers, so they are liked better than the bitter varieties when cassava is grown for food. It is important to note that the two major cyanogenic glucosides found in cassava are linamarin and lotaustralin. Because these glucosides are soluble in water, and decompose at temperatures higher than 150°C, cooking cassava makes it safe to eat. In the Pacific region, the sweet varieties are widely grown and cultivated.

Design and layout: Muriel Borderie - SPC Publications Section

Cassava

The plant is grown from cuttings taken from the base of the stem of a mature plant. They can be planted at any time of the year. Cassava grows best in light, sandy soil where extra water drains off easily. But it can also grow in dry or poor soil where other root crops cannot grow. It grows well when planted among coconuts or other crops. During periods of drought, the cassava plant shed its leaves as a survival mechanism. The plant can grow up to about 1.5 metres. The many varieties differ in stem colour and leaf shape. Some varieties take about six to nine months to harvest after planting.

When the roots are harvested, the young leaves can be pulled off for use as a vegetable. Young leaves can also be picked from the cassava plant before harvesting, but if too many are taken, the roots will not grow properly.

Nutrient content

The roots

The cassava root is an energy-rich food and an excellent source of carbohydrate, fibre and vitamin C. Carbohydrate provides the body with energy, which it needs for warmth, work and play. Vitamin C keeps body tissues strong, helps the body use iron, helps wounds heal and fights against infection.

Cassava roots do not contain a much good quality protein, which the body needs for growth and maintaining healthy body tissues. Meals containing cooked cassava must, therefore, include foods such as meat, fish, eggs, beans and dark green leafy vegetables, which have high quality protein and other nutrients, When cassava is used as a complementary food for babies over six months old, it is advisable to mash it with high quality protein foods and vegetables. Children need such foods for healthy growth.

Table 1: Nutrient content of 100 g of boiled cassava compared to 100 g of plain white flour and cooked rice

Food name	Energy	CHO	Protein	Fat	Fibre	Calcium	Iron	Vit A	Vit C	Vit E	Thiamin	Riboflavin	Niacin	Zinc
	(Kcal)	(g)	(g)	(g)	(g)	(mg)	(mg)	(ug)	(mg)	(mg)	(mg)	(mg)	(mg)	mg
Cassava, boiled	117	27.5	0.6	0.4	1.4	10	0.2	t	15	0.2	0.02	t	0.3	0.3
Cassava, baked	117	41.5	2.0	0.3	1.3	35	2.2	t	53	0.2	0.11	0.05	0.7	0.4
Cassava, earth-oven baked	151	35	0.8	0.5	2.8	11	0.2	t	31	0.2	t	t	0.4	0.4
Cassava leaves, boiled	47	3.3	3.9	1.1	4.6	106	1.9	477	64	1.6	0.07	0.18	1.8	1.7
Cassava, flour	349	84.5	1.1	0.5	3.7	84	1.0	t	0	t	0.05	0.07	1.4	2.7
Wheat flour, white, plain	349	72.1	10.7	1.6	3.6	17	1.3	0	0	0.3	0.72	0.03	1.7	0.6
Rice, white, boiled	123	28.0	2.3	0.2	0.8	4	0.3	0	0	t	0.03	0.01	0.6	0.6

Source: Dignan et al. 2004
Abbreviation: CHO, carbohydrate; t: trace

The leaves

Cassava leaves provide high amounts of vitamins A and C. Half a cup of cooked cassava leaves provides half the daily vitamin A needs of a young child. Vitamin A is needed for proper growth and healthy eyes, and it helps the body fight infection. People should be encouraged to eat this valuable vegetable whenever it is available. Cassava leaves also have a fair amount of dietary fibre.

Functional properties

In addition to the nutritional content described above, cassava roots have other functional properties. They contain antioxidants such as polyphenols and carotenoids in the form of ß-carotene, which is associated with the yellow coloured varieties. Antioxidants have been found to protect cells from oxidative damage and are associated with lowering the risk of heart diseases and cancers.

Antioxidants

The functional properties of the cassava root can be easily seen in the range and intensity of colours. Yellow varieties of cassava are rich in carotenoids, contributing to their antioxidant capacity as shown in Table 2 below. The green cassava leaves are also excellent sources of antioxidants.

Glycemic responses

Carbohydrate rich foods have been ranked according to their glycemic response, i.e.the rate carbohydrates break down in our body. Carbohydrates that break down quickly during digestion have a high glycemic index (GI 70 and above). Their blood sugar response is fast and high. Carbohydrates that break down slowly, releasing glucose gradually into the blood stream, have a low glycemic index (GI 55 and less). Consumption of low GI food is associated with a lower risk of developing diabetes and coronary heart disease than consumption of high GI foods. The

glycemic index of boiled cassava is 77, similar to that of white bread (GI 77), but less than jasmine rice (GI 109) and Calrose rice (GI 83). Cassava may not be a good food for people with diabetes due to its high GI level.

Storage and preservation

Cassava roots have the shortest post-harvest life of all root crops, deteriorating very quickly after just one day, so it is best to cook them immediately after harvest.

Sometimes harvesting many roots after natural disasters such as a flood or hurricane is unavoidable, in which case preserving cassava roots using any of the various methods described below is essential.

Covering with sawdust: In some parts of the Pacific, cassava roots are placed in shallow pits surrounded by damp sawdust. The pit is then covered with soil, keeping the cassava roots fresh for several months.
Fermenting: Cassava can be preserved by a type of chemical change called fermentation. Fermentation

Table 2: Antioxidant, polyphenol and carotenoid contents of 100 g of cassava

Food name	Total Antioxidant Capacity* (mg)	Total Polyphenols (mg)	Total Carotenoids** (mg)	Total Flavonoids*** (mg)
Cassava, white	23	11	0.02	nd
Cassava, yellow	28	14	0.5	nd

*TEAC (Trolox equivalent antioxidant capacity) method; ** total of lycopene, a- and b-carotene; *** total of myricetin, fisetin, morin, quercetin, kaempferol and isorhamnetin.
Source: Lako et al. 2007
Abbreviation: nd, not detected

increases the amount of B vitamins in the cassava. One way to ferment cassava is to make *bila*, fermented grated cassava. (See the recipe below).

How to ferment cassava

1. Peel, wash and cut the cassava into large pieces. Place the pieces in an enamel, clay or plastic pot, bowl or basin. Do not use iron or aluminium containers. Cover the cassava completely with water. Make sure no part of the cassava sticks out above the water or it will turn black.
2. Put the lid on and leave the cassava for 4 or 5 days to ferment. As the cassava ferments, it will start to smell strongly and bubbles will rise in the water. The warmer the place it is left, the quicker it will ferment.
3. When the cassava has become very soft to the touch, drain the water and spread the cassava out in the sun to dry for a few hours.
4. Pound the cassava with a stone and take out the stringy fibres.
5. Use as required or store in a clean, dry plastic bag.

Drying: The cassava roots can be peeled, washed, sliced thinly, then spread in the sun to dry. In hot, sunny weather, the slices will take only one day to dry. Dried cassava will keep for several months if stored in a clean, airtight container. The dried cassava can later be cooked in water or pounded into flour for making various gluten-free baked products such as bread, scones and cakes. Cassava flour can also be mixed with wheat flour if raising agents are desired when making bread, biscuits or other snacks. One half or less of the mixture should be cassava flour and the rest can be wheat flour.

Freezing: If a freezer is available, cassava can be peeled, cut into serving-size pieces, sealed in plastic bags and frozen. Later, the frozen cassava can be cooked. It should **not** be allowed to thaw first.

Extracting cassava starch: Starch can be taken from the cassava root and made into cassava starch flour. Cassava starch flour can be used instead of corn-flour for thickening soups, sauces, gravies and puddings. It can even be used to making pie fillings instead of custard. Replacing corn-flour and wheat flour with cassava flour can save money and trips to the store.

Cassava starch flour:

1. Peel and wash the cassava root.
2. Grate, wrap in a piece of muslin or other loosely woven material, and tie.
3. Fill two basins with cold water. Swish the cassava through the water in the first basin, rinsing and squeezing again and again. Do this for several minutes.
4. Swish the wrapped cassava in the same way through the water in the second basin, until all the milky white liquid has been squeezed out.
5. Let the water stand in the basins until the white starch has settled to the bottom (about one hour), then pour off the water. Scrape the cassava starch from the basins and spread it out on trays in the sun. When it is partly dry, break it up into small pieces.
6. When the cassava starch is completely dry, lay it on a clean cloth or leaf, and roll it with a rolling pin or bottle. When it becomes a fine and powdery flour, strain it through a sieve. Store in a jar or tin with a tightly fitting lid.

Value addition

Cassava can be made into many different products including cassava flour that makes very good scones and bread, extruded cassava products such as pasta and noodles, cassava chips, cassava flakes and cassava dessert. To get the best value-added products, it's important to select the appropriate cassava variety because of the differences in the starch content among the different varieties.

Preparation and cooking

Both the cassava roots and leaves contain a chemical called *hydrocyanic acid*, which is poisonous. Cassava poisoning is not common in the Pacific but care should be taken in preparing cassava. Cassava should never be eaten raw and the bitter varieties of cassava should not be eaten at all.

Cassava root: the root should be peeled and washed thoroughly and cooked for a long time. The safest and easiest way to prepare cassava is to peel and wash the roots, cut them into pieces, and boil them in water. A family size pot of cassava will take 30–40 minutes to cook. When the cassava is cooked, **the cooking water should be thrown away,** because the water often contains harmful substances that were removed from the cassava during boiling.

Cassava can also be steamed, baked in a ground oven and roasted over an open fire. Boiling and steaming are the best methods. When grated, cassava can be used in puddings or included in meat and vegetable dishes to make a balanced meal.

Cassava leaves: these contain hydrocyanic acids, which make them taste bitter. Thus only very young, tender cassava leaves are used. They are boiled for 5–10 minutes, and the cooking water is discarded. The cooked leaves can then be added to soups and other dishes. As long as cassava leaves are cooked carefully, they can be used in the same way as any other green, leafy vegetable. Cassava leaves can be mashed and added to cooked rice or mashed root crops. This method provides a good meal for young children who do not like eating green vegetables.

Recipes

1. Bila

Number of bila produced: five

Nutrition facts
One serving size: 125 g

Amount per serving
Energy: ..... 1525 kJ (363 kcal)
Fat: ..... 16.4 g
Carbohydrate: ..... 50.8 g
Protein: ..... 2.3 g
Iron: ..... 1.4 mg
Sodium: ..... 17.4 mg

1 cup fermented cassava powder (use the fermentation procedure above)
1/3 cup grated fresh cassava
1/3 cup grated coconut

1. Mix the fermented cassava with a little grated fresh cassava, if desired. (This will keep it from being too sticky.) Add the grated coconut, mix well and divide into serving portions.
2. Wrap each portion in banana leaves or baking foil and steam or bake in an earth oven for one hour.
3. Serve immediately or save for later use. *Bila* will keep for about one week.

2. Cassava soufflé

Number of servings: four

Nutrition facts
One serving size: 224 g

Amount per serving
Energy: ..... 1190 kJ (283 kcal)
Fat: ..... 7.4 g
Carbohydrate: ..... 46.5 g
Protein: ..... 7.9 g
Iron: ..... 0.84 mg
Sodium: ..... 117 mg

2 cups mashed, cooked cassava
2 eggs
¾ cup milk

1. Beat together the mashed cassava, milk and eggs.
2. Bake in a hot oven (200°C or 400°F) for 40 minutes.

Note: This is a good way to use up leftover cassava.

3. Laplap

Number of servings: six to eight

Nutrition facts
One serving size: 219 g

Amount per serving
Energy: ..... 1364 kJ (325 kcal)
Fat: ..... 12.0 g
Carbohydrate: ..... 41.8 g
Protein: ..... 11.4 g
Iron: ..... 1.7 mg
Sodium: ..... 57.1 mg

4 cups grated raw cassava
1 cup coconut cream
1 cup cooked fish or lean meat
1 cup finely chopped green leaves
1 medium onion, finely chopped

1. Soften small banana leaves over a fire and place a layer of grated cassava in the centre of the banana leaves.
2. Add a layer of green leaves, then a layer of chopped meat or fish.
3. Repeat layers: cassava, then leaves, then meat or fish. Top with a final layer of cassava.
4. Using a clean finger, poke holes into the top layer down to the bottom layer. Pour coconut cream into the holes.
5. Sprinkle the chopped onion over the mixture.
6. Fold the softened banana leaves over the cassava mixture to make a parcel, tie, and steam or bake for 1½–2 hours.
7. Serve.

Note: Small, one-serve parcels may also be made, using only one layer of meat or fish and leaves between two layers of cassava. These make nutritious, convenient school lunches for children. These parcels take less time (45 minutes) to cook, and may be cooked in boiling water, as well as steamed or baked. Cooking foil sheets can be used instead of softened banana leaves.

4. Cassava rolls

Number of servings: four to six

Nutrition facts
One serving size: 333 g

Amount per serving
Energy: ..... 1965kJ (468 kcal)
Fat: ..... 17.4 g
Carbohydrate: ..... 72.3 g
Protein: ..... 4.8 g
Iron: ..... 1.9 mg
Sodium: ..... 63.5 mg

4 medium cassava
1½ cups of coconut cream
1 medium onion
½ cup finely chopped cassava leaves

1. Peel, wash and cut the cassava into small pieces.
2. Boil until cooked, pour out the water and remove the stringy part of the cassava.
3. Pound the cooked cassava with a small amount of coconut cream until the mixture is moist and forms a dough.
4. Heat the coconut cream in a pot, add the chopped onions and cassava leaves.
5. On a chopping-board, divide the dough into equal portions. Roll each portion with a rolling-pin and shape into approximately 9 cm (3½ inch) squares.
6. Spoon the cooked cassava leaves mixture into each cassava square and then roll up.
7. Steam or bake for 45 minutes.

5. Cassava balls

Number of servings: three to four

Nutrition facts
One serving size: 186 g

Amount per serving
Energy: ..... 1230kJ (293 kcal)
Fat: ..... 12.8 g
Carbohydrate: ..... 41.9 g
Protein: ..... 2.8 g
Iron: ..... 0.59 mg
Sodium: ..... 50.0 mg

2 cups mashed cooked cassava
1 medium onion
1 teaspoon chopped fresh herbs (e.g. parsley, basil, sage) or ½ teaspoon dried herbs
1 egg
¼ cup cooking oil

1. Peel and chop the onion.
2. Mix together the mashed cassava, onion and herbs.
3. Lightly beat the egg. Add to the cassava mixture and mix well to form a smooth mixture.
4. Form mixture into small balls.
5. Lightly fry the cassava balls in cooking oil until golden brown.

Note: A finely chopped fresh chilli or clove of garlic can be used instead of the herbs. You can also add minced or shredded cooked meat or tinned fish.

6. Cassava meatloaf

Number of servings: four

Nutrition facts
One serving size: 149 g

Amount per serving
Energy: .....783 kJ (186 kcal)
Fat: .....7.1 g
Carbohydrate: ..... 21.7 g
Protein: .....8.8 g
Iron: .....1.3 mg
Sodium: ..... 44.2 mg

½ kg (1 lb) minced meat
1 cup grated raw cassava
1 onion, finely chopped
½ teaspoon black pepper
¼ cup chopped green leaves
Oil

1. Mix together all the ingredients except the oil.
2. Form mixture into a long roll, put into a greased baking tin and brush with oil. Or wrap the rolled mixture in oiled foil and put into greased baking tin.
3. Bake in a slow oven (150°C or 300°F) for 1½ hours.

Note: Instead of baking, the cassava meatloaf may be wrapped in banana leaves and steamed.

7. Cassava bibinka

Number of servings: four to six

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Nutrition facts
One serving size: 243 g

Amount per serving
Energy: ..... 1878 kJ (447 kcal)
Fat: ..... 25.2 g
Carbohydrate: ..... 44.4 g
Protein: ..... 10.3 g
Iron: .....1.6 mg
Sodium: ..... 200 mg

2 eggs
2 tablespoons melted butter or margarine
3 cups grated raw cassava
Sugar to taste
½ cup thick coconut cream
½ cup scraped young coconut
4 tablespoons chopped nuts, if desired
60 g (2 oz) cheese, if desired

1. Beat the eggs, then add the coconut cream, grated cheese and chopped nuts.
2. Add the cassava and young coconut and mix well. Add sugar to taste.
3. Line a pan or cake tin with a banana leaf and pour in the mixture.
4. Bake in a moderate oven (350°F or 180°C) for about 40 minutes.
5. When almost brown, brush with 2 tablespoons melted butter or margarine and sprinkle with a little sugar.
6. Continue baking until golden brown.
7. Serve cold as a dessert.

8. Banana and cassava pudding

Number of servings: six to eight

Nutrition facts
One serving size: 248 g

Amount per serving
Energy: ..... 1158 kJ (276 kcal)
Fat: ..... 0.34 g
Carbohydrate: ..... 52.4 g
Protein: ..... 5.0 g
Iron: ..... 1.3 mg
Sodium: ..... 11.9 mg

Pudding:
12 ripe bananas
1 cup grated raw cassava
Water

1. Peel and slice the bananas, put them in a pot, cover with water, and bring to the boil.
2. Cook 20–30 minutes, then mash thoroughly.
3. Add grated cassava, sprinkling in a little at a time and stirring often. Cook until mixture thickens (about 3 minutes).

Coconut cream
2 coconuts
1 cup water

1. Grate the coconuts, add water, and squeeze out the coconut cream using clean coconut husk or cloth. Strain the cream through a sieve.
2. Serve the banana pudding with coconut cream.

Note: The pudding can also be served plain or with milk or cream

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Breadfruit

Leaflet No. 5 - Revised 2012

Introduction

The scientific name of breadfruit is *Artocarpus altilis*. Breadfruit is also known as *mei, mai, ulu* and *uto* and is an important staple crop in the Pacific, especially on the atoll islands. It is a seasonal crop. In a good season, the abundant supply may be wasted because the fruit cannot all be eaten at once. Traditional preservation methods, such as fermentation and drying, are rarely practised and no longer appreciated, unfortunately, now that easy-to-prepare foods are available. Yet preserved breadfruit is a good emergency food after hurricanes or floods, before hurricane relief supplies become available.

Combining new and old ways of preservation and preparation can make breadfruit an important food all year round in the Pacific.

Breadfruit has many uses. Of course, people eat the fruit and seeds, but these are also used, uncooked, for livestock feed. The tree is also important for shade and provides support for crops such as yam. The timber may be used for houses, canoes, furniture and firewood. Its large leathery leaves (over 30 cm long, or 1 ft) can be used to cover cooking pots and earth ovens, to wrap food for cooking or serving, and as fans. Some parts of the breadfruit tree are used for medicine. The sticky latex or breadfruit gum may be used to caulk canoes to make them watertight and to prepare surfaces for painting.

Design and layout: Muriel Borderie - SPC Publications Section

Figure 1: Breadfruit trees naturally grow tall, but can be cut back to keep the breadfruit within reach.

Major types of breadfruit and cultivation

Many varieties of breadfruit grow in the Pacific, both seedless and seeded types. There are also some variations within the breadfruit types and hybrids. In Fiji, about ten species and 15 to 20 varieties are available, which bear fruit at different times of the year. Thus breadfruit is available in Fiji for most of the year, with the most abundant months being February to mid-April. In Micronesia, a related species with seeds *(Artocarpus mariannenis)* is available, as well as the usual varieties.

Seeded breadfruit is a delicacy on many islands. It can be eaten raw when ripe as a snack or dessert, or cooked and eaten as a staple food with the main meal. The seeds, which are eaten when cooked, have a pleasant texture and taste.

Varieties of breadfruit differ in many ways — in the shape of the leaves, and the shape, size, and time of fruit ripening. There is concern about the loss of some varieties due to pests, disease, old age and neglect. Collections have been started, such as the one at the Breadfruit Institute in the National Tropical Botanical Garden in Hawaii, to help conserve the many varieties.

Cultivation

Planting seeds from full, ripe fruits in well-drained soil is one way to grow breadfruit trees or to plant young shoots or suckers. Young breadfruit trees need protection from hot sun. Later, they grow best in full sunlight. Older trees require little care except on atolls where they sometimes need to be watered and fed with compost. In general, the trees grow to 9 to 18 metres (30 to 60 feet), but can easily be trimmed back to keep the fruits within reach (Figure 1). Breadfruit trees begin bearing fruit after about six years and continue to produce fruit for more than 50 years.

Breadfruit trees grow and fruit in a variety of soils, as well as on atolls. They have adapted to different climates, but high winds or little rainfall can cause loss of leaves,and may even kill the tree.

Breadfruit is usually picked when mature but not ripe. Traditionally, a stick that forks at the end is used for this. Men and children also climb the trees to pick the fruit, using ropes if the tree is too tall. It is best to pick the fruit from the tree rather than letting it drop to the ground. The fruit is damaged when it hits the ground and may soften sooner than hand picked fruit.

Nutrient content

Breadfruit is an important energy food. The energy is provided by the starch and sugar it contains, which vary according to the degree of ripeness when the fruit is eaten. Dietary energy is needed by the body for warmth, work and play.

Breadfruit is rich in fibre, which is important for a healthy digestive system. A diet rich in fibre also helps to control blood sugar in diabetics, reduce blood lipids (a risk for heart disease) and control weight. It is currently recommended that adults consume 20–35 grams of dietary fibre per day. Two cups (500 grams) of boiled breadfruit at lunch and dinner provide around 25 grams of fibre, but a similar serving of white rice provides only 6.8 grams.

Breadfruit contains some calcium and is a good source of vitamin C (for fighting infection). In particular, a typical serving of one of the seeded types meets daily vitamin C requirements. White rice is very low in both nutrients.

Table 1: Nutrient content of 100 g of boiled breadfruit fruit compared with 100 g of rice and bread

Food name	Energy	CHO	Protein	Fat	Fibre	Calcium	Iron	Vit A	Vit C	Vit E	Thiamin	Riboflavin	Niacin	Zinc
	(Kcal)	(g)	(g)	(g)	(g)	(mg)	(mg)	(ug)	(mg)	(mg)	(mg)	(mg)	(mg)	mg
Breadfruit, boiled	75	14.4	1.3	0.9	2.5	13	0.2	3	22	0.7	0.08	0.05	0.7	0.1
Breadfruit, baked	103	22.1	1.3	0.6	2.5	18	0.3	2	22	1.0	0.08	0.04	0.6	0.1
Breadfruit, seeds, boiled	155	27.3	5.3	2.3	3.0	69	0.7	0	6.1	na	0.34	0.19	6.0	0.8
Breadfruit, seeds, roasted	191	34.1	6.2	2.7	3.7	86	0.9	0	7.6	na	0.41	0.24	7.4	1.0
Rice, white, boiled	123	28.0	2.3	0.2	0.8	4	0.3	0	0	trace	0.03	0.01	0.6	0.6
Bread, white	242	47.2	8.2	2.0	2.7	32	1.1	0	0	trace	0.13	0.08	1.2	0.6

Source: Dignan et al. 2004.
Abbreviations: CHO carbohydrate; vit, vitamin; na, not available.

The flesh of ripe, seeded breadfruit is particularly rich in provitamin A carotenoids. These help protect against infection, diabetes, heart disease and cancer, and they also help maintain good eye health and vision and strong blood. Two cups of ripe breadfruit eaten at lunch and dinner provide 100% of the estimated daily vitamin A requirements for an adult.

Breadfruit seeds are a fair source of protein (5.3 grams per 100 grams) and have significant levels of the B vitamins, niacin and thiamin, which are important for metabolism. Breadfruit paste, a traditional dried product that looks like dates and has a similar texture, is rich in energy and contains significant levels of calcium.

The leaves are used to wrap other foods for cooking. They are not normally eaten in the Pacific, but they can be eaten. Young breadfruit leaves are a good source of vitamin C, iron and calcium. Iron helps keep the blood healthy and calcium helps to make strong bones and teeth.

Functional properties

In addition to the nutrition value noted above, breadfruit has other functional properties such as antioxidants and low levels of glycemic responses.

Antioxidants

The functional properties of breadfruit can be easily seen in the range and intensity of the colour of the flesh. The yellow colour in some varieties is associated with carotenoids. New findings show that varieties of breadfruit with yellow flesh contain significant amounts of ß-carotene, a type of carotenoid that converts to vitamin A in the body as needed and helps protect eye health. Deeper shades of this colour indicate an increased amount of antioxidants and thus greater health benefits. Carotenoids, polyphenols, flavonoids and the total antioxidant capacity have been found to be present in certain varieties of breadfruit, as shown in Table 2.

Table 2: Antioxidant, polyphenol and carotenoid contents of 100 g boiled breadfruit

Food name	Total Antioxidant Capacity* (mg)	Total Polyphenols (mg)	Total Carotenoids** (mg)	Total Flavonoids*** (mg)
Breadfruit, boiled (white variety)	35	33	nd	1

Source: Lako et al. 2006.
Notes: *TEAC (Trolox equivalent antioxidant capacity) method; **total of lycopene, a- and b-carotene; ***total of myricetin, fisetin, morin, quercetin, kaempferol and isorhamnetin.
Abbreviation: nd, not detected.

Furthermore, vitamins C and E are also strong antioxidants and help remove free radicals from different part of the body cells. Vitamin C being water soluble removes free radicals from the hydrophilic (water) components of the cells while vitamin E being fat soluble removes free radicals from the lipophilic (fat) components of cells.

Cooking food at moderate temperatures and for a reasonable period of time does not destroy carotenoids and flavonoids but does limit some antioxidants such as vitamin C. Cooking helps the body to metabolise carotenoids more easily.

Glycemic responses
Carbohydrate rich foods have been ranked according to their glycemic response, i.e. the rate carbohydrates break down in our body. Carbohydrates that break down quickly during digestion have a high glycemic index (GI 70 and above). Their blood sugar response is fast and high. Carbohydrates that break down slowly, releasing glucose gradually into the blood stream, have a low glycemic index (GI 55 and less). Consumption of low GI food is associated with a lower risk of developing diabetes and coronary heart disease than consumption of high GI foods.

The glycemic index of boiled breadfruit ranges from 47–60, depending on the degree of maturity and ripeness level, compared with white bread (GI 77), Jasmine rice (GI 109) and Calrose rice (GI 83). Therefore eating breadfruit is more beneficial than white bread and long grain Jasmine rice.

Storage and preservation

When storing breadfruit for a short period of time, keep it in a cool, dark place until needed. If it is to be stored overnight, place the whole breadfruit under water.

Breadfruit not eaten during the breadfruit season can be preserved by drying, burying and freezing. These methods enable the breadfruit to be used at any time of the year and in emergencies. Using preserved breadfruit saves money.

Drying is done by the sun or in a very slow oven (50°C or 120°F). Wash mature breadfruit and cut it into pieces. Peel and core. Slice very thinly, place on racks, and put in the sun or oven to dry. When well dried, wrap in plastic bags or leaves so as to keep out moisture. Dried breadfruit is an excellent addition to soups and stews. Another way of drying breadfruit is to cook it first and then mash into a paste. Dry the paste in the sun and store in airtight containers.

Breadfruit flour is made from dried breadfruit, by pounding or grinding. Sift and repeat the process until all of the flour is sifted. Store the flour in an airtight jar. It can be used instead of wheat flour in many recipes.

Fermentation through burying breadfruit is a preservation method used in some parts of the Pacific. It is peeled, cored, and cut up into small pieces. A pit is lined with banana or breadfruit leaves and the breadfruit is placed inside the pit. It is covered with lots of fresh leaves, old sacks, earth and a layer of stones.

After two months, the breadfruit is fermented and is ready to be eaten. It may be kept this way for a year. When the breadfruit is dug up, it is put into sacks and rinsed with water until the sour-smelling liquid has been removed. Then it is mixed with coconut cream and baked. Mashed bananas may also be added to the mixture before baking.

Freezing breadfruit also preserves it. Boiled, baked or roasted breadfruit can be frozen. Cut the fruit into thin slices, wrap in grease-proof paper, and then package in plastic bags. It is more convenient for use if frozen in small amounts. Reheat over steam or use in stews or soups. Once unfrozen, it can be fried.

Value-addition

Breadfruit can be made into many different products, such as breadfruit flour, which makes very good scones and bread, extruded products such as pasta and noodles, breadfruit chips, breadfruit flakes, and breadfruit dessert.

Preparation and cooking

Breadfruit is used when it is mature, that is, when the white milky sap comes to the surface and runs over the outside. The fruit is still hard and green. If it is allowed to ripen more, some of the starch in it turns to sugar which contributes to the sweet taste of soft mature breadfruit.

Breadfruit

Breadfruit seeds, leaves and blossoms are also eaten. The seeds have a pleasant, nutty flavour. Only very young leaves may be eaten. The blossoms may be eaten if they are picked when just ripe, before they turn brown and hard.

Traditional methods of preparing breadfruit include baking in earth ovens or roasting over hot coals. The fruit may be fermented by burying it in layers between leaves. The fermented breadfruit is removed from the pit, washed well, mixed with coconut cream, and baked into sour bread.

Today, it can be prepared by these traditional methods, or cooked on a stove. The fruit is pricked with a fork before baking or roasting, so that it does not explode. Bake it in a moderate oven (180°C or 350°F) for about 1½ hours or until soft when tested with a sharp knife or skewer. When steamed or boiled with the skin on, it should be peeled before consumption. Mature, grated breadfruit may be used instead of wheat flour in some recipes.

Fried breadfruit is prepared using roasted or boiled mature breadfruit. Core and slice to the desired thickness then fry in hot oil until golden brown and serve warm.

Young leaves can be softened over a fire. Remove the stalks, wash the leaves and cook, covered in a small amount of salted water, for about 20 minutes. Serve with coconut cream if desired.

Prepare breadfruit seeds by washing and then dropping them into salted boiling water. Cook for 45 minutes. Drain and serve hot. They can also be used as nuts when baking.

In summary, breadfruit can be consumed in various ways:

- fresh and raw as a snack (seeded variety); any variety can be eaten raw when ripe;
- boiled, steamed, baked, roasted or fried;
- cooked in coconut cream;
- as a complementary infant food, from about six months of age;
- as bread made from fermented breadfruit;
- as a sweet snack made from preserved paste;
- seeds cooked as a snack or part of a main meal.

Recipes

1. Breadfruit and beef stew

Number of servings: four to six

Nutrition facts
One serving size: 369 g

Amount per serving
Energy: ..... 2156 kJ (513 kcal)
Fat: ..... 20.3 g
Carbohydrate: .....33 g
Protein: ..... 47.6 g
Iron: .....6.8 mg
Sodium: ..... 75.2 mg

½ cup flour
Salt to taste
½ kg (1 lb) beef
3 tablespoons cooking oil
1 large onion, chopped
1 cup dried breadfruit
1 cup pumpkin, chopped
2 cups green leafy vegetables

1. Mix flour and salt.
2. Cut up meat into small pieces. Add to the flour mixture, mixing until well coated.
3. Heat cooking oil in a large pot. Add the coated meat and brown.
4. When the meat is almost brown, add chopped onion. Stir occasionally until browned.
5. Add water. Cover and cook until meat is tender, about 30 minutes.
6. Add breadfruit that has been soaked in water for 10 minutes, pumpkin, and green leafy vegetables.
7. Cook for another 10 to 15 minutes. Serve hot.

2. Breadfruit fritters

Twelve fritters

Nutrition facts
One serving size: 38 g

Amount per serving
Energy: ..... 200 kJ (48 kcal)
Fat: ..... 2.3 g
Carbohydrate: ..... 4.8 g
Protein: ..... 1.7 g
Iron: ..... 0.15 mg
Sodium: ..... 14.0 mg

1 cup boiled mature breadfruit
1 egg, beaten
¼ cup skimmed milk powder
1 tablespoon onion, finely chopped
Salt to taste
1 tablespoon capsicum, chopped (optional)
2 tablespoons water
Oil for frying

1. Mash breadfruit well with a fork. Make sure to get rid of the lumps.
2. Add beaten egg and milk powder. Stir well.
3. Mix in onion, salt, and capsicum.
4. Add just enough water so that the mixture will drop off a spoon.
5. Fry in hot fat, until golden brown. Serve.

3. Breadfruit and fish salad

Number of servings: four

Nutrition facts
One serving size: 307 g

Amount per serving
Energy: ..... 1023 kJ (244 kcal)
Fat: ..... 5.9 g
Carbohydrate: ..... 23 g
Protein: ..... 22.2 g
Iron: ..... 2.0 mg
Sodium: ..... 123 mg

2 cups cooked mature breadfruit
1 cup cooked fresh fish or tinned fish
2 hard-boiled eggs, chopped
1 cup finely sliced vegetables such as carrots, Chinese cabbage, cucumber, or tomato
3 tablespoons onion, grated
Watercress

1. Cut the cooked breadfruit into cubes.
2. Combine all of the ingredients, except the watercress.
3. Add salad dressing or lemon juice if desired.
4. Serve cold on watercress.

4. Roast chicken and breadfruit stuffing

Number of servings: four to six

Nutrition facts
One serving size: 308 g

Amount per serving
Energy: ..... 2915 kJ (694 kcal)
Fat: ..... 43.7 g
Carbohydrate: ..... 11.5 g
Protein: ..... 64.4 g
Iron: ..... 2.7 mg
Sodium: ..... 197 mg

1.5 kg (3 lb) chicken
Salt to taste
2 cups cooked mature breadfruit
2 tablespoons cooking oil
1 piece garlic, finely chopped (optional)
2 teaspoons lemon juice
2 teaspoons grated citrus rind
2 tablespoons parsley, chopped (optional)
Butter or margarine

1. Rub the chicken well with salt.
2. Mash the breadfruit.
3. Fry the onion and garlic in the oil. When cooked, mix it with the mashed breadfruit.
4. Stir grated lemon rind and lemon juice into the breadfruit mixture with 1 teaspoon salt and parsley.
5. Place mixture inside chicken. Sew up the end with cotton.
6. Rub chicken with lemon, and then butter.
7. Put in a covered baking dish with ¼ cup water in bottom. Cook in a moderate oven (180°C or 350°F) for 1 hour.
8. Remove cover, baste, and brown for about 30 minutes.
9. Remove the cotton. Serve.

5. Breadfruit pudding

Number of servings: four to six

Nutrition facts
One serving size: 225 g

Amount per serving
Energy: ..... 2092 kJ (498 kcal)
Fat: ..... 34 g
Carbohydrate: ..... 40.5 g
Protein: ..... 5.1 g
Iron: ..... 2.3 mg
Sodium: ..... 17.3 mg

1 large mature breadfruit
2 coconuts, grated
Sugar to taste

1. Roast breadfruit over open fire until cooked, about 1 hour.
2. Peel off the skin and wrap in coconut leaves.
3. Beat the breadfruit until tender with a stick or mallet.
4. Cut the breadfruit into small cubes.
5. Prepare coconut cream by putting 3 hot stones into the grated coconut. Quickly toss the coconut around the stones so that it is roasted, but not burnt.
6. Remove the stones and squeeze out the coconut cream, using only a small amount of water.
7. Add sugar to taste to the coconut cream. Pour over breadfruit cubes. Serve warm or cool.

6. Breadfruit pastry

Amount prepared: One pie crust

Nutrition facts
One serving size: 895 g

Amount per serving
Energy: ..... 5293 kJ (1260 kcal)
Fat: ..... 30.3 g
Carbohydrate: ..... 224 g
Protein: ..... 17.6 g
Iron: ..... 3.3 mg
Sodium: ..... 226 mg

1 ripe breadfruit
½ teaspoon salt
2 tablespoons butter
Flour

1. Wash the breadfruit well and prick with a fork.
2. Roast on an open fire or bake in a moderate oven (180°C or 350°F) until soft, about 1 hour.
3. Remove the skin, seeds and dark spots. Sieve the breadfruit while still hot.
4. Measure 2 cups of breadfruit into a bowl.
5. Mix in salt and butter.
6. Form into a smooth ball and knead lightly on a floured board.
7. Shape the pastry into a pie dish using fingers and a glass. The pastry is like a crumb pastry.
8. Prick with a fork. Bake in a moderately hot oven (200°C or 400°F) for 12 to 15 minutes.
9. Fill with a savoury filling.

7. Breadfruit buns

Amount prepared: 18 buns

Nutrition facts
One serving size: 184 g

Amount per serving
Energy: ..... 1053 kJ (2051 kcal)
Fat: ..... 6.3 g
Carbohydrate: ..... 41.8 g
Protein: ..... 6 g
Iron: ..... 0.67 mg
Sodium: ..... 84.4 mg

2 cups breadfruit flour
1 teaspoon baking powder
½ cup skimmed milk powder
½ teaspoon mixed spice (optional)
2 tablespoons butter or margarine
½ cup sugar
1 egg
1 teaspoon vanilla
½ teaspoon citrus rind, finely grated
1 cup mature breadfruit, grated
¼ cup water

1. Mix together flour, baking powder, milk powder, and mixed spice. Set aside.
2. Cream together the butter and sugar. Add egg, vanilla, and grated citrus rind. Mix well.
3. Add grated breadfruit to the butter mixture.
4. Stir the flour mixture into the butter mixture, adding just enough of the water to make a stiff dough.
5. Drop by tablespoonfuls onto a greased baking sheet.
6. Bake in a moderately hot oven (190°C or 375°F) until golden brown, about 30 minutes. Cool and serve.

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Banana

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Introduction

The banana is a member of the genus *Musa* and is also known as *jaina, tiaina, fai* and *siaine*. Bananas are grown in gardens and plantations and are readily available in markets and stores throughout the Pacific. They are an important staple food for many people in the region, especially on atoll islands. The plants grow from an underground stem called a corm, which sends up a shoot called a sucker. This grows into a mother plant that dies after it fruits. The whole set of fruit is called a bunch, a cluster of fruit is a hand, and a single fruit is a finger.

Banana fruits are generally categorised as cooking bananas and dessert bananas and are available in different varieties of various shapes, colours, sizes and tastes. Both types of banana can be eaten when still green, as well as when ripe, and they can be cooked or eaten raw. They are convenient, tasty, hygienic and available everywhere. All bananas are covered by an easy-to-remove skin that protects the fruit from germs and keeps in the nutrients.

Some banana varieties are disappearing from Pacific farms because of alternative land uses, cultural changes and neglect. However, Pacific countries are working with regional and international agencies to try and save these varieties by conserving them in collections and promoting their use.

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Major types of bananas and propagation

Cooking bananas (also known as plantains) are normally cooked when still green and they are generally eaten as a starchy vegetable. However, some are eaten in the half-ripe and ripe stages, in which case they are considered both 'cooking' and 'dessert' types. Cooking bananas, like dessert bananas, come in a great variety of shapes, sizes and colours. They may be large, weighing up to 300 grams, but some popular types of cooking banana have small fingers of around 50–100 grams. Unripe bananas generally have green peel, but some varieties have brownish, red-orange or ash-coloured peel. The flesh of cooking bananas ranges from cream to orange. Some varieties are more commonly used for cooking than others.

Dessert bananas are the sweeter varieties that can be eaten raw as snacks when ripe, or cooked and used in different types of dessert. Some types of dessert bananas weigh only 30 grams, while others weigh up to 300 grams. The peel colour is often bright yellow but may also be red or orange, and the fruit varies greatly in taste and texture. Some are much sweeter than others. Some have a very creamy texture and can be eaten with a spoon. The soft textures of dessert bananas make them excellent complementary food for babies over six months old, as they are very easy to digest and can supply the energy and vitamins that babies need. Making baby food at home with locally grown bananas is easy and saves money. Ripe, eating bananas also make good food for elderly or sick people because they are easily digested.

Propagation

Banana plants are propagated by suckers and usually fruit after 1–1½ years. They fruit throughout the year but are more likely to fruit during warm weather. Bananas may be harvested when three-quarters of the fruit on the stem are full size. To ripen the bananas, hang the bunch in an airy place. Other ripening methods, such as burying or using chemicals may also be used.

The plant structure of bananas varies. Some grow to only three metres (eight feet) high, while others grow as high as eight metres (15 feet). The bunches of fruit hang downwards except for Fe'i bananas, which grow upwards and are unique to the Pacific.

In order to bear large crops, banana plants must be properly looked after and must not be overcrowded. To retain healthy plants, it is necessary that plants are thinned so that there is only one bearing shoot, one follower, and one new sucker, as shown in the picture on the next page.

Nutrient content

Bananas are rich in energy that the body needs for warmth, work and play. The energy comes from the sugars and starch in the bananas. Green bananas have higher levels of starch than sugars. As bananas ripen, the starch turns into sugars, which are more easily digested. Ripe bananas have the same energy value as green ones, but more of the energy comes from sugar, which the body can use more quickly. Sportsmen and sportswomen eat ripe dessert bananas before and after exercising to quickly boost or replenish energy. Bananas are also rich in vitamins and minerals, including vitamins A and C.

The nutrient content of different types of bananas varies greatly. Bananas with yellow/orange flesh are rich in provitamin A carotenoids, the precursors to vitamin A. This vitamin is important for protecting against infection and for good vision and eye health. As bananas ripen, the flesh colour changes and the provitamin A carotenoids gradually develop to their maximum levels. ß-carotene is the most important of the provitamin A carotenoids and consuming carotenoid-rich food may help to protect against diabetes, heart disease and cancer. Cooking does not destroy carotenoids and may even help the body use them more effectively.

Research has shown that a variety of Fe'i banana called (called *Karat* in Pohnpei) is very rich in riboflavin (a B vitamin), niacin (another B vitamin), alpha-tocopherol (vitamin E) and calcium. The Pacific Islands Food Composition Tables show that cooking bananas have a higher level of potassium than dessert bananas. Potassium is a vital mineral for regulating the metabolism and maintaining normal blood pressure. Bananas are also a good source of vitamin C, which is important for fighting against infection and helps the body use certain forms of iron. Bananas contain many of the nutrients lost during diarrhoea, so they are a good food for people to eat at this time. Bananas are the better buy than processed snack foods because they have more food value for the money spent.

The banana flower bud, which can be used as a vegetable, is particularly rich in nutrients and is a good source of vitamin C, provitamin A carotenoids, iron and potassium. Vitamin C is, however, destroyed by long cooking.

Functional properties

In addition to the nutritional value, both types of bananas also exhibit other functional properties such lower glycemic response and contain antioxidants such as polyphenols, carotenoids and flavonoids, which can protect cells from damage and lower the risk of cardiovascular diseases and cancer.

Antioxidants

The functional properties of banana vary significantly depending on the variety. The major colours associated with the functional properties of bananas are yellow and orange. Carotenoids, polyphenols, flavonoids and the total antioxidant capacity have been found to be present in banana varieties, such as Karat, that have deeper yellow or orange coloured flesh. These varieties may contain up to 400 times more ß-carotene than white-fleshed varieties. ß-carotene is the most important of the provitamin A carotenoids. Eating foods rich in darker shades of these colours helps protect against diabetes, heart disease and cancer.

Glycemic responses

Carbohydrate foods have been ranked according to the rate at which carbohydrates break down in our body. Carbohydrates that break down quickly during digestion have a high glycemic index (GI 70 and above). Their blood sugar response is fast and high. Carbohydrates that break down slowly, releasing glucose gradually into the blood stream, have a low GI (GI 55 and less). Consumption of low GI food is associated with a lower risk of developing diabetes and coronary heart disease than consumption of high GI foods.

The GI of dessert bananas varies from 30 to 70, depending on the degree of ripeness,The average is 51. Some over-ripe bananas have a GI over 51 because starches are converted to available sugars as bananas ripen. In under-ripe bananas with yellow and green sections, the GI is about 42.

The GI of cooking bananas also varies according to the degree of ripeness. Some have a low GI of 30, because starches present in green bananas are in the form of resistant starch.

A study conducted in Fiji revealed that green and slightly yellow cooking bananas have a moderate GI of 64, compared with white bread (GI 77), Jasmine rice (GI 109) and Calrose rice (GI 83). Thus consuming boiled green bananas as part of a healthy diet is better than consuming a diet containing mostly white bread and long grain Jasmine rice, especially for people with diabetes.

Storage and preservation

One traditional method of preserving green bananas is to store them in a pit lined with coconut husks or banana leaves, cover them with the same material and then seal the pit with soil. Green bananas will keep green for about a month if stored like this before they start to ripen. Another method is to boil the bananas before packing them in a clean plastic bag and then freezing them.

Table 1: Nutrient content of 100 g of banana compared with 100 g of boiled white rice

Food name	Energy	CHO	Protein	Fat	Fibre	Calcium	Iron	Vit A	Vit C	Vit E	Thiamin	Riboflavin	Niacin	Zinc
	(Kcal)	(g)	(g)	(g)	(g)	(mg)	(mg)	(ug)	(mg)	(mg)	(mg)	(mg)	(mg)	mg
Banana, cooking, boiled, unsalted[1]	111	26.3	0.8	0.2	1.2	5	0.5	10	9.0	0.3	0.03	0.04	0.5	0.2
Banana, cooking, ami, baked[1]	109	25.1	1.4	0.1	1.8	2	1.0	17	15	0.3	0.05	0.08	0.6	0.1
Banana, cooking, opine, baked[1]	180	42.4	2.4	0.2	0.7	3	1.7	17	25	0.5	0.08	0.13	1.0	0.2
Banana, cooking, ripe, fried[1]	265	43.9	1.5	9.2	2.3	6	0.8	12	12	2.2	0.11	0.02	0.6	0.4
Banana, common varieties, ripe[1]	103	23.6	1.3	0.4	0.8	11	0.6	4	17.3	0.4	0.07	0.08	0.7	0.2
Banana, Samoan, *Musa troglodytarum*, ripe[1]	126	26.7	1.6	1.4	0.8	21	0.5	12	t	0.3	0.06	0.04	2.3	0.3
Ripe banana, boiled, yellow-flesh, raw/cooked[2,3]	na	na	na	na	na	6.5	0.1	na	na	na	na	na	na	na
Ripe banana, yellow/ orange-flesh, raw/cooked [2,3]	na	na	na	na	na	68.6	0.2	na	na	1.55	na	0.47-14.3	22.6	na
Banana flower, cooked[1]	42	6.1	1.7	0.9	1.8	70	2.0	15	3.0	t	0.02	0.02	0.7	0.1
Banana flower, raw[1]	43	6.4	1.8	0.9	1.5	73	2.1	16	5.8	t	0.03	0.03	1.1	0.1
White rice, boiled[1]	123	28	2.3	0.2	0.8	4	0.3	0	0	t	0.03	0.01	0.6	0.6

Sources: [1]Dignan et al. 2004 ; [2]Englberger et al. 2003a; [3]Englberger et al. 2005b.
Abbreviations: CHO, carbohydrate; na, not available; t, trace.

Table 2: Antioxidant, polyphenol, carotenoid and flavonoid contents of 100 g of banana

Food name	Total Antioxidant Capacity* (mg)	Total Polyphenols (mg)	Total Carotenoids** (mg)	Total Flavonoids*** (mg)
[a]Ripe, yellow/orange flesh raw/ cooked	na	na	1.450–8.508[a]	na
[a]Ripe, cream-flesh	na	na	0.085–0.205[a]	na
Plantain, ripe	1.0	11	0.4	2
Banana, ripe	1.0	9	1.5	15
Green plantain, cooked	18	16	2.2	t

Source: Lako et al. 2007
Notes: *TEAC (Trolox equivalent antioxidant capacity) method; ** total of lycopene, a- and b-carotene; *** total of myricetin, fisetin, morin, quercetin, kaempferol and isorhamnetin; aß-carotene (Englberger et al. 2003).
Abbreviations: na, not analysed; t, trace.

Dried bananas:
Bananas can be dried and pounded to make flour, which makes delicious scones and bread. Select firm bananas of any kind, although some varieties dry better than others. Ripe cooking bananas dry much better than dessert varieties. Slices of dessert bananas can be tossed in lime/lemon juice to minimise the browning (oxidation reaction) in some varieties such as Cavendish during the drying process. Avoid using overripe bananas because they do not dry very well and become sticky.

Dried bananas make a delicious, inexpensive snack. They can also be soaked and added to dishes such as porridge before cooking.

To prepare dried bananas, use the following method:
1. Choose firm, ripe bananas of any kind.
2. Peel and cut into slices about 1 centimetre thick. (If the slices are too thin, they fall apart during the drying process or stick to the drying tray. If they are too thick, they do not dry properly in the middle. All the slices should be about the same thickness so that they dry in the same time).
3. Dry the banana slices on trays in the sun or in an oven or a dehydrator. Be sure to cover the slices well during drying to protect against flies and other pests.
4. Store in airtight containers or sealed plastic bags.

Value-addition
Green bananas can be made into many different products — banana chips, banana flakes, banana dessert, banana porridge and banana flour, which makes very good scones and bread. There is also the potential to use banana flour for baby foods and confectionary products. Ripe bananas can be processed into puree, paste or jam; canned in syrup or nectar; or used in a mixed fruit juice blend.

Preparation and cooking
Generally, green bananas, ripe bananas, flowers and corms are all consumed, depending on the cultivars.

Green cooking bananas
These are used as starchy vegetables. They make a good starch for puddings and green banana flour is used in the food industry. For easy peeling, green bananas are boiled or steamed in their skins until soft and then peeled. Traditionally in some Pacific islands, green bananas are cooked in earth ovens or over hot coals. They may be peeled, soaked in salt water and then baked. Another cooking method is to bake grated or sliced bananas wrapped in leaves with coconut cream. Fermented paste made from green bananas may be baked in an earth oven as a cake.

Ripe bananas
These may be used in savoury meat dishes, dessert dishes, drinks, salads or sandwich fillings. Ripe cooking bananas can be boiled with coconut syrup to make a tasty sweet dish or cooked in coconut cream with fish. A traditional chiefly drink in some Pacific countries is prepared by pounding ripe dessert bananas and mixing them with lemon-leaf-scented coconut cream. Ripe bananas may be mashed and used in recipes with root crops such as taro and cassava or with green cooking bananas. They may also be used in modern recipes, e.g. mixed with flour to make breads or pancakes.

Banana flowers
These are usually picked from the end of a bunch of cooking bananas when the fruit is half grown. Picking the flower buds at this time will not damage the fruit. To prepare banana flower buds for eating, remove the tough outer layers of the flower bud and slice thinly into sections like an onion. Wash in salty water, and knead to wash out some of the sticky sap. Rinse in fresh water and use in salads, soups or other cooked dishes, including meatless burgers and seafood or meat dishes. Note that flowers from dessert bananas have a bitter taste and should not be eaten. Only flowers from cooking varieties are eaten.

Corms from a certain kind of banana that does not flower can be eaten. This kind grows in some places in the Pacific. The corm is eaten as a starchy vegetable.

Note that banana leaves are not eaten, but are often used to wrap food. Use a clean, undamaged, whole banana leaf and soften it by holding it over a flame. Trim the mid rib off the back so that the leaf lies flat. Cut the leaf to the size needed. After filling it with food, fold and tie with a mid rib from a coconut leaf or string. Wrapping foods in banana leaves for school lunches or for selling at the market is convenient, cheap and hygienic, as long as the leaves are wiped

clean before use. A nutritious way to cook foods is to wrap them in banana leaves and steam or bake them in an earth oven.

Also note that stems and fibres of banana can be used for medicinal purpose.

To sum up, cooking bananas can be prepared and used in many ways including the following:

- boiled, steamed, baked or fried;
- mashed and baked with coconut cream;
- mashed with other root crops, such as taro and cassava in traditional recipes;
- dried in slices for snacks.

Dessert bananas can also be prepared and used in several ways as indicated below:

- eaten fresh and raw as a snack or dessert;
- boiled, steamed, baked, and fried;
- prepared as drinks, smoothies and shakes;
- mashed and baked with coconut cream;
- mashed with other food crops such as taro or cassava, or in other traditional recipes;
- added to fruit salads, ice creams or other desserts;
- as a sandwich filling or spread;
- as a complementary food for babies from six months;
- dried in slices for snacks.

Recipes

1. Banana bread

Number of loaves: two

Nutrition facts
One serving size: 148 g

Amount per serving
Energy: ..... 1234 kJ (274 kcal)
Fat: ..... 10.3 g
Carbohydrate: ..... 44 g
Protein: ..... 6.4 g
Iron: ..... 0.78 mg
Sodium: ..... 297 mg

3½ cups flour
3 teaspoons baking powder
1 teaspoon salt
1 teaspoon baking soda
2 cups mashed, ripe dessert bananas
2 tablespoons lemon juice
¾ cup butter or margarine
1½ cups sugar
3 eggs
¾ cup milk

1. Sift together flour, baking powder, salt and baking soda. Set aside.
2. Mash bananas with a fork. Add lemon juice and mix. Be sure the bananas are mashed well.
3. Cream together the butter or margarine and sugar, until they are well mixed. Add the eggs and beat thoroughly until light.
4. Add the sifted ingredients to the egg mixture in small amounts, adding a little of the milk each time. Beat well after each addition.
5. Fold in the banana mixture.
6. Pour the mixture into two greased loaf pans. Bake in a moderate oven (180°C or 350°F) for about 1 hour.
7. Cool and serve.

Note: Instead of baking, this bread can also be steamed using the following method:

1. Start water boiling in a large pot with stones or shells in the bottom.
2. Grease 2 large clean tin cans.
3. Pour bread mixture into cans, no more than half full.
4. Cover can tops with grease-proof paper or a leaf.
5. Put the cans in the pot, resting them on the stones or shells. Cover the pot.
6. Steam the bread for 1 hour, or until a knife comes out dry after it is put into the bread.

2. Banana rice

Number of servings: eight

Nutrition facts
One serving size: 275 g

Amount per serving
Energy: ..... 1162.5 kJ (278 kcal)
Fat: ..... 8.5 g
Carbohydrate: 46.9g
Protein: ..... 3.5 g
Iron: ..... 1.6 mg
Sodium: ..... 58.5 mg

2 cups rice uncooked
12 ripe dessert bananas
1 coconut
Salt to taste (optional)

1. Wash the rice.
2. Peel and slice the bananas.
3. Put the rice and bananas in a pot. Add water to 5 cm (2 inches) above the rice and boil gently until cooked.
4. Grate coconut, add a little water, and squeeze out the cream. Add salt to taste.
5. When the rice is cooked, mix in the coconut cream.
6. Serve hot or cold with greens or other vegetables.

3. Banana milk drink

Number of servings: one

Nutrition facts
One serving size: 386 g

Amount per serving
Energy: ..... 1220 kJ (290 kcal)
Fat: ..... 9.7 g
Carbohydrate: ..... 39.3 g
Protein: ..... 11.1 g
Iron: ..... 0.64 mg
Sodium: ..... 115 mg

1 cup milk
1 ripe dessert banana

1. Use fresh milk or prepare powdered milk using 1 cup water to 4 tablespoons of milk powder.
2. Mash the banana thoroughly.
3. Pour the mashed banana into the milk and stir well.
4. Serve in a glass.

Note: This is a good drink for babies and children. It is also a very refreshing drink for sick people.

4. Banana flower soup

Number of servings: four

Nutrition facts
One serving size: 161 g

Amount per serving
Energy: ..... 976 kJ (233 kcal)
Fat: ..... 15.2 g
Carbohydrate: ..... 4.3 g
Protein: ..... 19.2 g
Iron: ..... 1.7 mg
Sodium: ..... 367 mg

2 cooking banana flowers
1 cup shelled shrimp or prawns
1 onion, sliced
4 tablespoons oil
2 cups water
4 cloves garlic, chopped (optional)
Lemon and salt to taste

1. Remove the tough covering of the flower. Slice across into thin pieces. Squeeze it with salt and rinse. Set aside.
2. Mix the shrimp or prawns with the sliced onion and lemon juice.
3. Fry the garlic in the oil. Add the shrimp mixture.
4. Add the water and continue cooking.
5. Add the flowers. Turn over constantly until tender. Season with salt.
6. Serve hot.

5. Baked cooking banana and fish

Number of servings: eight

Nutrition facts
One serving size: 319 g

Amount per serving
Energy: ..... 2512 kJ (598 kcal)
Fat: ..... 35.4 g
Carbohydrate: ..... 44.7 g
Protein: ..... 26.3 g
Iron: ..... 2.8 mg
Sodium: ..... 122 mg

4 ripe cooking bananas
8 pieces of fish
1 onion, sliced
4 tomatoes (optional)
Coconut cream from 2 coconuts
Salt to taste

1. Peel and slice the bananas.
2. Wrap the bananas and fish with the other ingredients in 4 banana leaf packages.
3. Place in a baking dish.
4. Bake in a moderate oven (180°C or 350°F) until the fish is tender (about 30 to 45 minutes).

6. Banana chips

Number of servings: eight

Nutrition facts
One serving size: 92 g

Amount per serving
Energy: ..... 567 kJ (135 kcal)
Fat: ..... 4.5 g
Carbohydrate: ..... 23 g
Protein: ..... 0.7 g
Iron: ..... 0.44 mg
Sodium: ..... 3.5 mg

2 green cooking bananas
Oil for frying
Salt to taste

1. Pour oil into pot and heat.
2. Peel the bananas and cut them into thin slices.
3. Put them on paper-covered plates and sprinkle with salt.
4. When the oil is very hot, fry the chips until they are a pale gold in colour.
5. Drain on paper. Serve at once.

7. Bananas in coconut milk

Number of servings: six to eight

Nutrition facts
One serving size: 237 g

Amount per serving
Energy: ..... 2587 kJ (616 kcal)
Fat: .....40 g
Carbohydrate: ..... 60.1 g
Protein: .....5.4 g
Iron: .....2.7 mg
Sodium: ..... 14.6 mg

6 ripe cooking bananas
1 cup grated coconut
Coconut cream from 2 coconuts

1. Peel the bananas and cut in half along their length.
2. Coat with grated coconut.
3. Place in a baking dish. Cover with coconut milk.
4. Bake in a moderate oven (180°C or 350°F) for 20 to 30 minutes.
5. Serve cold.

8. Stuffed green bananas

Number of servings: six to eight

Nutrition facts
One serving size: 191 g

Amount per serving
Energy: .....958 kJ (228 kcal)
Fat: .....3.7 g
Carbohydrate: ..... 39.8 g
Protein: .....8.8 g
Iron: .....1.5 mg
Sodium: ..... 30.3 mg

6 green cooking bananas
225 g (8 oz) raw minced meat
1 onion, chopped
Salt
1 egg, beaten

1. Without peeling, cut the bananas into halves along their length.
2. Scoop out the flesh with a spoon. Leave the boat-shaped peel.
3. Grate the banana flesh.
4. Mix the mince, chopped onion, and salt with the grated banana flesh. Add the beaten egg to bind the mixture.
5. Put the mixture back into the peel. Tie the halves together with string.
6. Steam for 25 minutes or bake in a moderate oven (180°C or 350°F) for 45 minutes.
7. Serve with gravy or a sauce made from cooked tomatoes, if desired.

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Pumpkin

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Introduction

Pumpkins belong to the Cucurbitaceae family of plants. The pumpkin is also known as *papukeni, pauteni, maukeni, fua mosini, hina* and *bwaukin.* Originally from central and south America, pumpkins are now an important and nutritious food for many Pacific Islanders. It is a very valuable food because most parts of the plant — fruit, seeds and flowers — can be eaten and are rich in nutrients. Pumpkin is easy to grow and one plant in the garden can supply pumpkins and green leaves throughout the year, making it one of the least expensive food items to have in our diet.

Pumpkin is also valued as a protective food — a rich source of ß-carotene, which the body converts to vitamin A when eaten, and also of fibre, vitamin C, magnesium and potassium.

Major types of pumpkin and cultivation

Pumpkins are creeping vines, which do not need much care once they are planted. They can be grown throughout the Pacific, even on atolls. There are many different varieties of pumpkin including iron bark (Queensland Blue), jap (Japanese), golden

Design and layout: Muriel Borderie - SPC Publications Section

Pumpkin

Figure 1: Common varieties of pumpkin

Source: Go for 2&5. www.gofor2and5.com.au/Guide.aspx?c=1&a=6&s=15&l=57&n=192

nugget, butternut and gem squash. These varieties differ in flavour, texture, colour and storing quality. Pumpkin plants grow easily from either seeds or cuttings with roots. The best way to get the desired variety is to plant cuttings. Pumpkins grow best in loose, rich soil. The site of an old rubbish heap is a good place for growing pumpkins. Kitchen scraps put round the plants will also add goodness to the soil. Pollinating the flowers by brushing them gently with a feather or brush will help to produce more pumpkins.

Nutrient content

Pumpkin leaves, flesh, flowers and seeds are all protective, health-giving foods. They contain vitamins and minerals the body needs to stay healthy. Table 1 presents an overview of the nutrient profile of the various edible portions of the pumpkin plant.

The ***fruit*** and ***leaves*** are excellent sources of vitamins A and C while the ***seeds*** are an excellent source of plant protein, vitamins E, B_1 (thiamin), B_2 (riboflavin) and B_3 (niacin). The leaves are an excellent source of calcium, and a good source of iron. The iron present in plants is the nonheme form of dietary iron (heme iron, on the other hand, is found in animal foods such as meat, fish and poultry). Generally, the absorption of nonheme iron is not as efficient as the absorption of heme iron. Meat and vitamin C will improve the absorption of nonheme iron but other food components, such as tannins (found in tea), calcium and polyphenols decreases absorption. It is important to include foods that enhance nonheme iron absorption. This is particularly important for women in childbearing age when iron losses are high (which may occur with heavy menstrual losses) and when iron requirements are high (as in pregnancy). This is also important for people who do not eat animal based foods (vegetarians).

Being rich in vitamin A, cooked mashed pumpkin is an excellent complementary food for babies from six months.

Functional properties

Pumpkins contains other functional properties, including antioxidants, polyphenols, carotenoids and flavonoids, which can protect cells from damage, lower the risk of cardiovascular disease and provide other health benefits.

Table 1: Nutrient content of 100 g of pumpkin

Food name	Energy	CHO	Protein	Fat	Fibre	Calcium	Iron	Vit A	Vit C	Vit E	Thiamin	Riboflavin	Niacin	Zinc
	(Kcal)	(g)	(g)	(g)	(g)	(mg)	(mg)	(ug)	(mg)	(mg)	(mg)	(mg)	(mg)	mg
Pumpkin, boiled	44	7.1	2.3	0.4	1.4	27	0.5	223	11	2.0	0.05	0.07	0.7	0.3
Pumpkin, butternut, boiled	49	7.7	2.3	0.7	1.5	22	0.4	208	6	1.9	0.07	0.09	0.5	0.1
Pumpkin seeds, raw	565	19.8	29.4	40.4	5.4	39	10	19	0	20	0.23	0.32	1.7	6.6
Pumpkin leaves, boiled	26	1.5	2.7	0.2	3.7	335	1.5	248	4.0	1.0	0.11	0.30	1.1	0.4

Source: Dignan et al. 2004
Abbreviations: CHO, carbohydrate; vit, vitamin.

Table 2: Antioxidant, polyphenol, carotenoid and flavonoid contents of 100 g of pumpkin

Food name	Total Antioxidant Capacity* (mg)	Total Polyphenols (mg)	Total Carotenoids** (mg)	Total Flavonoids*** (mg)	Total Anthocyanin (mg)
Pumpkin, cooked	5	23	5.1	1	nd

Source: Lako et al., 2007
Notes: *TEAC (Trolox equivalent antioxidant) method; **total of lycopene, a- and b-carotene; ***total of myricetin, fisetin, morin, quercetin, kaempferol and isorhamnetin; aß-carotene (Dignan et al. 2004).
Abbreviation: nd, not detected.

Antioxidants

The major colours associated with the functional properties of pumpkin are the yellow and orange of the flesh and the green of the leaves. Deeper shades of these colours provide an increased amount of antioxidants and thus greater health benefits. Carotenoids, polyphenols, flavonoids, anthocyanins and the total antioxidant capacity have been found to be present in the flesh (see Table 2) as well as in leaves.

In addition, vitamins C and E are strong antioxidants. Vitamin C is a water-soluble vitamin that helps remove free radicals from the hydrophilic (water) components of the body cells, while vitamin E removes free radicals from the lipophilic (fat) components of the body cells.

Glycemic responses

Pumpkin contains carbohydrate so it has a glycemic response. The glycemic index (GI) ranks food that contains carbohydrates according to the rate at which the carbohydrates break down in our body. Carbohydrates that break down quickly during digestion have a high glycemic index (GI 70 and above). Their blood sugar response is fast and high. Carbohydrates that break down slowly, releasing glucose gradually into the blood stream, have a low glycemic index (GI 55 and less).

The GI value for boiled pumpkin is 75 which make it appear to be a high GI food. However, pumpkin is a nutrient rich food with a low carbohydrate content. This offsets its high GI value, resulting in a less significant effect on blood sugar than indicated by the high GI ranking. You would have to eat a large amount of boiled pumpkin to increase your blood sugar significantly.

Storage and preservation

Whole pumpkins keep better if picked leaving 5 cm (2 inches) of the stem on. Dry them in the sun for a few days, then store them in a dry, shady place. They should not be touching each other. Pumpkins can be stored this way for up to six months.

Pumpkins may be preserved by drying or freezing.

Drying must be done carefully in order to kill all the germs that would spoil the pumpkin. Split the pumpkin in half and remove the seeds. Remove the skin, cut the flesh into thin slices and steam for about six minutes. Spread on a tray and dry in the sun or in a solar dryer until dry and brittle. This will take about two days. If flies are a problem, cover with netting. Pumpkin needs to be dried in hot sun so that it dries quickly before it spoils.

Freezing is another way of preserving pumpkins. Wash the pumpkin and cut it into pieces. Remove the seeds, but do not peel. Cook until soft by boiling, steaming or baking. Scrape the pumpkin flesh from the skin and mash it well. Pack, seal and freeze immediately. Mashed pumpkin may be used later for baby foods, soups and breads.

Value-addition

Pumpkin can be freeze-dried and used to prepare soup and bread. It can be made into vegetable juice, puree and jam, and used in baby foods. It can also be canned and used in soup and pie fillings.

Preparation and cooking

The tender leaves and the stems, flowers, fruit and seeds of pumpkin can all be eaten.

The ***leaves*** should be washed in clean water before cooking. Remove any tough stems. Place the leaves in boiling water, cover and cook for five to ten minutes, until just tender. Eating green leaves with coconut cream or other fats helps the body to use the vitamin A in the leaves. Pan-frying is also a good way to prepare pumpkin leaves. Heat a little cooking oil in a pot and add chopped garlic or ginger. Add cut up leaves, cover and cook for about ten minutes, shaking the pot often.

To cook the ***tips*** of the vines, scrape or peel off the hairy skin first. Boil in water or coconut cream until just tender, as for the leaves. Cool the tips, chop them and flavour with lemon juice for a tasty salad.

In some places, the ***flowers*** are eaten. Before cooking pumpkin flowers, the centres of the flowers must be pulled out. The flowers are delicious fried in a little butter or cooking oil, or dipped into batter and then fried. They can also be added to fish and meat dishes.

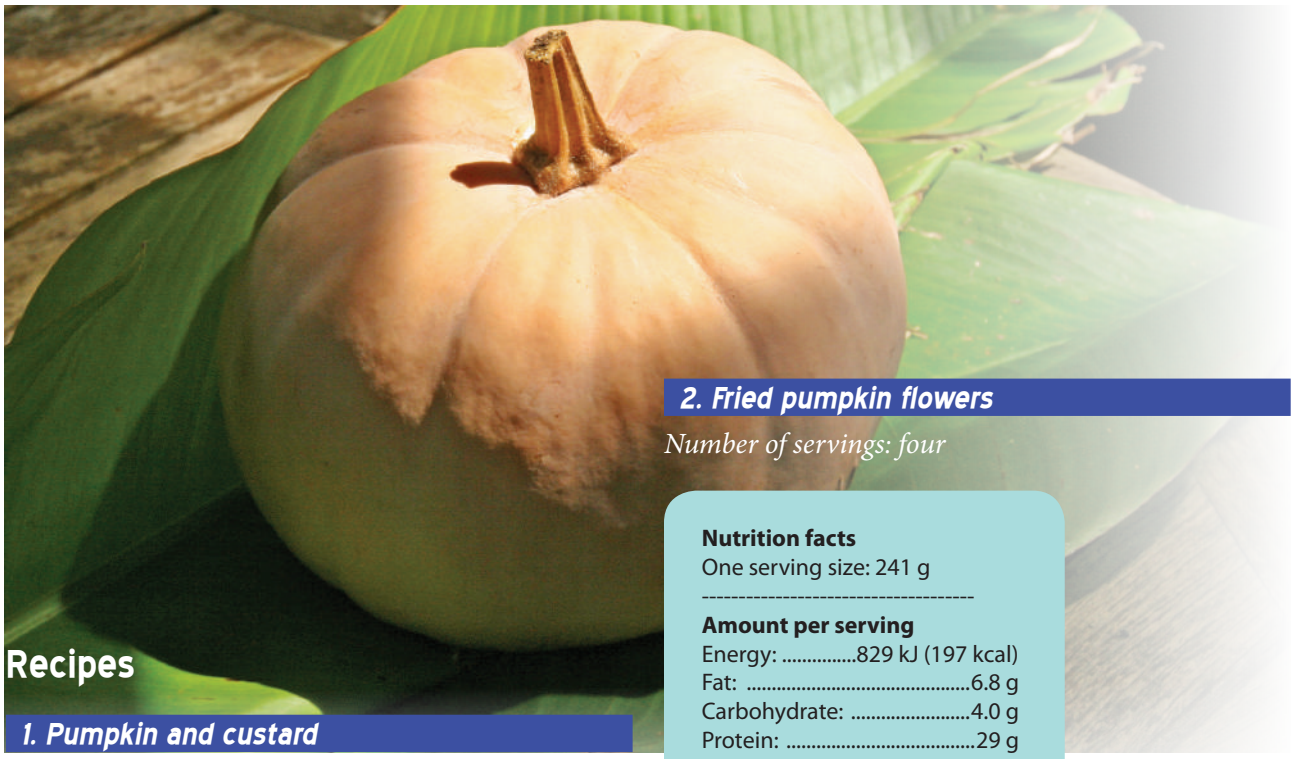
Pumpkin ***flesh*** can be baked, steamed, boiled and fried. It is delicious served as a vegetable or it can be made into tasty curries, soups and desserts. Pumpkin has the best flavour when cooked in the skin. The skin of very young pumpkin can be eaten, but it is best to peel the skin off older ones.

Pumpkins can be baked whole. Puncture the skin with a fork and bake it until it is soft. The cooking time will depend on the size of the pumpkin. When cooked, cut the pumpkin in half and scoop out the seeds before serving. Cooked, mashed pumpkin is an excellent complementary food for babies aged six months and older.

Another way to cook pumpkin whole is to cut the top off and scoop out the seeds. Stuff it with fresh or tinned meat or fish, and fresh vegetables, or coconut cream and onions. Replace the top and bake in an earth oven or a regular oven until cooked. Cut up the pumpkin and filling and serve hot.

The ***seeds*** are prepared by washing them carefully to remove the pulp. Then they can be boiled, toasted or dried in the sun. They make a delicious, cheap nutritious snack and are rich in protein and iron. They can also be fried in a little cooking oil and lightly salted. Do not throw away this valuable food. In some places pumpkin seeds are used to get rid of worms.

Pumpkin



Recipes

1. Pumpkin and custard

Number of servings: six

Nutrition facts
One serving size: 203 g

Amount per serving
Energy: .....941 kJ (224 kcal)
Fat: ..... 10.3 g
Carbohydrate: ..... 21.3 g
Protein: ..... 11.8 g
Iron: .....1.1 mg
Sodium: ..... 128 mg

1 small pumpkin
2 cups milk
3 eggs
¼ cup sugar

1. Cut the top off the pumpkin. Scoop out the seeds.
2. Beat the eggs lightly and mix in the sugar.
3. Heat the milk until it is just boiling. Add to the egg and sugar mixture. Mix well.
4. Pour the egg mixture into the pumpkin.
5. Replace top and bake in an earth oven or moderate oven (350°F or 180°C) for about 1 hour, until cooked.
6. Cool, slice and serve as a dessert.

Note: Sugar may be replaced by onion, green vegetable and a little salt to make this a savoury dish.

2. Fried pumpkin flowers

Number of servings: four

Nutrition facts
One serving size: 241 g

Amount per serving
Energy: .....829 kJ (197 kcal)
Fat: .....6.8 g
Carbohydrate: .....4.0 g
Protein: .....29 g
Iron: .....1.6 mg
Sodium: 142mg

3 cups pumpkin flowers (about 20 large ones)
1 fresh fish
1 medium onion
1 large tomato
1 tablespoon cooking oil
½ cup water or stock
Salt and pepper to taste

1. Clean the fish, remove all the bones and skin. Cut the fish into small pieces.
2. Peel and chop the onion. Wash and finely slice the tomato.
3. Remove the centres and stems from the pumpkin flowers. Wash the remaining flower petals well.
4. Heat cooking oil in a frying pan. Add the onion and cook until golden brown.
5. Add the tomato. When cooked, add the fish and cook for about 10 minutes.
6. Add the water or stock. When the mixture begins to boil, add the pumpkin flowers and season with salt and pepper.
7. Serve hot with cooked breadfruit, banana or root crops.

Note: Choose male flowers for this recipe so that female flowers are left to develop fruit.

3. Pasolo fish

Number of servings: two

Nutrition facts
One serving size: 575 g

Amount per serving
Energy: ..... 2929 kJ (697 kcal)
Fat: ..... 43.7 g
Carbohydrate: ..... 12 g
Protein: ..... 62.8 g
Iron: ..... 5.8 mg
Sodium: ..... 294 mg

1 fresh, cooked fish
Pumpkin leaves
1 coconut
1 onion, chopped
Salt to taste

1. Grate the coconut and squeeze out the cream into a pot.
2. Add the chopped onion, and salt to taste.
3. Bring the mixture to the boil.
4. Wash the pumpkin leaves. Wrap small pieces of fish in the leaves.
5. Add the fish parcels to the boiling coconut cream.
6. Cover with a lid and cook for 5 minutes.
7. Serve with cooked taro, cassava or breadfruit.

4. Savoury bananas

Number of servings: four

Nutrition facts
One serving size: 538 g

Amount per serving
Energy: ..... 3878 kJ (932 kcal)
Fat: ..... 49 g
Carbohydrate: ..... 80.6 g
Protein: ..... 40.9 g
Iron: ..... 4.4 mg
Sodium: ..... 180 mg

4 ripe cooking bananas
12 matchbox-sized pieces of pumpkin
2 spring onions
1 green pepper (optional)
4 serving pieces fresh fish
2 cups coconut cream

1. Put the fish pieces into a pot or baking dish.
2. Peel the bananas and cut lengthwise. Arrange on top of the fish.
3. Wash and chop the spring onions and green pepper. Sprinkle on top of the bananas.
4. Wash the pumpkin, cut into slices and add to the bananas.
5. Add coconut cream.
6. Cook for about 30 minutes or until the bananas are soft.
7. Serve hot.

5. Pumpkin bread

Number of servings: eight

Nutrition facts
One serving size: 253 g

Amount per serving
Energy: ..... 2680 kJ (638 kcal)
Fat: ..... 4.4 g
Carbohydrate: ..... 115 g
Protein: ..... 25.6 g
Iron: ..... 6.3 mg
Sodium: ..... 13.3 mg

1 kg wholemeal flour
1 teaspoon instant yeast
1 cup of cooked, mashed pumpkin
2 tablespoons toddy, golden syrup or honey
3⅓ cups lukewarm water or coconut cream

1. Mix toddy, syrup or honey with lukewarm water or coconut cream and mashed pumpkin.
2. Put flour into a bowl and mix in the instant yeast.
3. Make a well in the centre of the flour and pour in the lukewarm mixture.
4. Mix and work well into a soft, moist dough.
5. Shape dough into rolls and put into greased baking tins.
6. Leave to rise for 10 to 15 minutes.
7. Bake in a moderate oven for 30 minutes or until the rolls sounds hollow when tapped.

Note: Shelled pumpkin seeds can be added to the dry flour and yeast mixture.

6. Pumpkin drink

Number of servings: two

Nutrition facts
One serving size: 247 g

Amount per serving
Energy: ..... 1719 kJ (409 kcal)
Fat: ..... 31.6 g
Carbohydrate: ..... 25.9 g
Protein: ..... 6.6 g
Iron: ..... 2.7 mg
Sodium: ..... 14.9 mg

1 cup cooked, mashed pumpkin
1 cup coconut cream
1 cup cooking water from pumpkin
Sugar or toddy to taste

1. Prepare the pumpkin and leave to cool.
2. Mix all the ingredients well in a bowl or jug.
3. Cool and serve.

7. Chicken and pumpkin soup

Number of servings: six

Nutrition facts
One serving size: 406 g

Amount per serving
Energy: ..... 2531 kJ (603 kcal)
Fat: ..... 40.7 g
Carbohydrate: ..... 11.7 g
Protein: ..... 47.3 g
Iron: ..... 3.6 mg
Sodium: ..... 135 mg

2 tablespoons cooking oil
½ cup chopped onions
1 kg (2 lb) chicken
4 cups water
2 tomatoes, chopped
4 cups sliced and peeled pumpkin
6 pumpkin tips
1 cup coconut cream
1 green pepper, sliced (optional)
3 tablespoons lemon juice (optional)
Salt to taste

1. Wash the pumpkin tips and chop them.
2. Fry the onion in the cooking oil until tender.
3. Cut the chicken into small pieces.
4. Add the cut-up chicken to onion and cook for 10 minutes uncovered.
5. Add water, lemon juice and salt to taste.
6. Bring to the boil, lower the heat and cook for 15 minutes, covered.
7. Add the tomatoes, pumpkin, green pepper and pumpkin tips. Cook for 5 more minutes.
8. Add the coconut cream. As soon as the mixture comes to the boil again, remove from heat.
9. Serve hot with cooked root crops or breadfruit.

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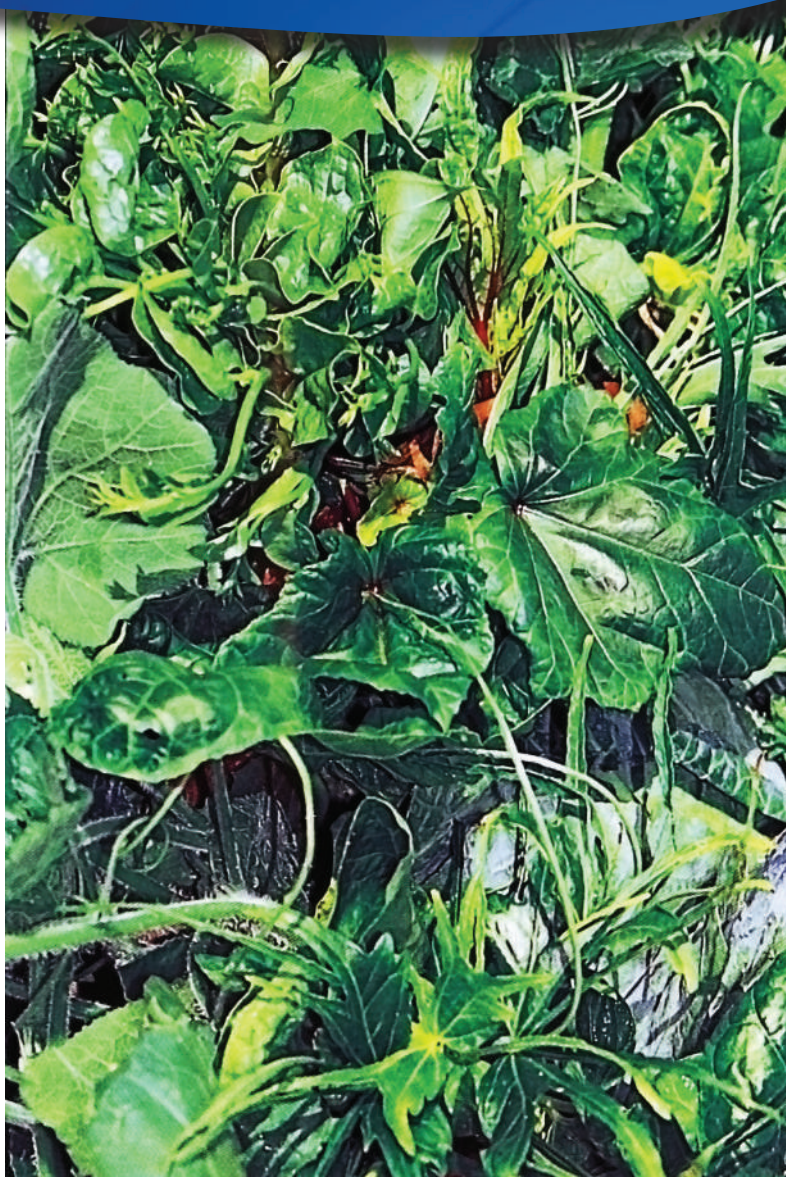
Green leaves

Leaflet No. 8 - Revised 2012



Introduction

The green leaves of plants are important foods in almost all parts of the world. Scientists believe that the leaves from about 1000 plants can be eaten as vegetables. Many of these vegetables grow on Pacific islands, especially on volcanic islands, although a few grow on dry, coral atolls.

Green leafy vegetables are nutritious and rich in phytochemicals. Many are suitable for home gardens to provide fresh green leaves daily for family meals. In the Pacific region, many edible, nourishing plants can also be found in the wild or growing as weeds. Gathering and preparing these is a low-cost way to enjoy the taste of this nutritious food.

Design and layout: Muriel Borderie - SPC Publications Section

Major types of vegetables

Many different types of edible, green, leafy vegetables grow and are eaten in the Pacific region. Some are eaten only when cooked, such as taro leaves, edible hibiscus and amaranth, while others, such as English cabbage and lettuce, can be eaten raw in salads.

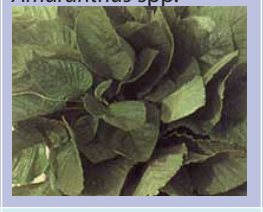
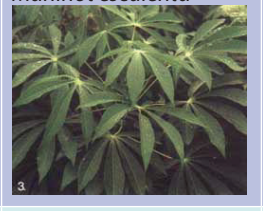
It is important to note that some popular plants that are grown for their roots or fruit have leaves that can be eaten, e.g. taro, sweet potato, cassava, pumpkin and chili. The leaves sometimes have greater food value than the root or fruit. However, if too many leaves are picked from one plant, the root or fruit may not grow properly. Therefore, it is best to keep two plots of these plants, one for leaves and the other for the root or fruit.

Edible, nutritious green leaves can be found in the wild or growing as weeds in gardens or on farmland. In the Pacific region, these include watercress, kangkong, edible fern and morning glory (*Ipomoea cairica*).

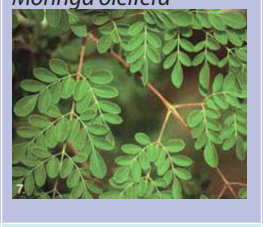
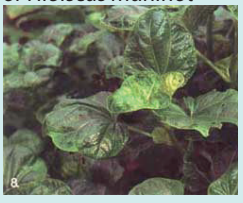
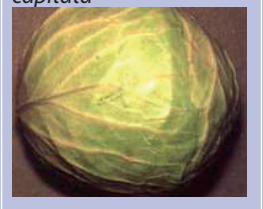
For people who live in towns, the market is the best place to buy green vegetables. Market vegetables are usually a better buy than imported ones. And with home-grown green vegetables you know they are fresh and have no pesticide on them.

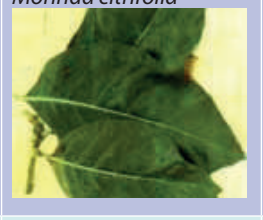
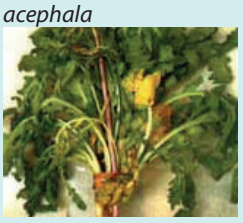
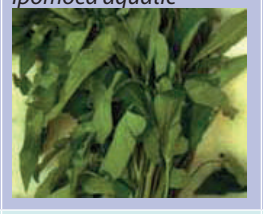
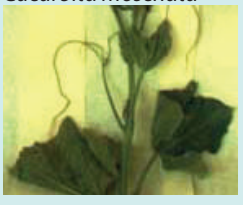
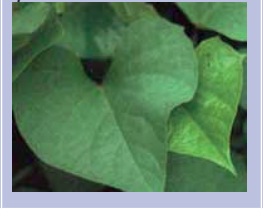
Green leaf vegetables are usually at their best during the hot, wet months. When leaves are picked from the plant during this time, new ones will grow back quickly.

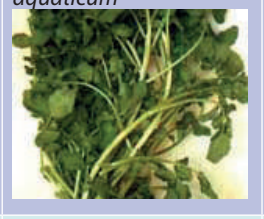
Table 1: Common green vegetables of the Pacific

English name	Scientific name	Some local names	Food value	Description of plant	Preparation method
1. Amaranth, tropical spinach, Ceylon spinach	*Amaranthus* spp. 	Aupua (PNG) Tubua (Fiji) Te mota (Kiribati) Bhaji (Indian)	Very good	Plant with erect stems and spikes of flowers; many different kinds	Easy method and stir fry
2. Basella, creeping spinach, Ceylon spinach	*Basella alba* *Basella rubra* 	Poi (Indian)	Good	Climbing or bushy plant with pink or white flowers and dark, oval leaves	Easy method (no longer than 5 minutes), stir fry or fresh in salads
3. Cassava leaves	*Manihot esculenta* 	Iaui manioke (Tonga) Te tabioka (Kiribati)	Very good	Root-bearing shrub with different stem colours and leaf shapes	Choose young leaves; cook by special method. **Do not eat raw.**
4. Chilli leaves	*Capsicum frutescens* 	Polo (Polynesia) Te boro (Kiribati)	Very good	Small, fruit-bearing bush	Easy method and stir fry

Green leaves

5. Chinese cabbage, pak choi	*Brassica chinensis* 	Te kabitini taina (Kiribati) Kapisi siaina (Tonga)	Good	Dark green leaves with light stalks	Easy method, stir fry or use fresh in salads
6. Cowpea leaves	*Vigna unguiculata*	Piini (Tonga) Te bin (Kiribati)	Good	Climbing or bushy plant with long pea-pods	Easy method and stir fry
7. Drumstick tree, horse-radish tree	*Moringa oleifera* 	Tiaitian (Kiribati) Suijan (Fiji)	Very good	Small tree with yellowish-white flowers and long pods	Easy method and stir fry
8. Edible hibiscus	*Abelmoschus manihot or Hibiscus manihot* 	Aibika (PNG) Bele (Fiji) Pele (Polynesia) Ailan kapis (Vanuatu)	Very good	Small shrub with soft, dark-green leaves of various shapes and yellow flowers	Easy method (no longer than 5 minutes, turn leaves once)
9. English cabbage	*Brassica oleracea var. capitata* 	Te kabitini ni Imatang (Kiribati)	Fair	Solid round heads of light green leaves	Easy method, stir fry or use fresh in salads
10. Fern	*Athyrium esculentum* 	Ota (Fiji)	Good	Large wild fern that grows in wet places and along edges of rivers	Use top of stalks, split into four pieces, then cook by easy method.
11. Fig leaves *(no photo)*	*Ficus species*	Laui fiki (Tonga)	Very good	Small tree, often with rough leaves, with edible fruit	Easy method or stir fry. Use young leaves.
12. Gnetum, jointfir spinach	*Gnetum gnemon* 	Tulip (PNG)	Very good	Small, nut-bearing tree that usually grows in the bush	Choose very young leaves, use easy method or stir fry. **Do not eat raw.**

13. Indian mulberry tree	*Morinda citrifolia* 	Te non (Kiribati) Nonu (Tonga) Kura (Fiji)	Very good	Small tree with dark green leaves, white flowers and bumpy fruit	Choose very young leaves and use easy method.
14. Kale seedlings	*Brassica oleracea* var. *acephala* 	-	Good	Small seedlings grow up to 10 centimetres before harvesting.	Easy method or stir fry or use fresh in salads.
15. Kangkong, water spinach	*Ipomoea aquatic* 	Te kangkong (Kiribati)	Good	Trailing plant that grows in water or on damp land, with pink or white flowers	Easy method, stir fry or use fresh in salads.
16. Lettuce	*Lactuca sativa* 	Letisi (Polynesia)	Fair	Small, upright plant with long or cylindrical leaves	Use fresh in salad after washing in clean water.
17. Nightshade	*Solanum nigrum* 	Polo kai (Tonga) Malasou (Fiji) Karakap (PNG)	Good	Small flowering plant, has small berries that are poisonous and must not be eaten	Easy method or stir fry. Choose young leaves.
18. Pumpkin leaves	*Cucurbita moschata* 	Te baukin (Kiribati) Lip pamkin (PNG) Laui hina (Tonga)	Good	Fruit-bearing vine with soft leaves	Choose young shoots and leaves, use easy method or stir fry.
19. Sweet potato leaves	*Ipomoea batatas* 	Te kumara (Kiribati)	Good	Root-bearing vine with soft green leaves	Easy method or stir fry.

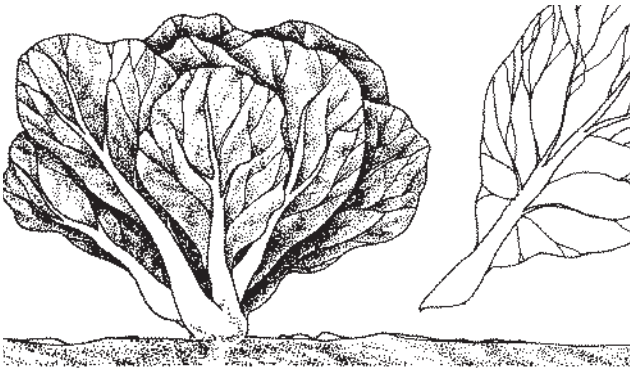
20. Taro leaves	*Colocasia esculenta, Xanthosoma* species 	Te taororo (Kiribati)	Very good	Root-bearing shrub with soft leaves	Choose soft young leaves with pale stalks, use special method. Do not eat raw. Stalks can also be cooked.
21. Watercress	*Nasturtium officinale, Roripa nasturtium – aquaticum* 	Cresson (New Caledonia) Kapisi vai (Samoa) Cress (PNG)	Good	Trailing plant that grows in water	Collect only from clean water and wash well. Easy method (only 3 minutes), stir fry, or use fresh in salads.
22. Winged bean leaves (*no photo*)	*Psophocarpus tetragonolobus*	Bin (PNG)	Very good	Climbing plant with long four-sided pods	Easy method, stir fry or use fresh in salads.

Nutrient content

Dark green leaves are good sources of many vitamins (such as vitamins A, C and K and folate) and minerals (such as iron, calcium, magnesium and potassium). The leaves are also great sources of fibre. Research has shown that the nutrients found in dark green vegetables are essential for promoting and maintaining good health and may prevent heart diseases and certain types of cancer. Adding a little oil such as virgin coconut oil or olive oil as a dressing to dark green leafy vegetables helps the body to absorb the vitamins they contain.

Edible leaves contain very little carbohydrate, and the carbohydrates that are present are packed in layers of fibre, so that they take a long time to digest. Therefore, in general, leafy vegetables have no glycemic index and thus little effect on blood glucose. They are full of essential nutrients but very low in calories, making them the ideal weight-loss food. Leafy vegetables are also treated as 'free foods' for people with diabetes, meaning that the carbohydrate does not have to be counted at all.

Green leafy vegetables are good sources of dietary iron, a mineral important in maintaining healthy blood. The type of iron present in green vegetables is in the form known as non-heme iron, which is present mostly in plant foods and is the only source of dietary iron for vegetarians (people who eat only plant foods). This type of iron is not well absorbed by



the body, although the vitamin C contained in green vegetables enhances absorption. Not having enough iron in the diet can cause iron deficiency anaemia, a condition common among women, making them feel tired and weak, and among children, affecting their growth, learning capacity and activity levels.

Because of the many health benefits associated with leafy vegetables, it is recommended that everyone eat at least one or two cups of leafy vegetables every day for good health.

Functional properties

In addition to the rich nutrient content, leafy vegetables have other functional properties, including antioxidants, polyphenols, carotenoids and flavonoids, which can protect cells from damage, lower the risk of cardiovascular disease and provide other health benefits. It is important to note that leafy vegetables have no glycemic index response because of their limited carbohydrate content.

Table 2: Nutrient content of 100 g of green leafy vegetables

Food name	Energy	CHO	Protein	Fat	Fibre	Calcium	Iron	Vit A	Vit C	Vit E	Thiamin	Riboflavin	Niacin	Zinc
	(Kcal)	(g)	(g)	(g)	(g)	(mg)	(mg)	(ug)	(mg)	(mg)	(mg)	(mg)	(mg)	mg
Amaranth, boiled	23	0.1	2.6	0.9	2.2	273	2.2	634	11	0.2	t	0.18	1.0	0.4
Cabbage, European white, boiled	30	4.6	1.6	0.3	1.3	55	0.8	1	41	0.2	0.03	0.03	0.3	0.3
Cabbage, European white, raw	24	2.8	1.3	0.1	3.8	33	0.6	3	45	0.2	0.05	0.04	0.4	0.3
Cabbage, red, boiled	27	2.5	2.0	0.3	3.5	33	0.6	2	55	0.1	0.08	0.12	0.5	0.3
Cassava leaves, boiled	47	3.3	3.9	1.1	4.6	106	1.9	477	64	1.6	0.07	0.18	1.8	1.7
Drumstick leaves, boiled	45	1.9	4.7	1.3	3.7	340	2.0	883	39	2.0	t	0.36	1.8	0.2
Edible Hibiscus leaves, boiled	29	0.3	3.4	0.8	3.5	216	1.5	731	7.0	1.0	0.10	0.30	1.3	1.2
Fern leaves, boiled	19	0.5	2.4	0.4	2.1	17	2.4	211	2.0	0.3	t	0.15	0.6	1.8
Pumpkin leaves, boiled	26	1.5	2.7	0.2	3.7	335	1.5	248	4.0	1.0	0.11	0.30	1.1	0.4
Sweet potato leaves, boiled	23	0.8	1.9	0.7	3.0	309	8.7	59	3.0	1.0	0.06	0.15	1.2	0.1
Spinach leaves, tropical, boiled	15	0.3	2.1	0.2	2.0	154	2.6	327	41.1	1.8	0.02	0.13	0.6	0.3
Cassava leaves, boiled	47	3.3	3.9	1.1	4.6	106	1.9	477	64	1.6	0.07	0.18	1.8	1.7
Taro leaves, boiled	28	0.7	3.8	0.6	2.5	214	1.7	414	20	2.2	0.06	0.13	1.0	0.3
Watercress leaves, cooked	18	t	2.0	0.2	4.4	117	2.9	245	29	0.5	0.08	0.08	0.9	0.2
Cabbage, Chinese, cooked	15	0.7	1.7	0.4	1.2	66	1.0	212	7.0	0.2	0.02	0.07	0.6	0.3

Source: Dignan et al. 2004.
Abbreviations: CHO, carbohydrate; t, trace; vit, vitamin.

Table 3: Antioxidant, polyphenol, carotenoid and flavonoid contents of 100 g of vegetables

Food name	Total Antioxidant Capacity* (mg)	Total Polyphenols (mg)	Total Carotenoids** (mg)	Total Flavonoids*** (mg)	Total Anthocyanin (mg)
Amaranth, steamed	95	79	35.3	14	nd
Cabbage, European white, steamed	16	27	0	1	nd
Cabbage, red, raw	140	140		2.0	5.0
Drumstick leaves, boiled	200	290	38	127	nd
Edible Hibiscus leaves, boiled	130	81	16.5	11	nd
Fern leaves, steamed	35	39	3.4	12	nd
Sweet potato leaves, steamed	650	270	15.1	136	nd
Spinach leaves, tropical, steamed	26	74	na	36.4	0.3
Taro leaves, boiled	100	120	19.6	3	nd
Kankong (water spinach), steamed	35	65	20.2	29	0.1
Watercress leaves, steamed	33	54	10.9	16	nd
Cabbage, Chinese, steamed	31	54	8.6	12	nd
Lettuce, raw	1	16	1.9	5	nd

Source: Lako et al. 2007
Notes: *TEAC (Trolox equivalent antioxidant capacity) method: **total of lycopene, a- and b-carotene; ***total of myricetin, fisetin, morin, quercetin, kaempferol and isorhamnetin;
Abbreviation; nd, not detected.; na, not available

Antioxidants

The functional properties of leafy vegetables differ significantly depending on the bioactive components present. The major colours associated with the functional properties of leafy vegetables are green and purple. Deeper shades of these colours provide an increased amount of antioxidants and thus greater health benefits. Carotenoids, polyphenols, flavonoids, anthocyanins and the total antioxidant capacity have been found to be present in various leafy vegetables but are particularly high in drumstick leaves and sweet potato leaves, as shown in Table 3. Sweet potato leaves have the highest levels of total antioxidant and are the richest source of flavonoids.

Storage and preservation

Fresh vegetables need to be washed thoroughly under clean running water, gently dried with a cloth or shaken dry and then wrapped in clean, fresh banana leaves and stored in a cool place. They can be kept

fresh like this for one or two days. Washed vegetables can also be packed in clean plastic bags and stored in the vegetable compartment of a refrigerator. There, they will keep fresh four for or five days.

Vegetables can be preserved by freeze-drying — steamed, then frozen — and then they are packed in clean plastic bags. Freeze-dried vegetables need to be rehydrated before use. They can be used in the preparation of instant soup.

Value addition

As stated above, vegetables can be freeze-dried and then used to prepare instant soup. Some green leafy vegetables, especially phytochemical rich ones, can be used in the preparation of vegetable juice for therapeutic purposes.

Preparation and cooking

The leaves chosen for eating should be young and soft. The crisp tops and side shoots of some plants can be used. Older leaves are sometimes tough, have a stronger flavour and need to be cooked longer. Most green leaves in the Pacific can be cooked, left to cool down and then used in a salad, e.g. *Athyrium* ferns and pumpkin shoots. Salads do not have to be prepared strictly according to recipes. Any available vegetables or other foods can be used. They taste best with a little lemon juice and oil mixed together, or salad dressing.

Some green leaves, such as watercress, basella and English cabbage can be eaten raw in salads. Raw salads are a healthy way to use green leaves since no vitamins or minerals are lost in cooking. It also saves cooking fuel. However, the leaves must first be washed thoroughly in clean water so that they do not cause sickness. Washing them is an ideal way to reduce loss of water-soluble nutrients. They should be gently dried with a cloth or shaken dry before use.

Green leaves should never be cooked longer than necessary. They should be eaten straight after cooking. Some good methods for cooking leaves are given below.

Preparation of most green leaves (Easy method)

1. Wash the leaves in clean water and remove tough stems.
2. Put a small amount of water in a cooking pot, and bring to the boil.
3. Add the leaves, cover with a lid, and cook until tender but still crisp (3–10 minutes).
4. Add coconut cream a few minutes before the leaves are cooked, or serve with coconut cream, if desired.
5. If making a soup or a sauce, use the leftover cooking water (except when cooking cassava leaves — throw away the water and use thin coconut cream instead).

Stir frying

1. Wash the leaves and then cut them up.
2. Heat a little oil or fat in a pot (1 teaspoon for every cup of leaves).
3. Add chopped garlic, ginger or other flavourings, and fry for 1 minute.
4. Stir in cut-up leaves and fry, stirring all the time, for about 5 minutes.
5. Add a few teaspoons of water if necessary, cover the pot, and steam for 2–5 minutes. Serve hot.

Note: Coconut cream can be added to the green leaves for extra flavour and food value. Cooking green leaves with coconut cream, a little oil, or other body-building foods such as meat, fish (especially fatty fish) and chicken helps the body use the vitamin A that is in the leaves. Green salads mixed with shellfish, legumes (beans and peas) and a little dressing is a very easy and nutritious way to eat green leaves. Green leaves can also be added to any kind of soup or stew to add flavour and nutritional value, or they can simply be cooked with meat or fish as a main dish for the family.

Some leafy vegetables that are bitter or that can cause the mouth or throat to itch or burn (such as taro and cassava leaves) require special preparation

1. Wash the leaves and place them in a pot with enough water to cover.
2. Bring to the boil and boil 5–10 minutes with the lid off.
3. Drain the water off and throw it away.
4. Add enough fresh water or coconut cream to cover the leaves again, add a little salt, put the lid on, and steam until tender (15–20 minutes).

Recipes

1. Vegetable soup

Number of servings: *four*

Nutrition facts
One serving size: 271 g

Amount per serving
Energy: .....919 kJ (219 kcal)
Fat: .....7.5 g
Carbohydrate: .....2.9 g
Protein: .....34.1 g
Iron: .....1.7 mg
Sodium: .....265 mg

1 bundle Chinese cabbage or other green leaves, chopped
1 cup thinly sliced meat or fish
½ teaspoon cornflour or cassava flour
1 teaspoon soy sauce
½ teaspoon sugar
1 tablespoon oil
1 onion, chopped
2 teaspoons sliced ginger
6 cups water
Salt
Pepper

1. Combine soy sauce, sugar, and cornflour, and mix well. Add meat or fish and set aside.
2. Heat oil, add ginger and onion, and fry until tender.
3. Boil water in a large pot. Add meat or fish and soy sauce mixture, ginger, and onion. Simmer for 10 minutes.
4. Add the green leaves and simmer another 10 minutes.
5. Season with salt and pepper to taste. Serve.

Note: Most green leaves are suitable for this recipe, except very soft ones such as taro leaves, gnetum and Indian mulberry.

2. Summer salad

Number of servings: *six*

Nutrition facts
One serving size: 143 g

Amount per serving
Energy: .....7415.6 kJ (99 kcal)
Fat: .....4.7 g
Carbohydrate: .....8.8 g
Protein: .....4.8 g
Iron: .....2.7 mg
Sodium: .....51 mg

1 cup shredded Chinese cabbage leaves
1 cup watercress
1 cup spinach leaves, broken in half
1 cup diced cucumber
3 spring onions, chopped
1 cup salad dressing (see recipe below)

1. Wash the leaves thoroughly and dry in a cloth.
2. Mix the leaves together with diced cucumber and chopped spring onions, and serve with dressing.

3. Tropical salad

Number of servings: four

Nutrition facts
One serving size: 114 g

Amount per serving
Energy: .....1320.8 kJ (532 kcal)
Fat: ..... 30.4 g
Carbohydrate: .....6.2 g
Protein: .....4.3 g
Iron: .....4.5 mg
Sodium: .....33 mg

2 cups chopped creeping spinach
¼ cup fresh grated coconut
2 tablespoons chopped green pepper (capsicum)
¼ cup chopped nuts (mixed)
1 cup salad dressing (see recipe below)

Mix all the ingredients together, and serve.

Note: Only green leaves that taste good raw should be used in this recipe. They include creeping spinach, Chinese cabbage, European cabbage, kangkong (water spinach) and watercress.

Salad dressing

Nutrition facts
One serving size: 1 cup

Amount per serving
Energy: ..... 3260 kJ (779 kcal)
Fat: .....87 g
Carbohydrate: .....1.8 g
Protein: .....0.3 g
Iron: .....1.1 mg
Sodium: .....8.1 mg

1/5 cup oil
1/5 cup lemon juice
Pepper, to taste
Crushed garlic, to taste

Put all ingredients in a bottle and shake well. Use immediately or store for later use.

4. Fish and green leaf curry

Number of servings: four

Nutrition facts
One serving size: 238 g

Amount per serving
Energy: ..... 1204 kJ (287 kcal)
Fat: ..... 21.8 g
Carbohydrate: .....4.8 g
Protein: ..... 15.9 g
Iron: .....4.8 mg
Sodium: ..... 181 mg

1 small onion
1 small chilli
2 cloves of garlic
½ teaspoon salt
1 bundle (230 g/8 oz) green leaves
2 tablespoons oil
1 cup water or coconut cream, if desired
½ large or 1 small tin of fish
Curry powder to taste

1. Finely chop the onion. Grind the garlic and chilli with salt. Wash and cut up the green leaves.
2. Put the oil in a pot, heat, then add the onion, garlic and chilli, and fry.
3. Add the curry powder and fry. Stir in the green leaves and fry for one minute.
4. Add the fish and stir well. For a wet curry, add water or coconut cream.
5. Cook slowly until the green leaves are soft. Serve.

Note: The best leaves for this recipe are amaranth (tropical spinach), drumstick, English cabbage, Chinese cabbage, kangkong (water spinach) and pumpkin tips.

5. Green leaves with white sauce

Number of servings: four

Nutrition facts
One serving size: 203 g

Amount per serving
Energy: .....866 kJ (206 kcal)
Fat: ..... 13.2 g
Carbohydrate: ..... 11.3 g
Protein: .....9.8 g
Iron: .....2.3 mg
Sodium: .....78.6 m

2 tablespoons butter or oil
2 tablespoons flour
¼ teaspoon salt
1 pinch pepper
1 cup milk
2 cups cooked green leaves

1. Heat the butter or oil in a pot. Remove from the heat and stir in the flour, salt, and pepper.
2. Return to the heat and stir until the mixture bubbles. Remove from the heat and gradually stir in the milk.
3. Return to the heat and stir until mixture boils. Simmer for a few minutes, then add the cooked green leaves. Serve.

Variations: Add a little chopped onion to the butter and fry for a few minutes before adding the flour. Or, add some grated cheese to the hot sauce before adding the cooked green leaves.

6. Green leaf laplap

Number of servings: four to six

Nutrition facts
One serving size: 233 g

Amount per serving
Energy: ..... 1150 kJ (274 kcal)
Fat: ..... 8 g
Carbohydrate: ..... 38.6 g
Protein: ..... 11.5 g
Iron: .....1.2 mg
Sodium: .....79 mg

8 large edible hibiscus leaves
4 cups grated raw cassava
1 cup cooked fish or lean meat
1 medium onion, finely chopped
½ cup coconut cream
8 small banana leaves

1. Soften eight small banana leaves over a fire. Lay a layer of hibiscus leaves on the banana leaves.
2. Add a layer of cassava and then a layer of meat or fish. Top with a final layer of hibiscus leaves.
3. Using a clean finger, poke holes from the top layer down to the bottom layer. Pour coconut cream through the holes.
4. Sprinkle the chopped onion over the mixture and fold the banana leaves over to make a parcel.
5. Steam or bake for 1½–2 hours. Serve.

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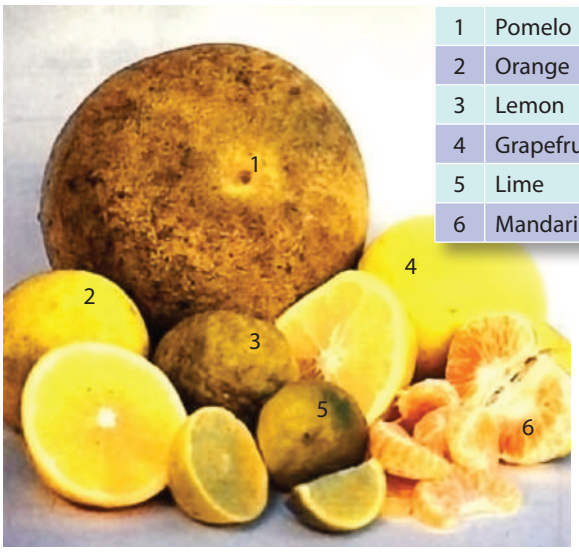
Citrus fruit

Leaflet No. 9 - Revised 2012

Introduction

Citrus fruit or *Citrus*, to give the scientific name, grow on some Pacific islands. Depending on the variety, the fruit may have either a sweet taste, or a sour, acidic taste. Sweet varieties are usually eaten alone or juiced, while the sour, acidic varieties are used in food preparations as flavour enhancers or as other functional ingredients.

Different parts of citrus plants — the flesh, the juice, the peel and the leaves — are used in food preparation. Thus these plants are a valuable food source in the Pacific region.



Key

1	Pomelo
2	Orange
3	Lemon
4	Grapefruit
5	Lime
6	Mandarin

Major types of citrus and cultivations

Many different varieties are available. The major types include oranges, mandarins, grapefruit, pomelos, kumquats, lemons and limes. Most plants are highly seasonal in the Pacific, normally fruiting in hot dry weather.

Not all varieties of citrus trees grow on all Pacific islands because of dry weather conditions and salt water intrusion, especially on atolls. Citrus trees need plenty of water in order to grow well. Water is especially important during the fruiting season when the roots can grow as deep as 1.2 metres (4 feet) underground searching for water. The water must be salt free, which is why citrus trees do not grow well on most atolls.

Design and layout: Muriel Borderie - SPC Publications Section

Citrus fruit

Citrus trees are planted from the seeds of ripe fruit. The seeds need to be washed and dried, then planted 1 cm (½ inch) deep in a partly shady place. When the plants are 20 cm (8 inches) high, they are ready to be transplanted. Only healthy plants should be transplanted. Plant them in a sunny, spacious area, far enough apart to allow room for them to grow.

The size of citrus fruit varies from small limes to large pomelos. The fruit should be picked when ripe.

Nutrient content

Citrus fruit is a protective, health-giving food, containing essential vitamins the body needs to stay healthy (Table 1). The fruit is an excellent source of vitamin C, which keeps body tissues strong, helps the body to use iron, and helps chemical actions in the body. There is a lot of vitamin C in the peel of citrus fruits as well as in the flesh. Citrus fruit is also a fair source of vitamin A and calcium. Vitamin A is needed for proper growth, healthy eyes and protection from disease, while calcium helps develop and maintain the health of bones and teeth.

Citrus fruits, especially the sweeter varieties, contain some carbohydrate, mostly fructose (a type of sugar present in fruit which accounts for the characteristic sweet taste). The sour varieties like lemon and lime have very little carbohydrate.

Compared to imported counterparts — which often look more attractive because of the use of chemical sprays and waxes to make the fruits shinier and brighter — locally grown citrus fruits are cheaper and have better food value.

Canned fruit has more calories than freshly picked fruit, because of the added sugar for syrup preservation. Local and fresh is best.

Functional properties

Citrus also contains functional properties, including antioxidants, phenols, flavonoids and carotenoids, as well as moderate levels of glycemic responses.

Antioxidants

The functional properties of citrus can be estimated by looking at the range and intensity of colours of the flesh. The major colours associated with the functional properties of citrus are yellow and orange. Eating foods rich in these colours helps protect against diabetes, heart disease and cancer. Yellow and orange colours present in food are associated with carotenoids; pink may be associated with polyphenols, especially flavonoids. Deeper shades of these colours provide an increased amount of antioxidants and thus greater health benefits. Carotenoids, polyphenols, flavonoids and the total antioxidant capacity have been found to be present in local oranges and mandarins as shown in Table 2.

Table 1: Nutrient content of 100 g of citrus compared with 100 g of apple

Food name	Energy	CHO	Protein	Fat	Fibre	Calcium	Iron	Vit A	Vit C	Vit E	Thiamin	Riboflavin	Niacin	Zinc
	(Kcal)	(g)	(g)	(g)	(g)	(mg)	(mg)	(ug)	(mg)	(mg)	(mg)	(mg)	(mg)	mg
Grapefruit	26	4.8	0.9	0.2	0.6	21	0.2	2	36	0.2	0.03	0.03	0.2	0.1
Lemon	16	1.8	0.6	0.2	2.5	20	0.3	1	48	0.2	0.04	0.02	0.2	0.1
Lime	18	1.8	0.8	0.2	2.9	22	0.3	3	47	0.2	0.03	0.02	0.2	0.1
Mandarin	41	8.0	0.9	0.2	2.0	26	0.3	7	47	0.2	0.06	0.03	0.3	0.1
Orange	40	7.9	1.0	0.1	2.0	29	0.4	11	52	0.2	0.11	0.03	0.2	0.2
Orange, local	46	10.0	0.6	0.3	0.7	21	0.3	11	30	0.2	0.09	0.06	0.8	0.2
Mandarin, canned in syrup	57	13.5	0.4	0.1	0.6	7	0.4	6	11	0.1	0.02	0.02	0.1	0.1
Apple	54	12.3	0.3	0.1	2.0	5	0.2	1	5	0.4	0.02	0.01	0.1	0.1

Source: Dignan et al. 2004.
Abbreviations: CHO, carbohydrate; vit, vitamin.

Table 2: Antioxidant, polyphenol and carotenoid contents of 100 g of citrus

Food name	Total Antioxidant Capacity* (mg)	Total Polyphenols (mg)	Total Carotenoids** (mg)	Total Flavonoids*** (mg)	Total Anthocyanin (mg)
Orange, local *(Batiri)*	38	98	nd	nd	nd
Mandarin	26	28	0.03	5	nd

Source: Lako et al. 2007
Notes: *TEAC (Trolox equivalent antioxidant capacity) method; **total of lycopene, a- and b-carotene; ***total of myricetin, fisetin, morin, quercetin, kaempferol and isorhamnetin.
Abbreviation: nd, not detected.

In addition, vitamin C is also a strong antioxidant, which helps remove free radicals from different parts of the body cells. Vitamin C being a water soluble vitamin, removes free radicals from the hydrophilic (water) components of the cells.

Glycemic responses

Some fruits also contain carbohydrate and thus have glycemic responses. The glycemic index (GI) is a tool that ranks food which contains carbohydrates according to the rate at which they break down in our body. Carbohydrates that break down quickly during digestion have a high glycemic index (GI 70 and above). Their blood sugar response is fast and high. Carbohydrates that break down slowly, releasing glucose gradually into the blood stream, have a low glycemic index (GI 55 and less). Consumption of low GI food is associated with a lower risk for developing diabetes and coronary heart disease than consumtion of high GI foods. Raw, ripe oranges have very low levels of carbohydrates, and thus a low GI of 44, while orange juice has a GI of 46.

Storage and preservation

The best way to keep citrus fresh is to leave the fruit on the tree. If citrus is picked for storing, care must be taken. The peel should not be scratched or bruised, and the fruit should be picked when dry. Cut the fruit from the tree and make sure the stems are cut close to the fruit. Store in a cool place and check often for any bad pieces of fruit.

Citrus juices can be preserved by **freezing** in ice-cube trays. When frozen, remove the cubes from the trays and store in plastic bags or airtight containers in the freezer.

Citrus peel can be grated and dried in the sun or in a solar dryer and stored it in an airtight container.

An important point to remember is that citrus fruits are often treated with pesticides and you may get the residue in peels when you squeeze or grate the fruit. **Always wash the fruit well before using,** or buy organic fruits.

Value addition

Citrus fruit can be made into various value-added products including jam, jelly, juice, nectar, and can even be canned in syrup, etc. The dried peel or frozen juice is used for flavouring in cooked dishes, including baked products.

As well as the food value, citrus fruits have other uses. Limonene (especially d-limonene) is a compound found in the oil of citrus peel and it is used in the production of cleaning products and additives to add an orange aroma or flavouring to a product.

Rust stains on cloth can be removed by rubbing lemon or lime juice into the stained area. Before it dries, rinse the area well with water.

Preparation and cooking

Fruit
Sweet citrus fruit varieties may be eaten straight from the tree, squeezed to make juice or used in cooking and baking. Freshly picked citrus fruit has high levels of vitamin C. In order to eat the flesh of the citrus, the peel and the white skin (pith) are removed, and the fruit is separated into sections. For larger citrus fruits, remove the thin covering that holds the sections together.

Juice
Citrus juice has many uses and makes delicious drinks. The juice is obtained by cutting the fruit in half and pressing it gently using a squeezer, or squeeze by hand. Lemon and lime juice in particular has many uses that are both food and non-food related. It can be used as flavouring for fish, green leaves, soups and curries. This juice is also a good substitute for vinegar because of its acidity. In a low salt diet, lemon or lime flavouring can hide the fact that there is little salt. Also, the juice can be used in baking when vanilla flavouring is not available.

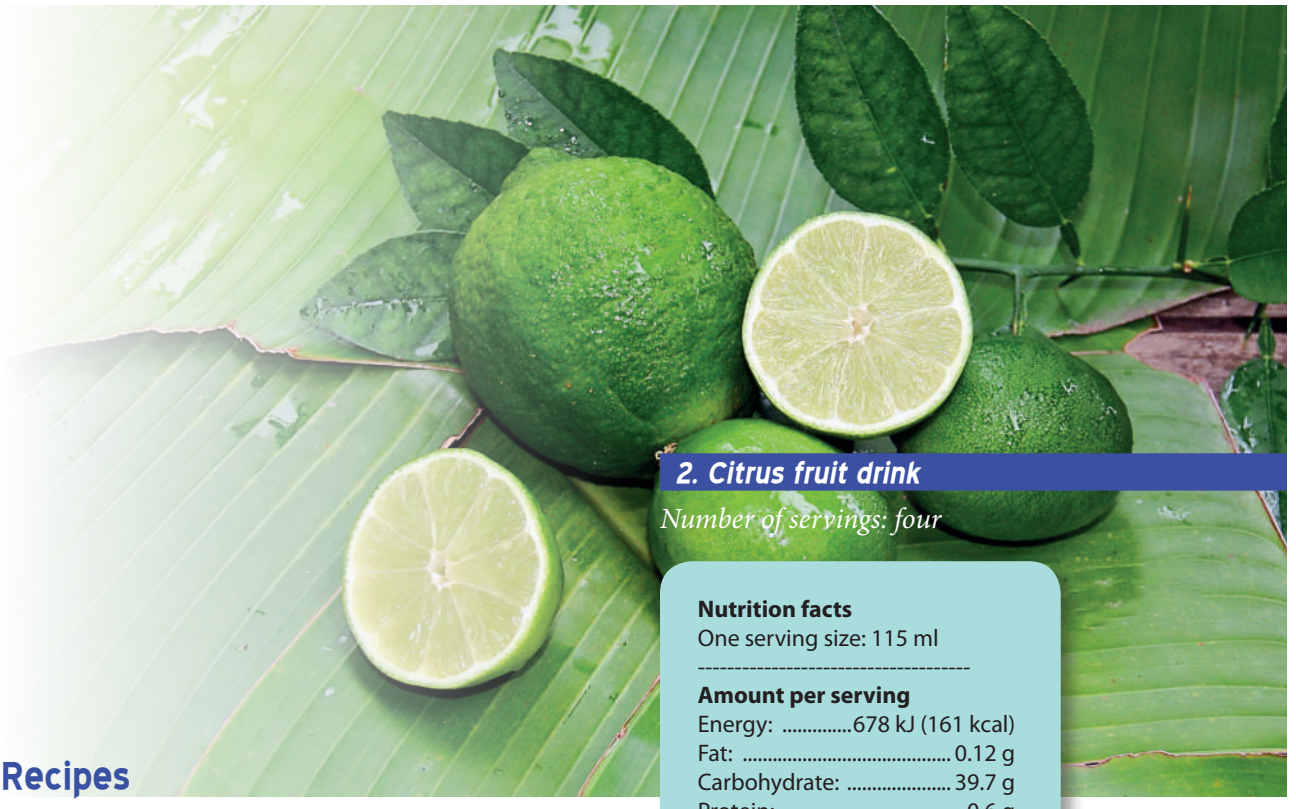
Lemon or lime juice helps to stop fresh fruit and vegetables from turning brown. For this reason it can be used when freezing fruit. The prepared fruit can be dipped in lemon or lime juice and then frozen. When the fruit is unfrozen, it will not go brown too quickly.

Home-made lemonade can be easily prepared and saves money that is often spent on expensive cordials and soft drinks.

Because of its high vitamin C content, citrus juice is good for babies. The stronger flavoured citrus juices should have water added to them so that babies will like the taste.

Peel
The grated peel of citrus fruit can be used as flavouring. It can be added to baked foods, soups, meats, sauces and desserts. To prepare citrus peel, use a small grater. Only grate off the coloured part of the peel. The white part (pith) underneath can have a bitter, unpleasant taste. **Never use the peel of imported oranges and lemons.** These have been sprayed with chemicals and wax, which are harmful to your health.

Leaves
Citrus leaves are also useful. They contain minerals that the body needs. If added to warm milk, crushed citrus leaves can make a nutritious drink for children. They may be used to make a citrus leaf tea or added to pot-brewed regular tea for extra flavour. Lemon leaves are especially good for this. Only the older, dark-green leaves should be used. Tear them into boiling water and leave to brew for several minutes. Citrus leaf tea is good to drink in the evening because it contains no caffeine, which is found in tea and coffee. Caffeine can keep you from sleeping well.



Recipes

Note: When the citrus fruit specified in the recipes is out of season, other citrus fruit can be used instead.

1. Pacific ambrosia

Number of servings: six

Nutrition facts
One serving size: 304 g

Amount per serving
Energy: ..... 1412 kJ (336 kcal)
Fat: ..... 22 g
Carbohydrate: ..... 29.4 g
Protein: ..... 4.1 g
Iron: ..... 2.0 mg
Sodium: ..... 14.6 mg

9 oranges
1 medium pineapple
1 cup grated coconut
½ cup thick coconut cream

1. Peel, seed and section the oranges.
2. Peel, core and cut the pineapple into pieces.
3. Mix the oranges, pineapple and grated coconut and leave in a cool place for a few hours.
4. Add the coconut cream, mix and serve.

2. Citrus fruit drink

Number of servings: four

Nutrition facts
One serving size: 115 ml

Amount per serving
Energy: ..... 678 kJ (161 kcal)
Fat: ..... 0.12 g
Carbohydrate: ..... 39.7 g
Protein: ..... 0.6 g
Iron: ..... 0.65 mg
Sodium: ..... 10.1 mg

2 tablespoons lemon juice
2 tablespoons lime juice
¼ cup orange juice
4 cups of water
Sugar to taste (optional)

1. Mix juices with the water.
2. Add a little sugar to taste if needed.
3. Serve cool with a slice of orange.

To make lemonade:

1. Wash and peel 1 lemon. Boil the peel in 2 cups of water to which 1 tablespoon of sugar has been added. Boil for 5 minutes.
2. Cool and remove the peel.
3. Add the juice and pulp of the lemon. Taste and add a little more sugar if needed.
4. Serve cool.

To make lemon leaf tea:

1. Crush 10 lemon leaves into 6 cups of boiling water. Boil for 5 minutes. Cool for a few minutes.
2. Remove the leaves and add 1½ cups milk, if desired, to the warm lemon tea and serve.

3. Lemon soup

Number of servings: six

Nutrition facts
One serving size: 61 g

Amount per serving
Energy: ..... 332 kJ (79 kcal)
Fat: ..... 2.6 g
Carbohydrate: ..... 10.1 g
Protein: ..... 4 g
Iron: ..... 0.7 mg
Sodium: ..... 23.4 mg

3 cups chicken stock
¾ cup cooked rice
2 eggs
3 tablespoons lemon juice

1. Boil chicken stock. Add rice and remove from heat.
2. Beat eggs and lemon juice together in a large bowl until just mixed.
3. Add 2 tablespoons of the hot stock to the egg mixture. Stir well.
4. Pour the egg mixture into the hot stock very slowly, stirring all the time.
5. Reheat gently for 1 or 2 minutes.
6. Serve at once.

4. Citrus dressing

Makes 1 cup

Nutrition facts
Serving size: ½ cup

Amount per serving:
Energy: ..... 2322 kJ (554 kcal)
Fat: 62.5g
Carbohydrate: ..... 0.5 g
Protein: ..... 0.1 g
Iron: ..... 0.03 mg
Sodium: ..... 0.6 mg

⅓ cup citrus juice
½ cup virgin coconut oil (optional)
½ teaspoon grated citrus peel

1. Put the citrus juice, peel and virgin coconut oil in a jar and shake to mix well.
2. Pour citrus dressing over the salad or steamed vegetables.
3. Serve.

This is a variation of the French vinaigrette dressing. Garlic, salt, pepper and a little mustard powder can be added for seasoning.

5. Lemon leaf punch

Number of servings: 16 cups

Nutrition facts
One serving size: 1 cup

Amount per serving
Energy: .....897 kJ (214 kcal)
Fat: ..... 0.17 g
Carbohydrate: ..... 52.5 g
Protein: ..... 0.73 g
Iron: ..... 0.87 mg
Sodium: ..... 13.3 mg

20 lemon leaves
8 cups water
Peel of one pineapple
2 teaspoons tea leaves
4 tablespoons grated fresh ginger
1 cup sugar
8 cups fresh fruit juice (e.g. citrus, pawpaw, pineapple, mango)

1. Put all the ingredients except the fruit juice into a pot and bring to the boil. Boil for 5 minutes.
2. Strain and cool.
3. Add fruit juice and taste. Add extra lemon juice or a little sugar if desired.
4. Serve cold with slices of lemon.

6. Citrus baked fish in coconut cream

Number of servings: four

Nutrition facts
One serving size: 193 g

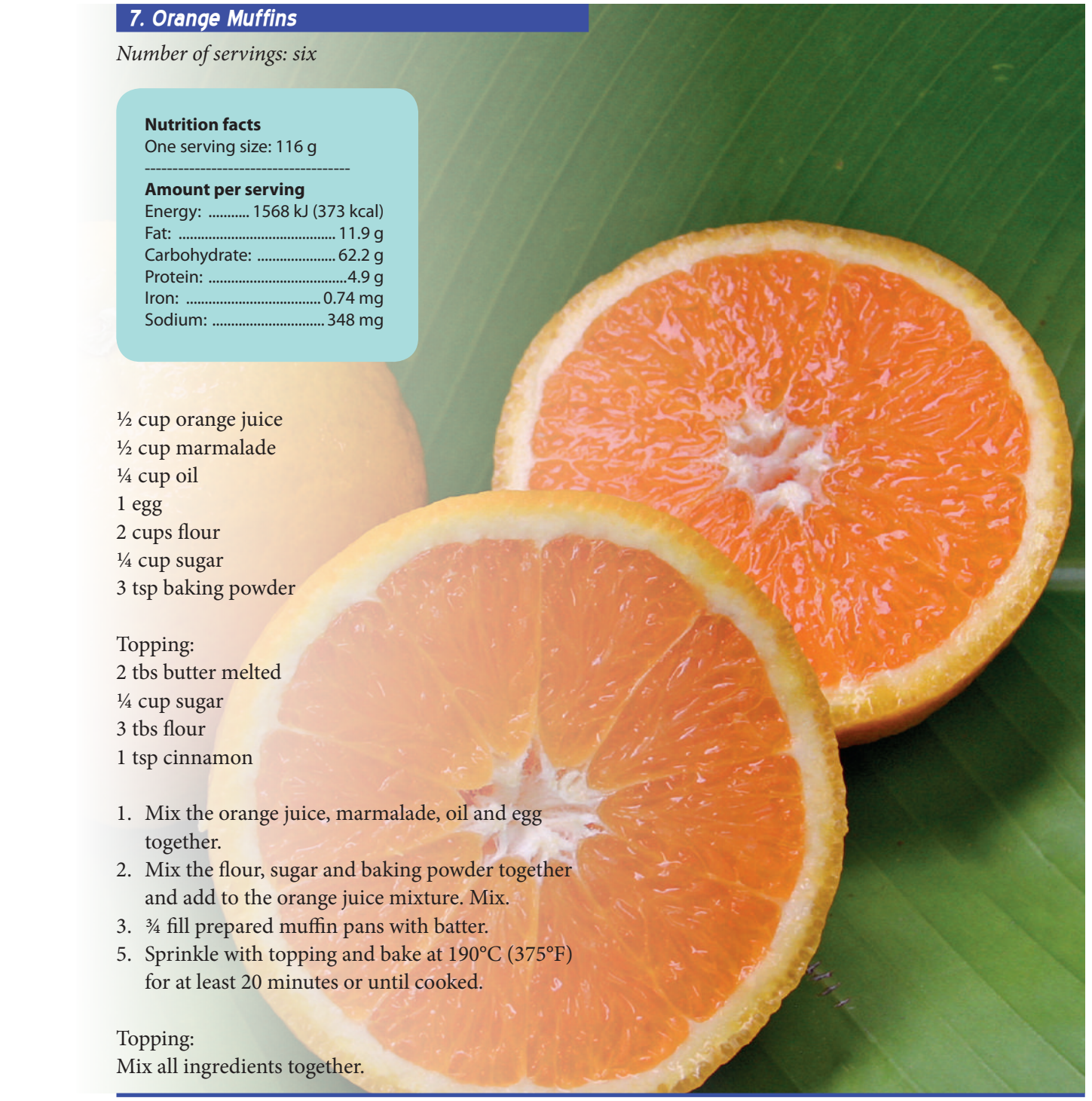
Amount per serving
Energy: ..... 1134 kJ (270 kcal)
Fat: ..... 15.2 g
Carbohydrate: .....4.5 g
Protein: ..... 28.7 g
Iron: .....1.3 mg
Sodium: ..... 141 mg

1 medium whole fresh fish
½ tablespoon ground black pepper (optional)
1 lemon
1 mandarin or orange
½ cup coconut cream
Salt to taste

1. Wash and clean the fish and place on a softened banana leaf.
2. Thinly slice the lemon and mandarin or orange.
3. Arrange alternate slices of lemon and mandarin or orange on the fish from head to tail.
4. Sprinkle with black pepper and pour the coconut cream around the fish.
5. Wrap the fish well in about three layers of softened banana leaves and bake in a moderate oven for 40 minutes or in an earth oven for about 1 hour.
6. Serve hot with cooked root crops, breadfruit or banana.

7. Orange Muffins

Number of servings: six



Nutrition facts
One serving size: 116 g

Amount per serving
Energy: ..... 1568 kJ (373 kcal)
Fat: ..... 11.9 g
Carbohydrate: ..... 62.2 g
Protein: ..... 4.9 g
Iron: ..... 0.74 mg
Sodium: ..... 348 mg

½ cup orange juice
½ cup marmalade
¼ cup oil
1 egg
2 cups flour
¼ cup sugar
3 tsp baking powder

Topping:
2 tbs butter melted
¼ cup sugar
3 tbs flour
1 tsp cinnamon

1. Mix the orange juice, marmalade, oil and egg together.
2. Mix the flour, sugar and baking powder together and add to the orange juice mixture. Mix.
3. ¾ fill prepared muffin pans with batter.
5. Sprinkle with topping and bake at 190°C (375°F) for at least 20 minutes or until cooked.

Topping:
Mix all ingredients together.

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Guava

Leaflet No. 10 - Revised 2012

Introduction

Guava, or *Psidium guajava* to give the scientific name, is also known as *quwawa, kuwawa, kuwava, kuawa* and *kuava.* It is usually regarded as a superfruit because of its high levels of nutrients. Guava is great as a snack and makes excellent juice, jelly and other dishes.

Introduced to the Pacific region from Central America, it is now an important crop in some Pacific Island countries. Many different varieties of guava are grown, and the trees grow wild in the bush on many Pacific islands. A seasonal tree, it usually bears fruit during the hot, rainy season.

Interestingly, on some islands in the Pacific, it is against the law to plant new guava trees, because wild trees easily spread to grazing land and farmland, making it difficult to clear for planting crops.

The guava tree is a good fruit tree for home gardens. If it is well cared for and its branches are trimmed occasionally, a home-garden guava tree will produce more good-quality fruit than a wild tree. Before planting guava trees in a home garden, it is best to talk to a local agricultural officer to find out the best variety for local conditions.

Design and layout: Muriel Borderie - SPC Publications Section

Table 1: Nutrient content of 100 g of ripe guava compared with 100 g of orange and apple

Food name	Energy	CHO	Protein	Fat	Fibre	Calcium	Iron	Vit A	Vit C	Vit E	Thiamin	Riboflavin	Niacin	Zinc
	(Kcal)	(g)	(g)	(g)	(g)	(mg)	(mg)	(ug)	(mg)	(mg)	(mg)	(mg)	(mg)	mg
Guava, raw, ripe (Hawaiian)	31	3.5	0.7	0.5	5.4	10	0.2	36	240	1.2	0.03	0.04	1.0	0.1
Orange	40	7.9	1.0	0.1	2.0	29	0.4	11	52	0.2	0.11	0.03	0.2	0.2
Orange, local	46	10.0	0.6	0.3	0.7	21	0.3	11	30	0.2	0.09	0.06	0.8	0.2
Apple	54	12.3	0.3	0.1	2.0	5	0.2	1	5	0.4	0.02	0.01	0.1	0.1

Source: Dignan et al. 2004
Abbreviations: CHO, carbohydrate; vit, vitamin.

Two kinds of guava

The common guava, with the scientific name *Psidium guajava,* is part of the large myrtle family, which includes eucalyptus. The guava tree is small, with copper-coloured bark. It has leaves with many veins, and white or cream-coloured flowers.

The fruit of the common guava varies in size and shape, but it is usually 4–8 cm (1½–3 inches) long. As the guava ripens, the outside skin changes colour from green to light green or yellow. The flesh of the fruit may be white, yellow, pink or red, and there are many small seeds in it.

The other kind of guava is the Cattley guava, also called strawberry or cherry guava. It is quite different from the common guava and has the scientific name *Psidium cattleianum*. The leaves are smaller, shinier, and darker green than those of the common guava. The fruit is also small, rarely growing to more than 4 cm (1½ inches) long. It is usually red or reddish purple with several large, nut-like seeds inside.

Nutrient content

Guavas are one of the richest sources of vitamin C and dietary fibre (especially in the form of pectin) found in the Pacific region. They contain almost five times as much vitamin C as oranges. Vitamin C keeps body tissues strong, helps the body to use iron and aids chemical reactions in the body. Vitamin C also helps cuts and wounds to heal and protects the body against boils. The fibre prevents constipation and it also tends to lower blood cholesterol levels and help prevent heart diseases.

Guavas also contain good amounts of vitamin A and have adequate levels of dietary minerals, potassium and magnesium (Table 1).

Guavas are more nutritious than many imported fruits such as apples, as shown in Table 1.

Functional properties

Apart from its nutritional content, guava fruit also contains functional properties, including antioxidants, polyphenols and carotenoids in the form of ß-carotene, which can protect cells from damage, lower the risk of cardiovascular disease and provide other health benefits. The seeds contain omega-3 and six polyunsaturated fatty acids. The flesh has a moderate glycemic index response of 20–60, depending on the degree of maturity and ripeness.

Storage and preservation

Most of the guava produced around the world is consumed fresh. It is also a favourite fruit for jelly because of its fine flavour and because it is high pectin, the chemical substance that helps jelly to set. The juice from half-ripe guavas may be used with hibiscus flowers or low-pectin fruits to make jelly. Guavas may also be used for butters, jams, marmalades and preserves.

Note: It is important to follow all the steps for bottling juice or other products such as jelly and jams exactly as outlined in the notes below. If bottles (or jars) are not washed thoroughly and sterilised well, the juice or jelly will go bad, and may even cause food poisoning. It is also dangerous to one's health to use chipped or cracked bottles or jars. If you do not

have a good water supply and find it hard to boil the bottles or jars for at least 20 minutes, do not attempt to preserve juice, jam or jelly in this way. You should make only enough to drink or eat immediately.

If you **can** sterilise your bottles well, then this is a good method of preserving fruits such as guava, and you can enjoy their flavour and goodness when they are not in season.

Value addition

Guava can be processed into puree, paste, canned slices in syrup, nectar or guava jelly, or made into clear guava powder for a mixed fruit juice blend. There is also a potential to use instant guava powder in formulated drinks, baby foods and confectionary products.

A special ingredient

The leaves of guava are rich in flavonoids, in particular, quercetin. Much of guava's therapeutic activity can be attributed to these flavonoids. They have demonstrated antibacterial activity. Quercetin is thought to contribute to the anti-diarrhoea effect of guava; it is able to relax intestinal smooth muscle and inhibit bowel contractions. Other flavonoids and triterpenes in guava leaves, show antispasmodic activity. Guavas also have antioxidant properties, which are attributed to the polyphenols, carotenoids and vitamin C found in the leaves.

Guava is also rich in tannins, phenols, triterpenes, essential oils, saponins, carotenoids, lectins, vitamins, fibre and fatty acids.

In the Pacific, young guava leaves are useful as a cure for diarrhoea.

Preparation and cooking

Both common and Cattley guava of good quality can be eaten as fresh fruit. Fresh guavas taste good when eaten plain or when mixed with other fruit in a salad. The flavour may be sweet or sour, but it will always have a special guava taste.

Both the outside skin and the inside flesh of the guava may be eaten. It is a good idea to eat the skin (fresh or cooked) as well as the flesh, because the

skin has more Vitamin C than the flesh. If the guava skin is to be eaten, only large juicy guavas should be chosen. The small dry guavas that often grow during a dry season are good only for making juice. Sometimes, when the fruit is too ripe, the skin can become soft, allowing insects such as fruit flies to destroy the guava. Always use fresh guavas while still firm and throw away those infected with larvae (worms) from the flies.

Both common and Cattley varieties can be used to make guava juice, which can give the whole family the Vitamin C they need every day, and can also save the money that is often spent on less nutritious soft drinks. For the best juice, good-quality guavas should be used. The juice should be prepared as soon as possible after picking. The mild, less sour guavas make good juice for babies. Mothers should add a little boiled water to the guava juice before giving it to their young children. Sugar is not needed.

By bottling guava juice, you can enjoy its good flavour and vitamins all year round. If properly prepared and stored, guava juice should keep for one year, although the longer it is stored, the more Vitamin C it loses. Putting the juice in dark bottles or storing it in a dark place will keep the Vitamin C in the juice longer. If you have a refrigerator or freezer the juice can be stored for a long time.

Recipes

1. Fresh guava juice

Nutrition facts
One serving size: 200 g

Amount per serving
Energy: ..... 263 kJ (61 kcal)
Fat: ..... 1 g
Carbohydrate: ..... 7 g
Protein: ..... 1.4 g
Iron: ..... 0.4 mg
Sodium: ..... 8 mg

10 firm, ripe guavas
2 litres water

1. Wash the guavas, cut off the ends, and slice.
2. Place the slices in a large pot with 2 litres of water to just cover them. Boil until the fruit is very soft (15–20 minutes).
3. Pour the fruit into a bag made of cheese cloth or muslin or two thicknesses of a clean flour or sugar sack. For clear juice, do not squeeze the bag.
4. Serve as a drink immediately, or use for making jelly, or bottle for future use. (The leftover pulp may be pressed through a strainer and used for making guava sauce.)

2. Bottled guava juice

Fresh juice obtained from step 3 above

1. Reheat the fresh juice on the stove.
2. As soon as the juice starts to boil, pour it into hot sterilised bottles and seal. (See notes on bottling.)

Notes on bottling:

1. Choose bottles or jars that are not cracked or broken in any way.
2. Wash the bottles thoroughly in soapy water, then rinse.
3. Line a large pot with a towel. (This prevents the bottles from breaking.)
4. Place the bottles on the towel lining in the pot and cover with water. The bottles may stand up right or lie on their sides, but they should be full of water on the inside end covered with water on the outside.
5. Bring the water to the boil, and boil for at least 20 minutes. This will kill any bacteria which could spoil the juice.
6. Remove the bottles, drain and pour in the juice immediately. Wipe the rims with a clean cloth.
7. Seal the bottles with tightly fitting lids or corks that have been boiled for 5 minutes, or tie waxed or greaseproof paper tightly around the rim of the bottle, using string or a rubber band.

3. Guava delicious

Number of servings: six

Nutrition facts
One serving size: 267 g

Amount per serving
Energy: .....681 kJ (162 kcal)
Fat: .....3.7 g
Carbohydrate: ..... 24.4 g
Protein: .....3.2 g
Iron: .....1.3 mg
Sodium:..... 22.7 mg

8 large ripe guavas
3 large ripe bananas
1 cup grated coconut
Sugar (optional)

1. Choose the best-quality ripe guavas. Wash and peel them, then cut them into halves.
2. Scoop out the pulp and press it through a sieve. Add a little sugar if desired and mix thoroughly.
3. Peel the bananas.
4. Cut the guava skins and bananas into thin slices.
5. Place half the guava-skin slices in a dish and cover with half the banana slices.
6. Pour half the guava pulp over the fruit in the dish, then sprinkle with ½ cup grated coconut.
7. Repeat layers: guava slices, banana slices, guava pulp. End with a layer of grated coconut.
8. Cover the dish and chill for 2–3 hours, if possible, before serving.
9. Serve as a dessert.

4. Guava drink

Number of servings: two cups

Nutrition facts
One serving size: 200 g

Amount per serving
Energy: ..... 263 kJ (61 kcal)
Fat: ..... 1 g
Carbohydrate: ..... 7 g
Protein: .....1.4 g
Iron: .....0.4 mg
Sodium: ..... 8 mg

4 ripe medium guavas
2 cups water
2 teaspoons sugar (optional)

1. Wash the guavas and and cut the ends off.
2. Grate into bowl, add water and sugar to taste.
3. Serve in tall glasses with a slice of lemon.

5. Guava sauce

Number of servings: four

Nutrition facts
One serving size: 183 g

Amount per serving
Energy: ..... 397 kJ (95 kcal)
Fat: ..... 0.7 g
Carbohydrate: ..... 17.7 g
Protein: ..... 1.9 g
Iron: ..... 1.3 mg
Sodium: ..... 17 mg

2 cups guava pulp
1 medium onion
1 small chilli, finely chopped, or pinch of ground pepper
1 clove garlic, finely sliced
⅓ cup vinegar
1 level teaspoon ground allspice (optional)
1½ teaspoons ground cinnamon (optional)
¼ teaspoon ground cloves
¼ cup sugar
Salt to taste

1. Prepare pulp by pressing the guava slices through a coarse sieve, or use pulp left over from making guava juice.
2. Cook the onion in water until soft. Add all the other ingredients and mix well.
3. Bring the mixture to the boil, then simmer for 30–40 minutes.
4. Pour the mixture into hot, sterilised jars and seal. (See notes on bottling.)
5. Serve as a sauce with meat or other foods.

6. Guava milkshake

Number of servings: one glass

Nutrition facts
One serving size: 416 g

Amount per serving
Energy: ..... 1780 kJ (424 kcal)
Fat: ..... 23 g
Carbohydrate: ..... 32.9 g
Protein: ..... 21 g
Iron: ..... 0.83 mg
Sodium: ..... 293 mg

1 cup milk (full-cream or skim milk)
1½ tablespoons guava puree

1. Mix milk and guava puree in a glass jar and cover with a tightly fitting lid.
2. Chill, if possible, then shake mixture thoroughly, and serve.

Note: A guava milkshake is an excellent drink for schoolchildren.

7. Guava dumplings

Number of servings: six

Nutrition facts
One serving size: 206 g

Amount per serving
Energy: ..... 1076 kJ (256 kcal)
Fat: ..... 7.6 g
Carbohydrate: ..... 37.9 g
Protein: ..... 5.4 g
Iron: ..... 0.72 mg
Sodium: ..... 364 mg

For filling:
9 ripe guavas
1 tablespoon lemon juice
1 teaspoon cinnamon (optional)
1–2 tablespoons butter or margarine

For dough:
2 cups plain flour
3 teaspoons baking powder
1 tablespoon sugar
¼ teaspoon salt
¼ cup butter or margarine
¼–⅓ cup water

1. Wash the guavas. Cut off the ends and bad parts.
2. Cut the guavas into halves, scoop out the flesh, and set the skins aside.
3. Press the guava flesh through a sieve and add the lemon juice. Mix well, then set aside.
4. Sift the flour with the baking powder, sugar and salt.
5. Rub in half the butter or margarine until well mixed. Then rub in the other half until the dough forms into pieces about the size of small pearls.

6. Slowly add enough water and mix well to make a firm dough.
7. Divide the dough into six parts of the same size. Roll each into a circle about 13 cm (5 inches) across and ½ cm (¼ inch) thick.
8. Place 3 half-skins of guava, one inside the other, in the centre of each piece of dough. Fill with guava mixture and sprinkle with cinnamon.
9. Lift the edges of dough, moisten and press together at top.
10. Place in a greased muffin tin or baking dish. Bake in a hot oven 220°C (425°F) for 10 minutes. Lower the heat, if possible (to 190°C or 375°F) and bake for 5 more minutes.
11. Serve hot, with milk or guava puree if desired.

8. Guava jelly

Number of servings: five

Nutrition facts
One serving size: 180 g

Amount per serving
Energy: ..... 1100 kJ (262 kcal)
Fat: ..... 0,54 g
Carbohydrate: ..... 61.9 g
Protein: ..... 0.88 g
Iron: ..... 0.94 mg
Sodium: ..... 17 mg

2½ cups guava juice
2 cups sugar
½ cup lemon juice

1. Prepare guava juice following the method given above, using slightly under-ripe guavas.
2. Pour 2½ cups of guava juice into a pot, and bring to the boil.
3. Add the lemon juice and sugar, stir until well mixed, then cook at a full rolling boil.
4. After a few minutes of boiling, test to see if the jelly is ready by putting a teaspoonful in a saucer, letting it cool, and running a clean finger through it. If the line made by the finger does not close up, the jelly is ready.
5. Pour the jelly into hot sterilised jars and seal. (See notes on bottling.)

9. Guava purée

Fully ripe guavas.

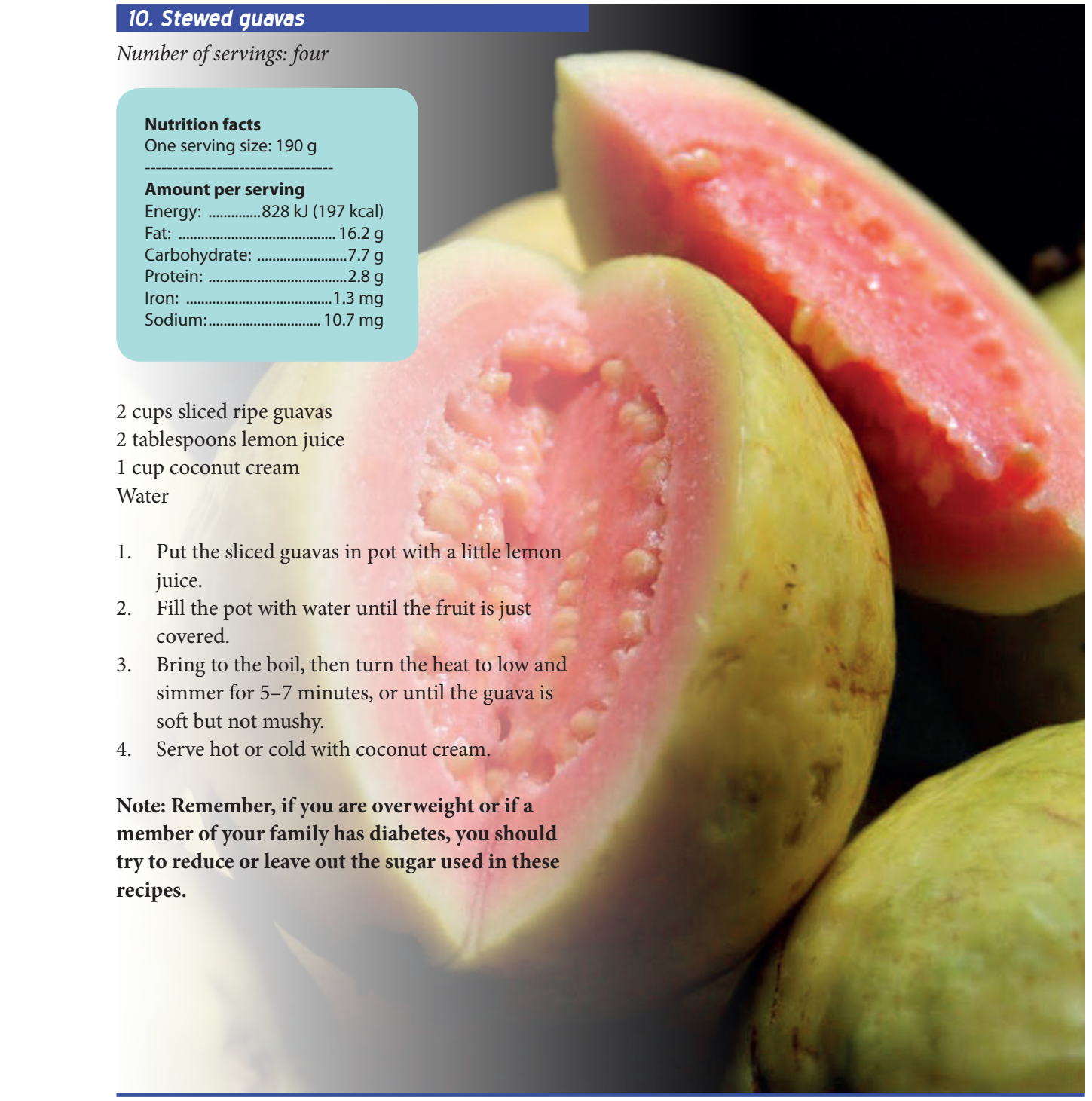
Nutrition facts
One serving size: 200 g

Amount per serving
Energy: ..... 263 kJ (61 kcal)
Fat: ..... 1 g
Carbohydrate: ..... 7 g
Protein: ..... 1.4 g
Iron: ..... 0.4 mg
Sodium: ..... 8 mg

1. Wash the guavas and cut off the ends and any bad parts.
2. Cut the guavas into halves and scoop out the flesh.
3. Press the guava flesh through a sieve.
4. Use the puree immediately in milkshakes, or serve as a sauce on ice-cream or other desserts.
5. The puree can be stored in a clean container in a refrigerator for 3–4 days.

10. Stewed guavas

Number of servings: four



Nutrition facts
One serving size: 190 g

Amount per serving
Energy: .....828 kJ (197 kcal)
Fat: ..... 16.2 g
Carbohydrate: .....7.7 g
Protein: .....2.8 g
Iron: .....1.3 mg
Sodium:..... 10.7 mg

2 cups sliced ripe guavas
2 tablespoons lemon juice
1 cup coconut cream
Water

1. Put the sliced guavas in pot with a little lemon juice.
2. Fill the pot with water until the fruit is just covered.
3. Bring to the boil, then turn the heat to low and simmer for 5–7 minutes, or until the guava is soft but not mushy.
4. Serve hot or cold with coconut cream.

Note: Remember, if you are overweight or if a member of your family has diabetes, you should try to reduce or leave out the sugar used in these recipes.

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Mango

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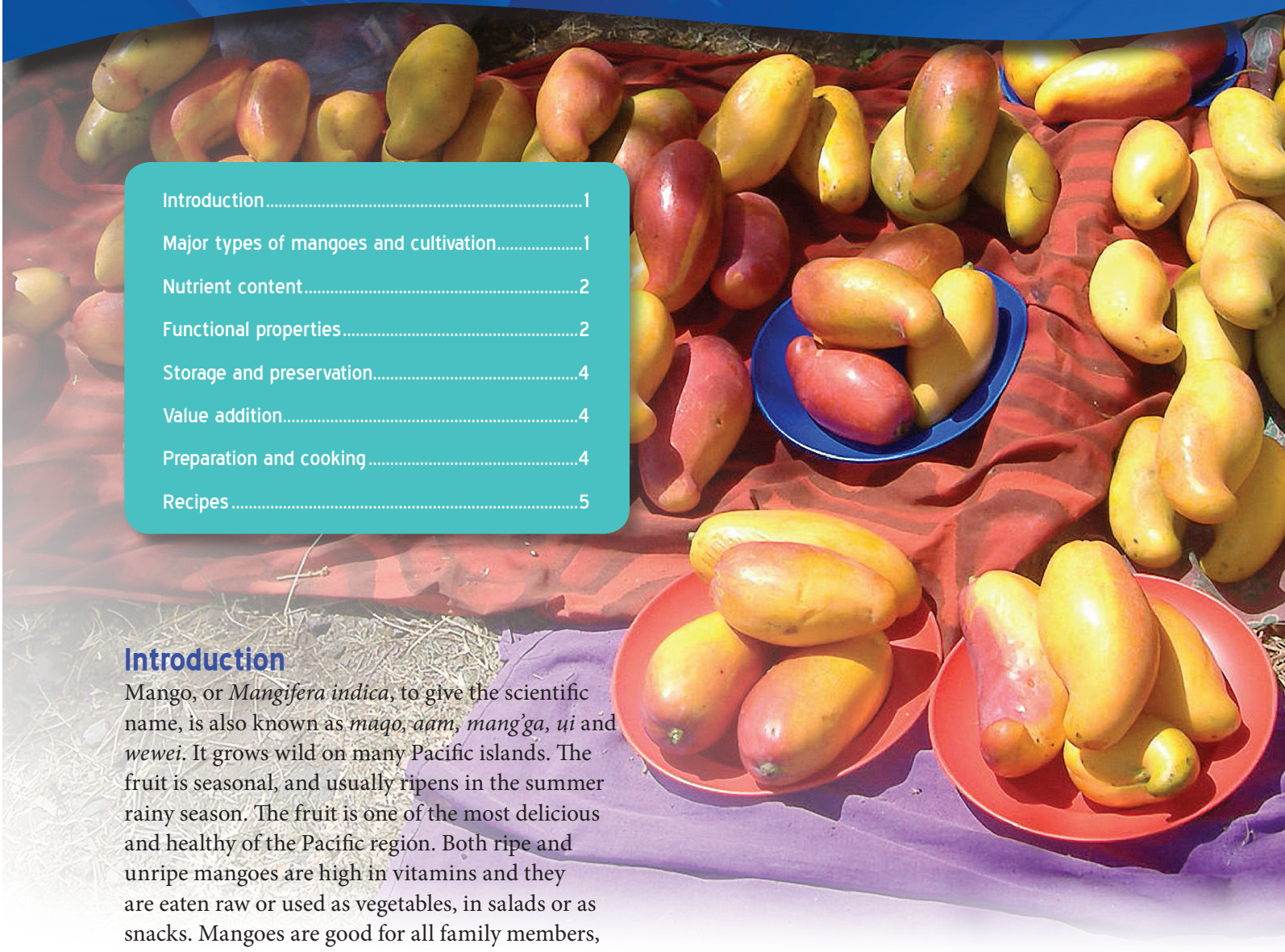


Introduction

Mango, or *Mangifera indica*, to give the scientific name, is also known as *maqo, aam, mang'ga, ui* and *wewei*. It grows wild on many Pacific islands. The fruit is seasonal, and usually ripens in the summer rainy season. The fruit is one of the most delicious and healthy of the Pacific region. Both ripe and unripe mangoes are high in vitamins and they are eaten raw or used as vegetables, in salads or as snacks. Mangoes are good for all family members, but smooth, ripe mangoes that are soft, less fibrous, and full of vitamins, are good for babies over six months of age, either mashed and strained or juiced.

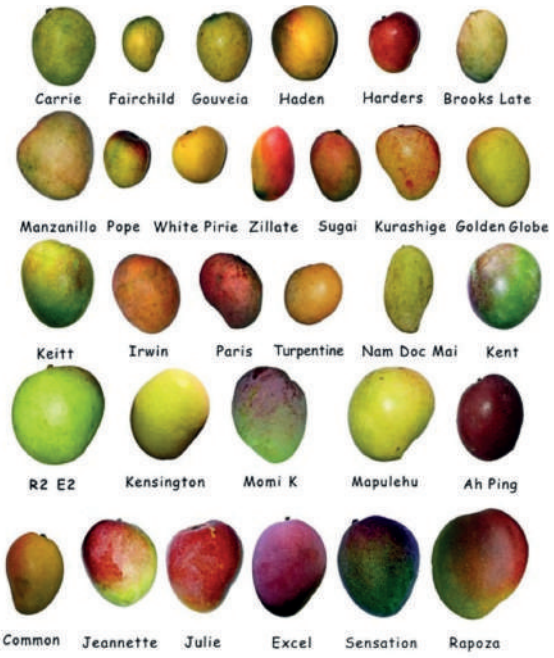
Major types of mangoes and cultivation

Many different varieties of mango are found in the Pacific, and these differ in size, shape, colour and weight. Various varieties are shown in Figure 1, although some belong to the cashew family. Mango trees can grow to a height of 15 to 18 metres (50 to 60 feet) and are thickly covered with narrow, dark green leaves.

Fruits vary in length from 3 cm to over 15 cm and in weight from under 50 g to over 1 kg. Some varieties are almost round, others are long and narrow, but most have a slight ridge on one side. The skin may be yellow or orange with a red flush, or else greenish yellow through to a rich golden yellow or a mixture of colours, depending on the variety. The fruit is also highly aromatic, depending on the chemicals present in each variety. At its best, the scent can have a pleasant resinous quality and its worst it smells strongly of kerosene, which it actually contains.

Design and layout: Muriel Borderie - SPC Publications Section

Figure 1: Major mango varieties



Source: www.rawandfit.com/different-mango-types

Mangoes are best grown from grafts or budded plants. This ensures a true variety and a healthy plant. For more information, contact your local agriculture officer. Mango trees start to bear fruit after four to six years. The fruit usually ripens during the hot, rainy season. It is important to note that mango trees sometimes bear heavy crops every alternate year and bear fewer fruit after 40 years of bearing.

The many varieties of mango taste and feel different. While the best mangoes are smooth and juicy, some are more fibrous and some are less juicy than others.

It is difficult to make rules about which type of mango to use, because different varieties grow on different islands. Local experience and experiments can help you decide which mangoes are best for which recipes.

Nutrient content

Ripe mangoes are an excellent source of vitamin A and C. Vitamin A is needed for proper growth, healthy eyes and protection from diseases. Green mangoes contain smaller amounts of vitamin A than ripe mangoes. Vitamin C keeps the body tissues strong, helps the body to use iron, and aids in chemical actions in the body. The amount of vitamin C varies among the different kinds of mango, but green fruit usually has more vitamin C than ripe fruit.

Mangoes are more nutritious than many imported fruits such as apples, as shown in Table 1. Therefore, choose to eat mangoes when in season.

Functional properties

Apart from the nutritional content described above, mangos contain functional properties, including antioxidants, phenols, flavonoids and carotenoids, as well moderate levels of glycemic responses.

Antioxidants

The functional properties of mango can be seen in the range and intensity of colours of the flesh. The major colours associated with the functional properties of mango are yellow, orange and reddish-orange. Eating foods rich in these colours helps protect against diabetes, heart disease and cancer.

Table 1: Nutrient content of 100 g of ripe mango compared to 100 g of apple

Food name	Energy	CHO	Protein	Fat	Fibre	Calcium	Iron	Vit A	Vit C	Vit E	Thiamin	Riboflavin	Niacin	Zinc
	(Kcal)	(g)	(g)	(g)	(g)	(mg)	(mg)	(ug)	(mg)	(mg)	(mg)	(mg)	(mg)	mg
Mango, raw, ripe (Australian)	58	12.6	1.0	0.2	1.5	7	0.5	198	28	1.0	0.02	0.04	0.6	0.3
Mango, raw, ripe (PNG)	68	15.1	0.7	0.2	2.1	10	0.3	133	41	1.1	0.06	0.06	0.9	t
Apple	54	12.3	0.3	0.1	2.0	5	0.2	1	5	0.4	0.02	0.01	0.1	0.1

Source: Dignan et al. 2004
Abbreviations: CHO, carbohydrate; vit, vitamin; t, trace

Table 2: Antioxidant, polyphenol and carotenoid contents of 100 g of ripe mango

Food name	Total Antioxidant Capacity* (mg)	Total Polyphenols (mg)	Total Carotenoids** (mg)	Total Flavonoids*** (mg)
Mango, ripe	34	48	2.4[a]	5

Source: Lako et al. 2007.
Notes: *TEAC (Trolox equivalent antioxidant capacity) method; **total of lycopene, a-and b-carotene; ***total of myricetin, fisetin, morin, quercetin, kaempferol and isorhamnetin; aß-carotene (Dignan et al. 2004).

Yellow and orange colours present in food are associated with carotenoids, and reddish orange may be associated with polyphenols, especially flavonoids. Deeper shades of these colours provide an increased amount of antioxidants and thus greater health benefits.

Carotenoids, polyphenols, flavonoids and the total antioxidant capacity have been found to be present in certain mango varieties, as shown in Table 2. Ripe mango has high levels of total polyphenols and is rich in ß-carotene and lutein. ß-carotene is a type of carotenoid, converted in the body to Vitamin A, which helps protect eye health.

Besides being nutrients, vitamins C and E are also strong antioxidants, which help remove free radicals from different parts of the body cells; vitamin C removes free radicals from the hydrophilic (water) components of the cells, while vitamin E removes free radicals from the lipophilic (fat) components of cells.

Glycemic responses

Some fruits also contain carbohydrate and therefore have glycemic responses. The glycemic index (GI) is a tool that ranks food which contains carbohydrates according to the rate at which carbohydrates break down in our body. Carbohydrates that break down quickly during digestion have a high glycemic index (GI 70 or more). Their blood sugar response is fast and high. Carbohydrates that break down slowly, releasing glucose gradually into the bloodstream, have a low glycemic index (GI 55 or less). Consumption of low GI food is associated with a lower risk of developing diabetes and coronary heart disease than consumption of high GI foods. Ripe mango has a low glycemic index of 55, which has good health benefits.

Mango

Storage and preservation

Mangoes are best when picked ripe from the tree. They are also picked when not fully ripe and left to ripen in a cool dry place. Once mangoes are fully ripe they must be eaten straight away or kept in a refrigerator.

Mangoes are seasonal, so they are often preserved. This is done by drying them under the sun or in the solar drier. Dried mangoes are excellent snacks for children, much better for them than lollies and sweets.

Dried mangoes

Use green or half-ripe mangoes, masala, curry powder or other spices (optional) and follow these instructions step by step.

1. Peel the mangoes and cut them into thin slices (any left-over pieces may be used in the mango chicken sauce).
2. Sprinkle the mango slices with spices if desired.
3. Spread the slices on a clean tray or banana leaves. Leave in the sun to dry for 2 or 3 days or in the solar drier for 1 or 2 days. Turn the slices over 2 or 3 times each day so that they dry evenly. If flies are a problem, cover the slices with netting when open to the sun.
4. Pack in clean, tightly sealed jars, tins or plastic bags. Dried mango will keep for several months when packed in such a way.

Value addition

Firm ripe mangoes can also be canned in syrup, pickled, dried,and used in jam and jellies.

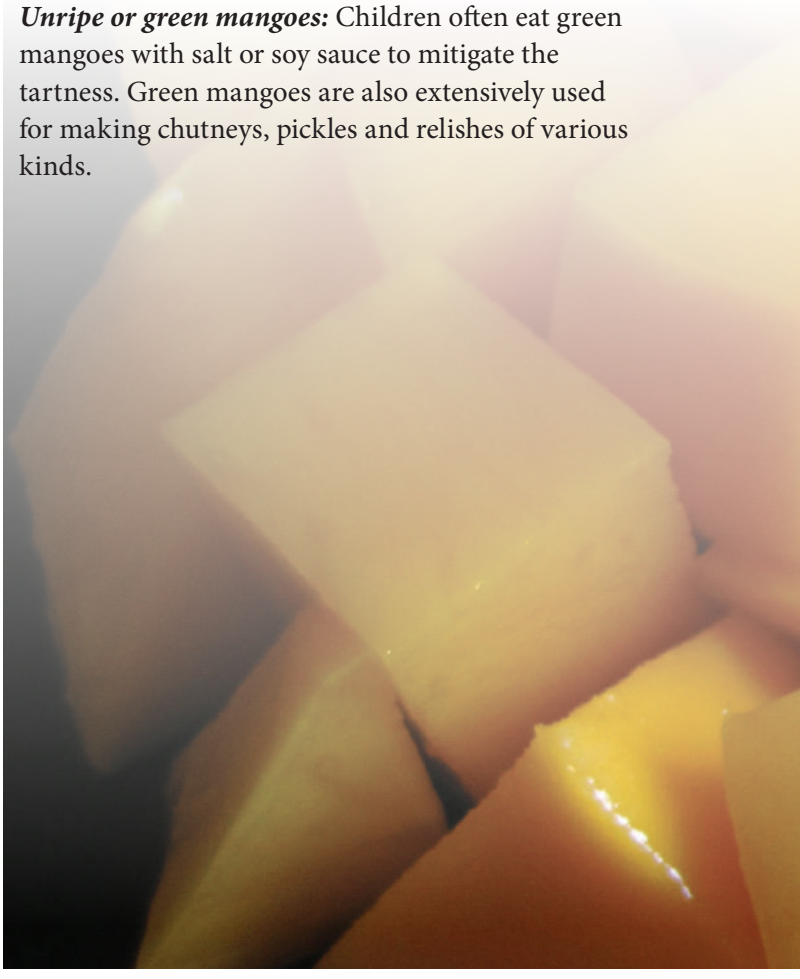
Preparation and cooking

Ripe mangoes: Eating ripe mangoes fresh is the most nutritious way to use them. They are good for breakfast, for dessert, salads, or as a snack. Ripe ones may be flavoured with lemon or lime juice or mixed with other fruits.

Over-ripe mangoes make excellent juice. This is done by pressing over-ripe or ripe mango flesh through a clean wire strainer or a clean cloth, and adding some cooled boiled water with lime or lemon. Do not add sugar.

Firm ripe mangoes may be cooked and used in almost any recipe requiring a sweet fruit. Because different kinds of fruit contain different amounts of water, the amount of water or other liquid required during preparation and cooking may have to be changed.

Unripe or green mangoes: Children often eat green mangoes with salt or soy sauce to mitigate the tartness. Green mangoes are also extensively used for making chutneys, pickles and relishes of various kinds.



Recipes

1. Mango and pawpaw relish

Number of servings: four

Nutrition facts
One serving size: 239 g

Amount per serving
Energy: .....472 kJ (112 kcal)
Fat: ..... 0.75 g
Carbohydrate: .....23 g
Protein: .....1.8 g
Iron: .....1.1 mg
Sodium: .....15 mg

2 cups ripe but firm mangoes (washed and chopped)
2 cups half-ripe pawpaw (peeled, chopped)
1 fresh red chilli (finely chopped)
1 cinnamon stick

1. Combine all the ingredients in a pan.
2. Bring to the boil. Reduce the heat and simmer for 20 minutes until the mixture thickens.
3. Cool and store in a clear container.
4. Serve with meat or fish and cooked root crops.

Note: This relish will keep for about one week, or for about a month in a refrigerator.

2. Mango drink (Otai, Tonga)

Number of servings: six

Nutrition facts
One serving size: 109 g

Amount per serving
Energy: ..... 998 kJ (23 kcal)
Fat: .....20 g
Carbohydrate: .....10 g
Protein: .....2.8 g
Iron: .....1.3 mg
Sodium: .....11 mg

1 coconut
2 cups mashed ripe mango
3 cups water

1. Crack the coconut, letting the coconut water pour into a bowl.
2. Grate the coconut into the same bowl.
3. Mix 1 cup of the grated coconut with the mashed mango.
4. Add 3 cups of water to the leftover coconut, mix thoroughly, then squeeze out the cream.
5. Strain the coconut cream into the mango mixture and stir.
6. Serve cold.

3. Mango nut bread

Number of servings: six

Nutrition facts
One serving size: 156 g

Amount per serving
Energy: ..... 2271 kJ (541 kcal)
Fat: .....29 g
Carbohydrate: .....56 g
Protein: .....14 g
Iron: .....1.9 mg
Sodium: ..... 467 mg

½ cup margarine
¾ cup sugar
2 eggs
2 cups self-raising flour
½ cup chopped nuts
¼ teaspoon salt
⅔ cup mango puree
1 tablespoon lime juice

1. Cream the margarine and sugar.
2. Add the eggs.
3. Stir in the dry ingredients.
4. Mix the mango puree and lime juice and add to the egg mixture.
5. Bake in a loaf pan at 175°C (350°F) for 1 hour.
6. Mango bread is better if it is cut 2 or 3 days after baking.

4. Green mango salad

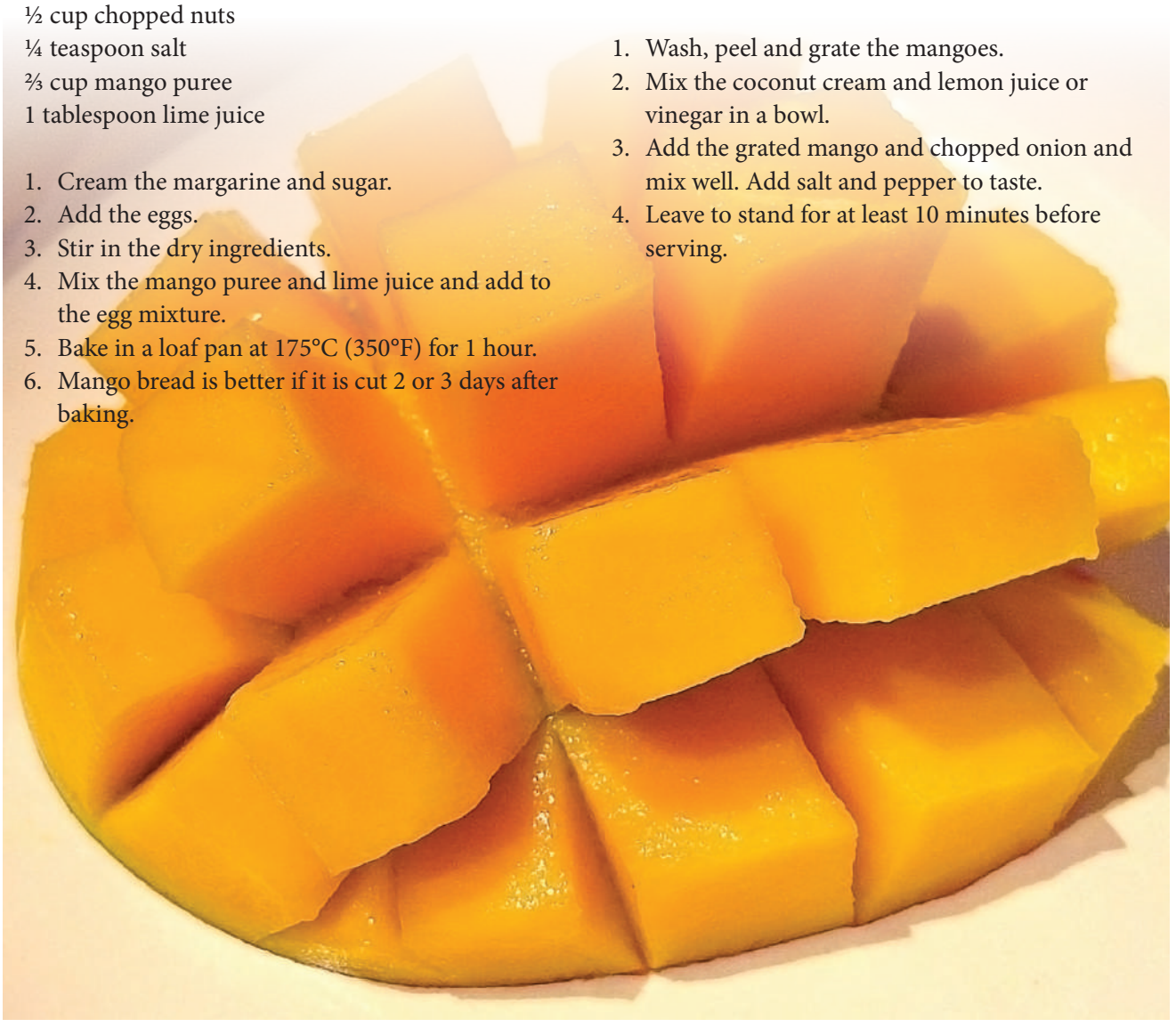
Number of servings: four

Nutrition facts
One serving size: 299 g

Amount per serving
Energy: ..... 1394 kJ (332 kcal)
Fat: .....20 g
Carbohydrate: .....33 g
Protein: .....5.3 g
Iron: .....1.9 mg
Sodium:..... 18.7 mg

4 small green mangoes
1 ¼ cups coconut cream
2 tablespoons lemon juice or vinegar
1 small onion, chopped
Salt and pepper to taste

1. Wash, peel and grate the mangoes.
2. Mix the coconut cream and lemon juice or vinegar in a bowl.
3. Add the grated mango and chopped onion and mix well. Add salt and pepper to taste.
4. Leave to stand for at least 10 minutes before serving.



5. Mango chicken

Number of servings: six

Nutrition facts
One serving size: 438 g

Amount per serving
Energy: ..... 2799 kJ (666 kcal)
Fat: .....41 g
Carbohydrate: ..... 16.5 g
Protein: ..... 56.6 g
Iron: .....4 mg
Sodium: ..... 198 mg

1 large chicken
2 large onions, finely sliced
2 large tomatoes, sliced
2 carrots, sliced
1 cup chopped dark green leaves (optional)
2 tablespoons cooking oil
3 cups mango sauce
½ cup water

Mango Sauce:
4 cups ripe or half-ripe mango slices
½ cup of water
½ cup coconut cream

1. Prepare the mango sauce first by cooking the mango slices in water until soft.
2. Add the coconut cream and cook for 5 minutes longer. Set aside.
3. Cut the chicken into serving portions and remove the skin.
4. Lightly fry the sliced onions in oil for 2 minutes. Add the chicken pieces and cook for a further 5–10 minutes.
5. Add the tomatoes, carrots, mango sauce and water and cook for 45 minutes, stirring occasionally.
6. Add the chopped green leaves and cook for a further 5–10 minutes.
7. Serve hot with cooked taro, sweet potato, breadfruit or brown rice.

Note: The sauce can be used with other meat and can also be eaten as a dessert.

6. Sweet and sour vegetables

Number of servings: six

Nutrition facts
One serving size: 380 g

Amount per serving
Energy: ..... 1577 kJ (375 kcal)
Fat: .....23 g
Carbohydrate: .....32 g
Protein: .....6.9 g
Iron: .....2.7 mg
Sodium: .....64 mg

6 cups of chopped mixed vegetables (any vegetables can be used, e.g. pumpkin, green beans, carrots, green pepper, tomatoes)
3 tablespoons cooking oil
4 large onions, chopped
4 half-ripe mangoes
1 cup water
1½ cups thin coconut cream
Salt and pepper to taste

1. Fry the onions in the oil for 5 minutes.
2. Add the chopped vegetables, water and coconut cream.
3. Lightly fry for about 5 minutes or until the vegetables are half cooked. (*Note*: do not overcook the vegetables.)
4. Wash and peel the mangoes. Cut them into slices.
5. Add the mango slices to the vegetables and cook for a further 2 minutes. Add salt and pepper to taste.
6. Serve hot as a vegetable with fish or meat.

7. Supreme fruit salad

Number of servings: six

Nutrition facts
One serving size: 318 g

Amount per serving
Energy: ..... 2061 kJ (491 kcal)
Fat: .....37 g
Carbohydrate: .....33 g
Protein: .....6.3 g
Iron: .....2.6 mg
Sodium: .....18 mg

2 cups coconut cream
1 tablespoon sugar
1 tablespoon lemon juice
2 cups ripe mangoes
2 ripe bananas
1 cup chopped fresh pineapple
1 cup chopped avocado
1 cup seedless grapes
6 lettuce leaves
Grated coconut

1. Make a dressing by mixing the coconut cream, sugar and lemon juice.
2. Immediately before serving, chop up the fruit and stir in the dressing. Mix well.
3. Serve on crisp lettuce leaves.
4. Sprinkle with freshly grated coconut.

8. Fresh fruit salad

Number of servings: six

Nutrition facts
One serving size: 260 g

Amount per serving
Energy: ..... 1043 kJ (248 kcal)
Fat: .....14 g
Carbohydrate: .....26 g
Protein: .....3.8 g
Iron: .....1.5 mg
Sodium: ..... 14.7 mg

2 ripe mangoes
1 small ripe pawpaw
1 small ripe pineapple
1 ¼ cups fresh lime or lemon juice
2 ripe bananas
Any other available fruit, e.g. guava, oranges, passionfruit
1 cup thick coconut cream

1. Wash and prepare all the fruit: peel and remove the seeds from the pawpaw, remove the skin from the pineapple, peel the bananas and oranges, etc.
2. Chop all the fruit into small pieces and mix together in a bowl. Add the lemon or lime juice and mix well.
3. Serve with coconut cream immediately or after chilling.

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Pandanus

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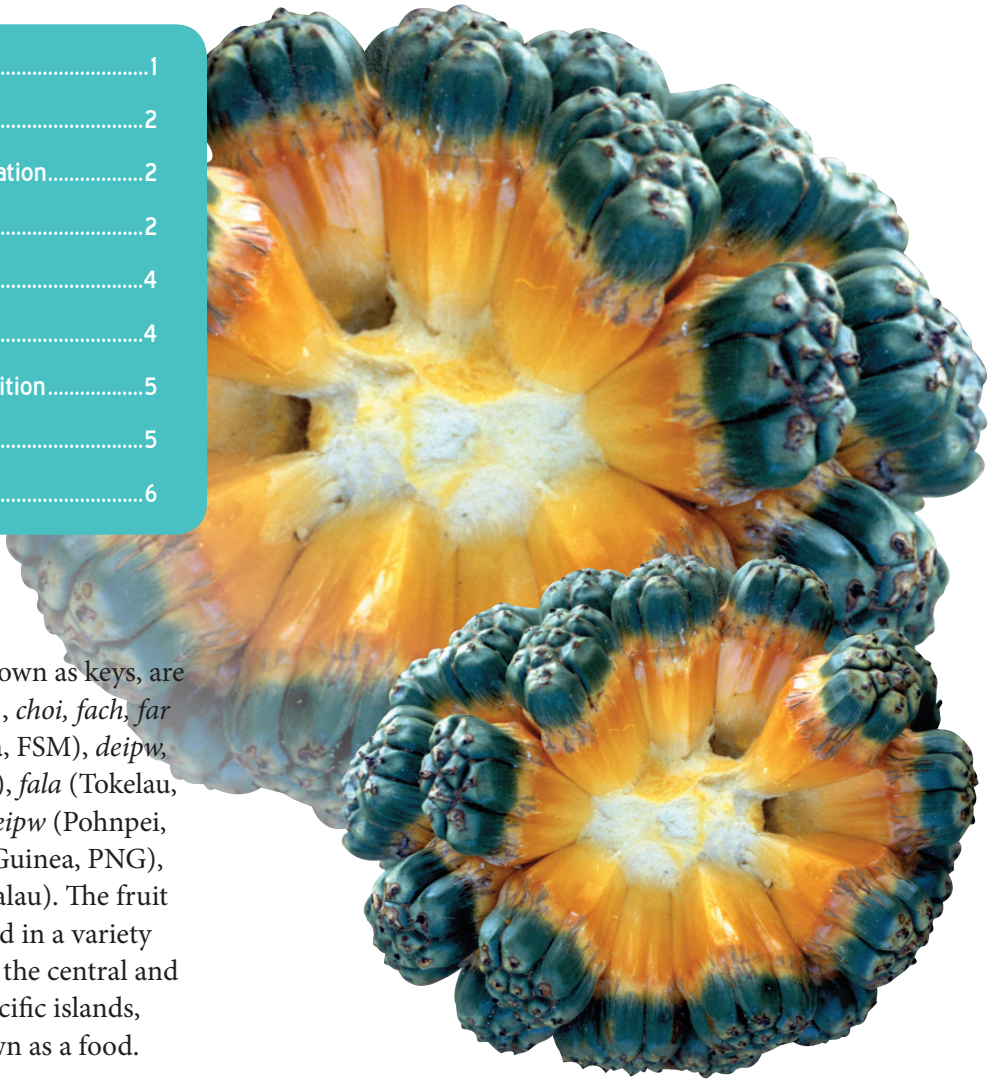

Introduction

Edible pandanus fruits and nuts, known as keys, are referred to as *bõb* (Marshall Islands), *choi, fach, far* (Yap, Federated States of Micronesia, FSM), *deipw, fach, far* (Chuuk, FSM), *epo* (Nauru), *fala* (Tokelau, Tuvalu), *te kaina* (Kiribati), *kipar, deipw* (Pohnpei, FSM), *marita, karuka* (Papua New Guinea, PNG), *mweng* (Kosrae, FSM) and *ongor* (Palau). The fruit and nuts are popular food items used in a variety of interesting ways in many parts of the central and northern Pacific. On many other Pacific islands, however, pandanus is not well-known as a food.

The pandanus plant plays an important role in everyday life in the Pacific. Apart from fruit as a food, the leaves are used for weaving and thatching and the wood for construction. The bark and flowers are used to scent body oils and the roots are used in making medicines, paintbrushes and rope.

This leaflet focuses on the *Pandanus tectorius* species shown in Figure 1a. Other species, however, such as *Pandanus conoideus* and *Pandanus jiulianettii* (Figure 1b and 1c), which are grown in Papua New Guinea, are also used for food.

Design and layout: Muriel Borderie - SPC Publications Section

Figure 1: Common varieties of Pandanus

a) *Pandanus tectorius*

b) *Pandanus conoideus*

c. *Pandanus jiulianettii*

Sources: www.naturalhistoryproductions.com.au; www. blacksirius07.wordpress.com

Cultural significance

In Kiribati, pandanus is called the 'tree of life'; it provides food, shelter and medicine. In Marshall Islands, it is called the 'divine tree', because of its important role in everyday life. In the Federated States of Micronesia, Tuvalu, Tokelau and Papua New Guinea, pandanus is an important staple food. *Pandanus conoideus* (*marita* or red pandanus) is used to make a ketchup-type sauce for flavouring food, and *P. jiulianettii* (*karuka* or highland pandanus) is eaten raw or the nuts are cooked. In the past, dried pandanus pulp was an important food for seafarers on outrigger canoes, enabling them to survive long journeys.

Major types of pandanus and cultivation

There are many varieties of pandanus, but only some have edible fruits and seeds. The plants have a distinctive shape and the near-coastal species, *Pandanus tectorius,* is found on most Pacific islands. The bunches of fruit have many sections called 'keys', which weigh from around 60 to 200 grams each. (The botanical term for these keys is phalanges, which means 'finger bones'.) People often eat the keys raw, but the juicy pulp can also be extracted and cooked or preserved. The seeds of some varieties are also eaten. A number of pandanus varieties are conserved in genebank collections.

Pandanus grows well in coastal areas and, once established, can withstand drought, strong winds and salt spray. It also grows and fruits at higher altitudes.

Pandanus can grow from seed, but cultivars with edible fruits (with low levels of itchy oxalates) must be grown from cuttings. The trees fruit about two to four years after a cutting is planted.

The plant structure varies greatly, depending on the species. Some trees grow to a height of about four metres and others to twelve metres. The leaves differ in width, length, longevity and softness. The bunches of pandanus fruit may be rounded or long and weigh between one and fifteen kilograms; the outer parts of the keys may be flat or have sharp edges. They also vary in colour, with deeper-coloured varieties having a higher nutritional value.

Different varieties also have different fruiting seasons, usually lasting just a few months, with lighter fruiting at other times of the year. Depending on their characteristics, pandanus varieties are prepared in different ways for eating. Hard keys are cooked before being eaten, while soft keys are eaten raw. There are also differences in texture and sweetness and the amount of mouth and throat irritation they cause. Those that cause itching must be cooked.

Nutrient content

Pandanus fruit is a valuable source of many nutrients, particularly for people living on atolls where only a limited number of food crops can grow due to poor soils and the harsh, dry climate.

Pandanus

Table 1: Nutrient content of 100 g of pandanus fruit compared to 100 g of apple

Food name	Energy	CHO	Protein	Fat	Fibre	Calcium	Iron	Vit A	Vit C	Vit E	Thiamin	Riboflavin	Niacin	Zinc
	(Kcal)	(g)	(g)	(g)	(g)	(mg)	(mg)	(ug)	(mg)	(mg)	(mg)	(mg)	(mg)	mg
Pandanus nut, sauce	172	3.9	1.4	16.7	1.5	134	5.7	15	2.0	6.5	0.04	0.06	2.5	3.4
Pandanus nut, kernel, dried	533	18.7	11.7	43.8	13.0	12	t	32	0	6.4	0.48	0.13	5.0	2.9
Pandanus nut, kernel, raw	380	11.4	15.0	30.0	4.6	10	t	25	0	1.0	0.38	0.10	4.0	2.4
Pandanus nut, kernel, roasted	195	6.8	4.1	16.3	3.7	4	t	11	0	0.4	0.16	0.04	1.7	4.2
Pandanus, fruit	86	17.2	1.3	0.7	3.5	88	0.4	5	5.2	na	0.09	0.02	0.9	0.3
Pandanus, paste	321	76.1	2.2	1.4	na	134	5.7	90	2.0	na	0.04	0.06	2.5	na
Apple	54	12.3	0.3	0.1	2.0	5	0.2	1	5	0.4	0.02	0.01	0.1	0.1

Source: Dignan et al. 2004
Abbreviations: CHO, carbohydrate; vit, vitamin; na, not available

Pandanus contains significant amounts of vitamin C, vitamin A and fibre. Vitamin C is important for fighting infection and for absorbing some forms of iron (needed for building blood). On some islands, eating ten keys a day is very common, even among children. This would provide more than the estimated daily requirement of vitamin C for most adults or children.

Pandanus also contains significant amounts of provitamin A carotenoids. These are converted in the body to vitamin A, which is important for good vision and eye health, helps to fight against infection and builds blood.

Fresh pandanus fruit are rich in fibre, which is important for a healthy digestive system. A diet high in fibre also helps to control blood sugar in diabetics, reduces blood lipids (a risk factor for heart disease) and prevents excessive weight gain.

Many people in Micronesia believe that pandanus is a health food and that eating it while ill helps one recover more quickly.

Functional properties

Apart from the nutritional content highlighted above, pandanus may also contain other functional properties, including some antioxidants, especially carotenoids of which **ß-carotene** is the most important as shown in Table 2. Different types of pandanus contain different levels of carotenoids; generally, the deeper yellow or orange (or red) the flesh, the higher the level. Consuming ten keys of a carotenoid-rich variety in a day would provide more than the estimated daily requirement of vitamin A for a child or adult. Eating carotenoid-rich food may also help protect against diabetes, heart disease and cancer.

Food uses

Pandanus can be prepared in various ways and eaten in many different forms including:

- fresh and raw
- boiled, steamed, baked and roasted
- as pulp extracted and used in traditional and modern recipes
- as one of the first infant foods, from six months of age
- seeds, cooked and raw
- as a preserved snack
- as a drink made from either fresh juice or from flour made from the dried pulp.

Table 2: Antioxidant ß-carotene content of 100 µg of pandanus fruit

Food item	ß-carotene equivalents (µg)
Pandanus fruit, fresh, colour unspecified[1]	60
Pandanus fruit, fresh, light-yellow coloured[3,4]	19–102
Pandanus fruit, fresh, deep orange coloured[3,4]	472–941
Pandanus paste[1,2,4]	155–1080
Pandanus flour[2,4]	100
Apple[1]	10

Notes: [1]Dignan et al. 2004; [2]Murai et al. 1958; [3]Englberger et al. 2003; [4]Englberger et al. 2005.

Storage, preservation and value addition

Once ripe, a whole bunch will keep for around a week. Individual keys do not keep well and should be refrigerated after they are separated from the bunch. In the Pacific region, a number of techniques are used to make pandanus products that can be stored for long periods. These include baking, boiling, drying and pounding into a paste or flour.

Dried pandanus paste

This paste, called *te tuae* in Kiribati, *mokwan* in Marshall Islands and *sehnikun in kipar* in FSM will keep for many years without refrigeration. Certain varieties are known to be best for making this paste. Traditionally, the keys are cooked (boiled or baked) and the pulp is scraped out. It is then spread in a thin layer (about 0.5 centimetres) on a clean surface to dry in the sun for five or more days. The finished product is either rolled tightly and bound in pandanus leaves or folded and kept in an air-tight container. The paste is used in other recipes (as *te roro* in Kiribati) or mixed in water to make a drink or thick custard (as *jennõb* Marshall Islands).

Dried pandanus chips

These chips *te kaka* in Kiribati or *jekaka* in Marshall Islands are prepared by cutting slices of the edible part of the pandanus and drying them in the sun. The dried slices can be stored in air-tight containers and eaten as a snack or used in other recipes.

Dried pandanus flour

Pandanus flour is still made in Kiribati (but rarely), Marshall Islands and in FSM. It is prepared from thin slices of the edible part of the pandanus keys. The slices are boiled or baked, pounded into a single sheet about two centimetres thick (called *te karababa*), placed in the sun for two or three days until almost dry, baked further in an oven and finally pounded into a powder. The powder must be stored in an airtight container and is traditionally used to make a drink.

Preparation and cooking

Most edible pandanus fruit turns from green to yellow and then orange, or orange-red, when ripe, although the ripe, edible portion of one variety in Kiribati remains greenish. The fruit is ripe when the keys are easy to pick or when they fall from the bunch. For some varieties, the bottom keys fall off the bunch when ripe. The bunches have a characteristic sweet smell when ripe.

The fruit should be washed before being eaten. Sometimes, bunches are infested with scale insects and these should be brushed off before washing the keys well.

Cooking

Some varieties of pandanus have soft keys that can be eaten raw. The keys of tougher varieties can be boiled in water or baked and then chewed. The pulp can be scraped out of the cooked keys and used in different recipes.

Recipes

1. Pandanus pudding (peru from Marshall Islands)

Number of servings: three

Nutrition facts
One serving size: 267 g

Amount per serving
Energy: ..... 1818 kJ (433 kcal)
Fat: .....23 g
Carbohydrate: .....52 g
Protein: ..... 5 g
Iron: .....1.9 mg
Sodium: ..... 162 mg

Fresh ripe pandanus fruit (400 g)
Coconut cream (1 cup)
Syrup prepared from sweet toddy or imported refined sugar (150 g)

1. Boil the pandanus keys.
2. Scrape out the pulp.
3. Mix the pulp with the coconut cream.
4. Add the sweet toddy syrup or sugar and combine well.
5. Put in a pan and bake for about one hour.
6. Cut in slices and serve.

2. Pandanus paste in coconut cream (te roro from Kiribati)

Number of serving: four

Nutrition facts
One serving size: 163 g

Amount per serving
Energy: .....2195 kJ (523 kcal)
Fat: .....22 g
Carbohydrate: .....79 g
Protein: ..... 5 g
Iron: .....6.8 mg
Sodium: .....8.1 mg

Preserved pandanus paste (*te tuae*) (400 g)
Coconut cream (1 cup)

1. Lay sheets of pandanus paste on a clean surface.
2. Squeeze over thick coconut cream.
3. Fold and squeeze over more thick coconut cream and repeat.
4. Cover and leave overnight to allow the cream to soak into the paste.
5. Serve with the main meal, or spread as jam on bread or biscuits.

Pandanus

Pandanus with taro (maitahlik from Mwoakilloa Atoll, Pohnpei, FSM)

Number of servings: three

Nutrition facts
One serving size: 400 g

Amount per serving
Energy: ..... 2299 kJ (547 kcal)
Fat: ..... 23 g
Carbohydrate: ..... 77 g
Protein: ..... 6 g
Iron: ..... 2.7 mg
Sodium: ..... 263 mg

Fresh ripe pandanus fruit
Coconut cream
Syrup prepared from sweet toddy or imported refined sugar
Giant swamp taro (*Cyrtosperma*), boiled or baked

1. Boil the pandanus keys.
2. Scrape out the pulp.
3. Add the coconut cream.
4. Add the sweet toddy syrup or sugar and mix well.
5. Grate the cooked giant swamp taro.
6. Form the grated taro into balls and put into a baking tin .
7. Add the pandanus mixture.
8. Bake and serve.

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Pawpaw

Leaflet No. 13 - Revised 2012

Introduction

Pawpaw, or *Carica papaya* to give the scientific name, is also known as papaya, *maoli, tebabaia, esi, vininita, paipai, es, olesi, lesi, loku, popo* and mummy apple. It grows on almost every island in the Pacific and its delicious, healthy fruit are available all year round.

When ripe, it is a popular breakfast fruit. Being high in vitamins and easy to digest, ripe pawpaw is especially suitable for babies over six months old when juiced or mashed. The green or unripe fruit is usually used as a vegetable. The leaves are not edible but contain papain, a chemical used to tenderise meat. The seeds are also edible, although often discarded. They are crunchy and have a peppery taste and are used, crushed, as a mildly spicy condiment.

Types of pawpaw tree

The three types of pawpaw tree are female, male and hermaphrodite. The most preferred is the female pawpaw tree because of the quantity and quality of fruits produced. Many different varieties of pawpaw are available and their ripe fruits vary considerably in size, shape and colour. The most common, readily available variety today is the *Hawaiian Solo,* which produces fruit of uniform size, texture and flavour. The female pawpaw trees shown in Figure 1 have fruit and flowers that grow on short stalks at the base of the leaves. To bear fruit, female trees need pollen from nearby male trees.

Design and layout: Muriel Borderie - SPC Publications Section

Pawpaw

Figure 1: Types of pawpaw tree

a) *Male pawpaw tree*

b) *Female pawpaw tree*

Male pawpaw trees have flowers that grow on long hanging stalks. Although male trees sometimes bear fruit, it is not good to eat. Usually one male tree is planted for every eight to ten female trees.

Hermaphrodite pawpaw trees have both male and female flowers. The male flowers supply the pollen the female flowers need to produce fruit, so that a single tree can bear fruit alone.

Pawpaw trees are usually grown from seed. The seeds can be either sown in a nursery and then transplanted, or planted directly in the soil. If planted directly, they should be spaced 2–2.5 metres (6–8 feet) apart and then thinned to ensure healthy growth.

Pawpaw trees bear fruit less than a year after planting. When the fruit turns yellow, it is ripe. The ripe fruit is very soft and must be handled carefully so that the skin does not bruise. When the ripe pawpaw is picked, the stalks should be cut close to the trunk of the tree. If this is not done, the other fruit still on the tree may be hurt by the sharp end of the stalk.

Pawpaw is suitable for all members of the family — babies six months and older, young children, the sick, adults and the elderly, and especially those with an upset stomach from eating meat, chicken or eggs. Eating pawpaw with these foods helps to digest them easily.

Table 1: Nutrient content of 100 g of ripe pawpaw compared to 100 g of apple

Food name	Energy	CHO	Protein	Fat	Fibre	Calcium	Iron	Vit A	Vit C	Vit E	Thiamin	Riboflavin	Niacin	Zinc
	(Kcal)	(g)	(g)	(g)	(g)	(mg)	(mg)	(ug)	(mg)	(mg)	(mg)	(mg)	(mg)	mg
Pawpaw, raw, ripe	51	11.8	0.5	0.1	0.8	24	0.7	59	73	1.2	0.03	0.05	0.4	0.1
Pawpaw, raw, unripe	26	4.7	1.0	0.1	1.5	38	0.3	1	40	0.8	0.02	0.03	0.3	0.2
Pawpaw, unripe, cooked	29	5.2	1.1	0.1	1.4	42	0.3	1	33	0.9	0.02	0.02	0.2	0.1
Apple	54	12.3	0.3	0.1	2.0	5	0.2	1	5	0.4	0.02	0.01	0.1	0.1

Source: Dignan et al. 2004.
Abbreviations: CHO, carbohydrate; vit, vitamin.

Nutrient content

Ripe pawpaw is an excellent source of vitamins A and C as shown in Table 1. Vitamin A is needed for proper growth, healthy eyes and protection from disease, while vitamin C helps to keep the body tissues strong, helps the body use iron and assists chemical actions in the body.

The vitamin C content in pawpaw increases as the fruit ripens. A pawpaw that still has green skin has only 50 to 60 per cent of the vitamin C content of a fully ripe one.

Apples, commonly imported to most Pacific Island countries, are not as nutritious as pawpaw. In addition, a slice of pawpaw provides more vitamin C than an adult's daily requirement of this vitamin. Pawpaw is a nutritious local fruit that is available all year round.

Functional properties

Apart from the nutritional content discussed above, pawpaw also contains other functional properties, including antioxidants, phenols, flavonoids and carotenoids, as well moderate levels of glycemic responses.

Antioxidants

The functional properties of pawpaw can be estimated by looking at the range and intensity of colours of the flesh. The major colours associated with the functional properties of pawpaw are yellow, orange and pink. Eating foods rich in these colours helps protect against diabetes, heart disease and cancer. Yellow and orange colours present in food are associated with carotenoids, and pink may be associated with polyphenols, especially flavonoids. Deeper shades of these colours provide an increased amount of antioxidants and thus greater health benefits. Carotenoids, polyphenols, flavonoids, anthocyanins and the total antioxidant capacity have been found to be present in the *Hawaiian Solo* variety of pawpaw, as shown in Table 2. Ripe pawpaw has high levels of total antioxidant capacity and is rich in ß-carotene, a type of carotenoid converted in the body to Vitamin A, which helps protect eye health.

Besides being nutrients, vitamins C and E are also strong antioxidants, which help remove free radicals from different parts of the body cells; vitamin C removes free radicals from the hydrophilic (water) components of the cells, while vitamin E removes free radicals from the lipophilic (fat) components of cells.

Glycemic responses

Some fruit contains carbohydrate and thus has a glycemic response. The glycemic index (GI) is a tool that ranks food containing carbohydrates according to the rate at which the carbohydrates break down in our body. Carbohydrates that break down quickly during digestion have a high glycemic index (GI 70 and above). Their blood sugar response is fast and high. Carbohydrates that break down slowly, releasing glucose gradually into the blood stream, have a low glycemic index (GI 55 and less). Consumption of low GI food is associated with a lower risk of developing diabetes and coronary heart disease than consumption of high GI foods. Ripe pawpaw has a moderate glycemic index of 55–60, depending on the degree of maturity, ripeness and variety.

Storage and preservation

Fresh pawpaw: Eating fresh ripe pawpaw is the best way to maximise the nutrients and antioxidants your body needs. If abundant ripe fruit is harvested, it can be dried and made into value-added products, such as those listed in the value-addition section below. Under-ripe pawpaw can be picked, stored in a cool dry place, and wrapped in clean green leaves such as banana leaves to keep the fruit fresh.

Table 2: Antioxidant, polyphenol and carotenoid contents of 100 g of ripe pawpaw

Food name	Total Antioxidant Capacity* (mg)	Total Polyphenols (mg)	Total Carotenoids** (mg)	Total Flavonoids*** (mg)	Total Anthocyanin (mg)
Pawpaw, ripe, *Hawaiian*	100	26	2.2	11	0.06

Source: Lako et al. 2007
Notes: *TEAC (Trolox equivalent antioxidant capacity) method; **total of lycopene, a- and b-carotene; ***total of myricetin, fisetin, morin, quercetin, kaempferol and isorhamnetin.

Dried pawpaw: Drying is a good way to preserve pawpaw. To dry pawpaw, you need to cut fresh ripe pawpaw into cubes. Lay the cubes on clean trays or clean banana leaves and leave them in the sun for two or three days. Turn the pawpaw cubes over two or three times a day so that they dry evenly. If flies are a problem, cover the pawpaw with netting. A solar drier can be used to dry pawpaw more quickly. Dried pawpaw will keep for several months when stored in a clean, tightly sealed jar, tin or plastic bag. It makes an excellent snack for children.

Value-adding

Pawpaw can be made into various value-added products, including jam, jelly, juice and fruit nectar. As described above, it can also be dried and used as snacks.

Pawpaw's special ingredient

Pawpaw is not only delicious and full of vitamins and flavour, but also contains a particularly useful substance. The leaves and green fruit of the pawpaw tree contain a chemical called **papain**. Papain can be used in a variety of ways, as described below.

Meat or octopus tenderiser: Meat or octopus can be wrapped in pawpaw leaves and left overnight, or the juice of green pawpaw can be rubbed into the meat or octopus. To get the juice of the green pawpaw, score or cut the skin of the fruit with a knife and let the juice drip onto a clean plate, before applying it to the meat. Papain is also used commercially for the manufacture of meat tenderisers.

Treatment of insect stings: The juice of green pawpaw can be carefully rubbed onto the insect sting to reduce the pain. Care should be taken not to allow the pawpaw juice to come into contact with the eyes.

Treatment of intestinal worms or indigestion: Three to four teaspoons of the milky juice of the green pawpaw can be mixed with the same amount of honey, and stirred into a cup of hot water.

Stain remover: Rub clothes with crushed pawpaw leaves, then rub the clothes against each other during washing.

Preparation and cooking

Ripe pawpaw: Firm, ripe fruit is good when baked or stewed with other foods. When baking, wrap the pawpaw with foil or banana leaves. When using it in a stew, cover the pot with a lid. These methods help to save some of the vitamins. Pawpaw should never be cooked longer than necessary, as important vitamins can be lost by overcooking, especially vitamin C. Note that cooking food at moderate temperatures and for a reasonable period does not destroy carotenoids and flavonoids but does limit some antioxidants such as vitamin C. However, cooking helps the body to metabolise carotenoids more easily.

Make a healthy juice by pressing a little ripe, soft pawpaw flesh through a clean wire strainer or a clean cloth, or mix in a blender. Add enough cooled, boiled water and squeeze a bit of lime or lemon in, according to taste. Do not add sugar.

Green pawpaw: Green fruit can be stewed with other foods, used in curries, added to other kinds of meal, and used in salads.

Recipes:

1. Pawpaw - coconut pudding

Number of servings: six

Nutrition facts
One serving size: 121 g

Amount per serving
Energy: .....912 kJ (217 kcal)
Fat: ..... 12.6 g
Carbohydrate: .....24 g
Protein: .....2.0 g
Iron: .....1.3 mg
Sodium: .....8.8 mg

1½ cups ripe pawpaw pulp
7 tablespoons cornflour or cassava flour
1½ cups thin coconut cream (from 1 coconut plus water)

1. To prepare the pawpaw pulp, peel the pawpaw and remove the seeds. Chop the pawpaw into small pieces, press it through a medium sieve or mash with a fork, then measure.
2. Gradually stir in the cornflour or cassava flour.
3. Cook over a low heat, stirring all the time, until the mixture thickens.
4. Add the coconut cream and cook 5–10 minutes. (When cool, the mixture should barely hold its shape; it should not be stiff enough to mould.)
5. Pour into a deep dish and chill, if possible.
6. Serve plain, or with coconut cream.

2. Green pawpaw curry

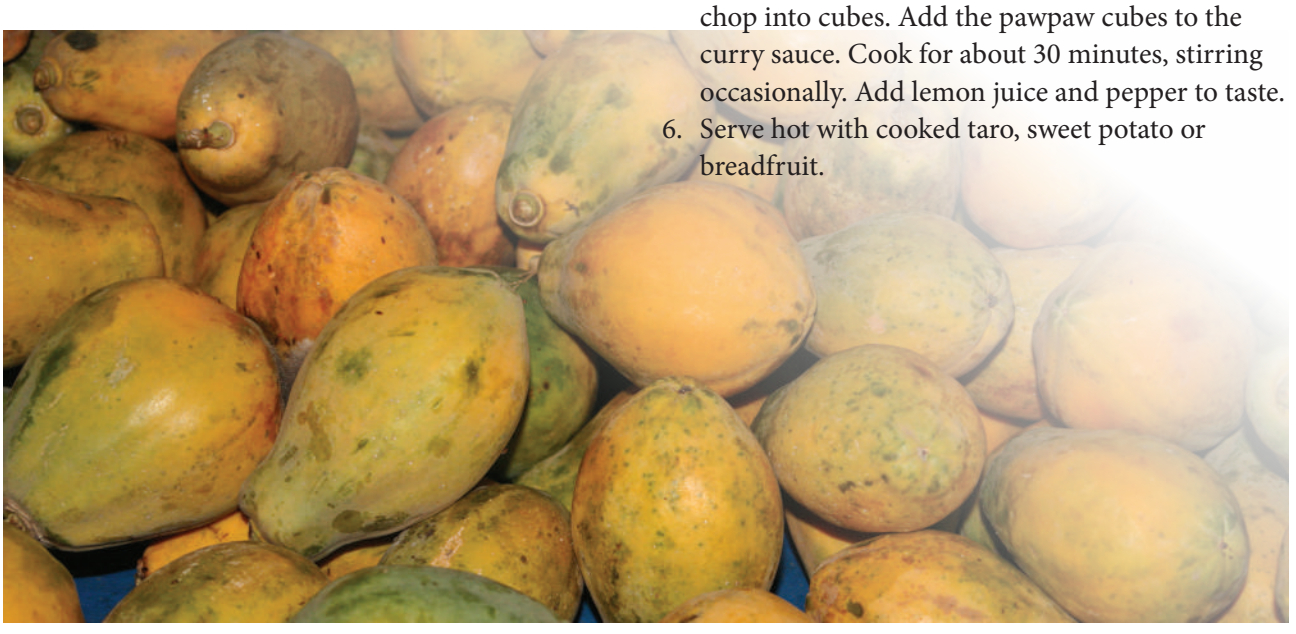
Number of servings: four

Nutrition facts
One serving size: 370 g

Amount per serving
Energy: ..... 1342 kJ (320 kcal)
Fat: ..... 22.9 g
Carbohydrate: ..... 20.5 g
Protein: .....6.3 g
Iron: .....4.9 mg
Sodium: ..... 105 mg

2 medium-sized green pawpaws
2 tablespoons butter, margarine or oil
1 large onion, chopped
2 cloves crushed garlic (optional)
1 small piece grated ginger (optional)
2 green chillies
1 tablespoon curry powder
1 cup coconut cream
1 cup water
½ cup lemon juice
Pepper

1. Melt the butter, margarine or oil.
2. Fry the onion, garlic and ginger for 3 minutes.
3. Add the chillies and curry powder and cook for about 5 minutes, until the mixture is a rich golden-brown colour.
4. Slowly stir in the coconut cream and water.
5. Wash and peel the pawpaw, remove the seeds and chop into cubes. Add the pawpaw cubes to the curry sauce. Cook for about 30 minutes, stirring occasionally. Add lemon juice and pepper to taste.
6. Serve hot with cooked taro, sweet potato or breadfruit.



3. Green pawpaw and fish soup

Number of servings: six

Nutrition facts
One serving size: 278 g

Amount per serving
Energy: ..... 1176 kJ (280 kcal)
Fat: ..... 13.7 g
Carbohydrate: ..... 7.9 g
Protein: ..... 31 g
Iron: ..... 1.6 mg
Sodium: ..... 345 mg

1 medium-sized fish
1 cup coconut cream (from 1 coconut)
2 cups coarsely grated green pawpaw
1 tablespoon soy sauce
3 cups water

1. Clean the fish and cut into pieces.
2. Bring the water to the boil, add the fish, then boil for 10 minutes. Remove the bones.
3. Add the grated pawpaw and soy sauce, then cook until tender (about 10 minutes.)
4. Add the coconut cream, stir once, and remove from heat.
5. Serve hot.

4. Pawpaw and pineapple fruit salad

Number of servings: six

Nutrition facts
One serving size: 204 g

Amount per serving
Energy: ..... 289 kJ (69 kcal)
Fat: ..... 0.2 g
Carbohydrate: ..... 13.8 g
Protein: ..... 1.1 g
Iron: ..... 0.85 mg
Sodium: ..... 10.7 mg

2 cups diced ripe pawpaw
2 cups diced pineapple
6 tablespoons lemon juice

1. Mix together all the ingredients.
2. Leave for half an hour in a cool place, then serve with cooked fish or meat and some taro, breadfruit or sweet potato.

5. Stuffed pawpaw

Number of servings: four

Nutrition facts
One serving size: 267 g

Amount per serving
Energy: ..... 984 kJ (234 kcal)
Fat: ..... 8.9 g
Carbohydrate: ..... 22.5 g
Protein: ..... 14.9 g
Iron: ..... 2.3 mg
Sodium: ..... 57 mg

1 medium-sized half-ripe pawpaw
¾ cup cooked minced meat or any leftover meat
¾ cup cooked rice or leftover cooked root crops (chopped)
1 small onion
1 egg, beaten
¼ teaspoon salt
¼ teaspoon pepper
Oil

1. Cut stalk end off pawpaw and save. Scoop out the seeds.
2. Finely chop the onion and fry in 2 tablespoons of oil.
3. Put onion, cooked minced meat and cooked rice or root crops in a bowl, then add the beaten egg, salt and pepper.
4. Mix the ingredients well, then stuff into the pawpaw. Attach the stalk end to the pawpaw, using a toothpick or the middle rib from a coconut leaf.
5. Brush with oil and bake at 180°C (350°F) until the pawpaw is soft (45 minutes to one hour). Any type of oven can be used. The pawpaw can also be steamed.
6. Serve with boiled green leaves or salad, if desired.

6. Dry pawpaw snacks

Nutrition facts
One serving size: 300 g

Amount per serving
Energy: .....433 kJ (103 kcal)
Fat: .....0.3 g
Carbohydrate: ..... 20.8 g
Protein: .....1.2 g
Iron: .....1.7 mg
Sodium: .....21 mg

1 ripe pawpaw
Cinnamon (optional)

1. Wash and peel the pawpaw and remove the seeds.
2. Slice thinly.
3. Spread out a clean plastic bag or a small tightly woven mat of coconut palm leaves.
4. Sprinkle cinnamon on top of pawpaws.
5. The slices of pawpaw must be as thin as possible so that they will dry quickly. If they are too thick they will not dry well, and later they may spoil.
6. Dry the pawpaw in the sun until the slices come off the plastic or mat without sticking.
7. When dry, remove the pawpaw from the plastic or mat, and store in a clean glass jar.
8. Makes a very healthy and nutritious snack for children instead of expensive lollies bought from the store.

Note: This recipe can also be used for other fruits such as mango.

7. Pawpaw vegetable salad

Number of servings: four

Nutrition facts
One serving size: 191 g

Amount per serving
Energy: ..... 307 kJ (73 kcal)
Fat: .....2.6 g
Carbohydrate: .....9.4 g
Protein: .....1.3 g
Iron: .....1.1 mg
Sodium: .....22 mg

1 small half-ripe but firm pawpaw
1 tablespoon coconut cream or vegetable oil
2 tablespoons lemon juice
Pepper
8 lettuce leaves

1. Peel the skin from the pawpaw and slice or grate the fruit thinly.
2. Rinse with clean fresh water and drain well.
3. Mix together the coconut cream or vegetable oil, lemon juice and a pinch of pepper.
4. Pour the mixture over the grated pawpaw and let stand for at least 10 minutes.
5. Serve on lettuce leaves.

8. Pawpaw drink

Number of servings: four

Nutrition facts
One serving size: 329 g

Amount per serving
Energy: ..... 1988 kJ (473 kcal)
Fat: .....40 g
Carbohydrate: ..... 19.7 g
Protein: .....6.3 g
Iron: .....3.3 g
Sodium: .....30 mg

2 cups ripe pawpaw pulp
2 cups milk or thin coconut cream
4 teaspoons lemon or lime juice

1. To prepare pawpaw pulp, peel the pawpaw and remove the seeds. Chop the flesh into small pieces, press it through a coarse sieve or mash with a fork, and then measure the amount.
2. Add the lemon juice and milk or thin coconut cream and mix well.
3. Serve immediately or, if possible, chill for a short time.

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Pineapple

Leaflet No. 14 - Revised 2012

Introduction

Pineapple, or *Ananas comusus* to give the scientific name, is also known as *faina, palawa, painapiu* and *vainaviu* and is grown and cultivated in many Pacific islands. In some, pineapple is grown commercially in large amounts for export to countries where it does not grow. This tropical fruit is seasonal, and usually ripens in the hot, wet months. It is refreshing, with a delicious flavour, sweet tasting when it is ripe, and with good food value. Pineapple is a protective, health-giving food and contains essential vitamins, minerals and fibre. It can be prepared and used in many different ways.

Major types of pineapple and cultivation

The pineapple plant is low-growing and produces fruit with a yellow, green or brown skin. Pineapple grows on most Pacific islands and requires good, well-composted, well-drained soil. Because pineapple plants do not cover the ground well, the soil is exposed to the sun and weeds can grow very fast. Weeds must be controlled so that a good crop of fruit can be obtained. If waste material from other crops is available, this can be spread over the ground as a mulch to keep down weed growth.

Design and layout: Muriel Borderie - SPC Publications Section

Pineapple

Pineapples can be planted in rows or individually. Suckers and tops are the two main kinds of planting material. Suckers grow round the bottom of the mature plant during the fruiting season. They can be cut from the plant about one month after picking the fruit. After removing a few of the leaves from the cut end, the suckers should be dried in the sun for one or two days before planting. They will fruit about 12 months after planting.

It is also possible to plant pineapples using the tops from the fruits. The tops are twisted off and planted. After about 18 months they will produce fruit. Pineapples are most plentiful during the main fruiting season, but there is also a smaller season six months later. Pineapples can be forced to fruit at other times (off-season) by applying special chemicals to mature plants. Because many people want these off-season pineapples, they can be sold for high prices.

Only ripe pineapples should be picked. When picked green, pineapples will not become sweeter, unlike many other types of fruit. Pineapples are usually sweetest when there has been a lot of sunshine during the growing season.

Nutrient content

Pineapple is a good source of vitamin C, which keeps body tissues strong, helps the body use iron, and helps chemical actions in the body. It is also a fair source of Vitamin B_1 (thiamin) and fibre. Thiamin helps the body to convert carbohydrates into energy and heat. Fibre is needed to help the intestines work properly and prevent constipation. Eating foods high in fibre, such as locally grown vegetables and fruit, gives the body the fibre it needs.

Fresh pineapple provides much more vitamin C than the same amount of canned pineapple. The canning process involves heat and Vitamin C is easily destroyed by heat. Moreover, extra sugar is added to canned pineapple as part of the canning process, contributing to the high calorie content of canned pineapple (Table 1).

Table 1: Nutrient content of 100 g of citrus compared with 100 g of apple

Food name	Energy	CHO	Protein	Fat	Fibre	Calcium	Iron	Vit A	Vit C	Vit E	Thiamin	Riboflavin	Niacin	Zinc
	(Kcal)	(g)	(g)	(g)	(g)	(mg)	(mg)	(ug)	(mg)	(mg)	(mg)	(mg)	(mg)	mg
Pineapple, Australia	41	8.0	1.0	0.1	2.1	27	0.3	2	21.0	0.1	0.04	0.03	0.1	0.2
Pineapple, PNG	53	11.6	0.7	0.3	0.8	17	0.5	3	22.0	0.1	0.06	0.03	0.3	0.2
Pineapple, canned in heavy syrup	88	21.1	0.6	0.0	1.3	5	0.3	1	12.0	t	0.04	0.03	0.2	0.2
Apple	54	12.3	0.3	0.1	2.0	5	0.2	1	5	0.4	0.02	0.01	0.1	0.1

Source: Dignan et al. 2004.
Abbreviations: CHO, carbohydrate; t, trace; vit, vitamins.

Functional properties

Apart from the nutritional content described above, pineapple contains other functional properties including antioxidants, phenols, flavonoids and carotenoids.

Antioxidants

The functional properties of pineapple can be estimated by looking at the range and intensity of colours of the flesh. Yellow is the major colour associated with the functional properties of pineapple. Deeper shades of yellow indicate an increased amount of antioxidants and thus greater health benefits. Foods rich in this colour help protect against diabetes, heart disease and cancer. Carotenoids, polyphenols, flavonoids, anthocyanins and the total antioxidant capacity are present pineapple as shown in Table 2. Ripe pineapple contains certain levels of total antioxidant capacity and some ß-carotene, a type of carotenoid converted to Vitamin A in the body. Vitamin A helps protect eye health, and also indicates fair amounts of flavonoids.

Vitamin C is also a strong antioxidant, helping to remove free radicals from the hydrophilic (water) components of the body cells because vitamin C is itself water soluble. Cooking food at moderate temperatures and for a reasonable period does not destroy carotenoids and flavonoids but does limit some antioxidants such as vitamin C. Cooking helps the body to metabolize carotenoids more easily.

Glycemic responses

Some fruit also contains carbohydrate and thus has a glycemic response. The glycemic index (GI) is a tool that ranks food which contains carbohydrates according to the rate at which carbohydrates break down in our body. Carbohydrates that break down quickly during digestion have a high glycemic index (GI 70 and above). Their blood sugar response is fast and high. Carbohydrates that break down slowly, releasing glucose gradually into the blood stream, have a low glycemic index (GI 55 and less). Eating low GI food rather than high GI food is associated with a lower risk of developing diabetes and coronary heart disease. Fresh ripe pineapple has a GI ranging from 45 to 66, depending on the degree of ripeness, while canned pineapple has a GI of 43.

Preparation and serving

Fresh pineapple is delicious when sliced and used fresh in fruit salads and other desserts. Pineapple can be served by itself or with other fruits, vegetables, meat or fish.

To prepare a pineapple, cut off the top and bottom, remove the peel and cut out the eyes by making diagonal cuts around the pineapple as shown in Figure 1. The pineapple can then be cut lengthwise into pieces and the core can be removed, if desired. Save any juice that drips out for young children. Instead of throwing away the skin and the core, use them to prepare a delicious pineapple drink as described below.

Figure 1: Preparation of pineapple for removal of eyes.

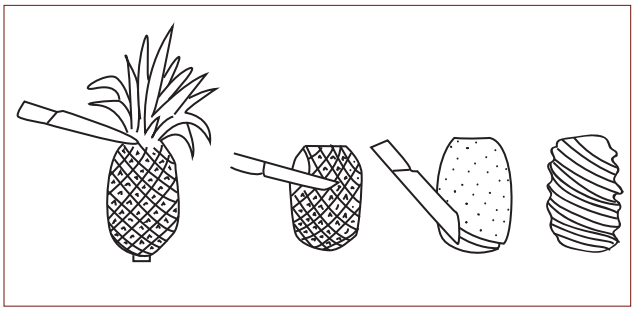


Table 2: Antioxidant, polyphenol and carotenoid contents of 100 g of pineapple

Food name	Total Antioxidant Capacity* (mg)	Total Polyphenols (mg)	Total Carotenoids** (mg)	Total Flavonoids*** (mg)	Total Anthocyanin (mg)
Pineapple	25	15	0.2	6	trace

Source: Lako et al. 2007.
Notes: *TEAC (Trolox equivalent antioxidant capacity) method; **total of lycopene, a- and b-carotene; *** total of myricetin, fisetin, morin, quercetin, kaempferol and isorhamnetin.

Storage and preservation

Pineapple needs to be stored in a cool dry place. When harvesting, avoid blemishes or damage.

Because pineapple is seasonal, preserving some for the off-season is a good idea because the fruit becomes very expensive then. The fruit can be preserved in a number of ways. It can be dried, frozen, made into jams, pickles, chutneys, juice and nectar.

Dried pineapple

1. Choose firm, not over-ripe, fruit.
2. Peel the pineapple and cut it into 7 mm (¼ inch) slices. Remove the core if it is too fibrous.
3. Lay the slices in the sun and cover them with netting or put them in a solar drier until dry, which usually takes two to three days.
4. If there is not enough sun, finish drying the pineapple slices in a cool oven.
5. Store in clean, tightly sealed jars or clean plastic bags.

Freezing is another way of preserving pineapple. Prepare the fruit in the usual way and cut into cubes. Put it into plastic bags, seal and freeze. When thawed and eaten, the fruit will not be as crisp as fresh pineapple.

Pineapple juice can also be frozen. Pour the juice into ice-cube trays and freeze. When frozen, remove the cubes from the trays and store frozen in sealed plastic bags.

Value addition

Ripe pineapples can be prepared in many ways. They are often canned in syrup, dried, used in jam and jellies, and processed into canned juice or nectar. Dried pineapple makes excellent snacks for children.

Special ingredient

Raw pineapple contains a substance called b**romelin,** which can be used to tenderise tough meat. Only fresh, uncooked pineapple has this ingredient. Once pineapple is cooked or canned, the bromelin is destroyed.

Meat can be tenderised by soaking it in a pineapple marinade. To make this marinade, mix cooking oil and lemon juice. Use twice as much oil as lemon juice. Add slices of fresh pineapple to the mixture and let the meat sit in this marinade for two hours before cooking.

Raw pineapple destroys gelatin. Use only cooked pineapple in any recipe that contains gelatin.

Recipes

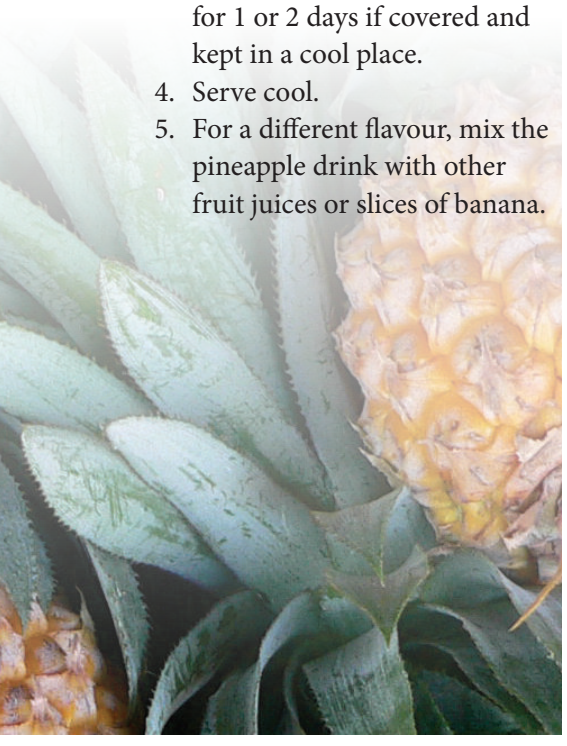
1. Fresh pineapple juice

1. Prepare pineapple in the usual way, as described above.
2. Grate or cut the pineapple into 2.5 cm (1 inch) cubes.
3. Put the grated pineapple or cubes into a plain clean cloth or strainer and squeeze the juice into a clean container.
4. Serve the juice cool.

Fresh pineapple juice is excellent for people of all ages. The leftover pulp can be dried and used when baking buns and cakes, and for flavouring meat and fish dishes.

2. Pineapple drink

1. Cut the pineapple peel and core into small pieces. Put these in a pot and cover with water. Put on the lid and bring to the boil.
2. Boil for 20 minutes. Boiling for a shorter time may cause the drink to go sour later.
3. Strain and store in a clean container. The drink will keep for 1 or 2 days if covered and kept in a cool place.
4. Serve cool.
5. For a different flavour, mix the pineapple drink with other fruit juices or slices of banana.



3. Sweet potato and pineapple casserole

Number of servings: six

Nutrition facts
One serving size: 244 g

Amount per serving
Energy: ..... 1684 kJ (401 kcal)
Fat: ..... 22 g
Carbohydrate: ..... 36.3 g
Protein: ..... 14 g
Iron: ..... 0.99 mg
Sodium: ..... 1159 mg

4 medium sweet potatoes, cooked and sliced
2 cups cheese sauce (see below)
1 tablespoon grated coconut
1 fresh pineapple, peeled, cored and sliced
2 tablespoons chopped spring onions
1 tablespoon butter or margarine
Salt to taste

1. Grease a baking dish.
2. Arrange some of the pineapple, sweet potato, grated coconut and spring onions in a layer.
3. Spread the cheese sauce over.
4. Repeat steps 2 and 3 until all the sweet potato and pineapple have been used.
5. Bake in a hot oven for 30 minutes.
6. Serve hot as a vegetable with cooked meat or fish.

Cheese sauce (for 2 cups)
1 tablespoon butter
1 heaped tablespoon flour
2 heaped tablespoons grated cheese
1½ cups milk
Salt and pepper to taste

1. Melt the butter, and stir in the flour, using a wooden spoon.
2. Cook over a gentle heat for 3 minutes without browning.
3. Remove from the heat and gradually stir in half the milk. Stir until thoroughly blended.
4. Return to the heat, cook slowly until the sauce thickens, stirring all the time.
5. Gradually add the remaining milk and bring to the boil.
6. Add the grated cheese, salt and pepper to taste, mix well.

4. Pineapple-avocado salad

Number of servings: six

Nutrition facts
One serving size: 172 g

Amount per serving
Energy: ..... 829 kJ (197 kcal)
Fat: ..... 18.4 g
Carbohydrate: ..... 5.1 g
Protein: ..... 2.4 g
Iron: ..... 0.9 mg
Sodium: ..... 5.8 mg

2 cups pineapple slices
3 large avocados
¼ cup water
Juice of one lemon or lime
Selection of fresh green salad vegetables

1. Cut each pineapple slice into 4 pieces.
2. Cut the avocado in half, remove seed, peel and slice. Mix the water and lemon juice and dip the avocado slices in it.
3. Wash and prepare the salad vegetables.
4. Arrange the avocado and pineapple slices on a bed of salad vegetables.
5. Serve with cold, cooked meat or fish.

5. Meal in a nutshell

Number of servings: two

Nutrition facts
One serving size: 670 g

Amount per serving
Energy: ..... 2755 kJ (656 kcal)
Fat: .....24 g
Carbohydrate: .....52 g
Protein: .....56 g
Iron: .....4.7 mg
Sodium:..... 298 mg

4 small sweet potatoes
2 spring onions
1 tomato
¾ cup dark green leaves
½ cup peanuts, chopped fish or corned beef
¼ medium pineapple, chopped
1 coconut

1. Peel and wash the sweet potatoes. Cut into small pieces.
2. Wash and chop the tomato and dark green leaves and peel and chop the spring onions.
3. Grate the coconut and save the coconut shell.
4. Prepare the coconut cream.
5. Put the vegetables and pineapple inside one half of the shell with the peanuts, fish or meat.
6. Pour the coconut cream over the vegetable mixture.
7. Put the other half of the shell on the top and tie tightly in place.
8. Steam in a pan of water for about 45 minutes or bake in an earth oven.
9. Serve in the shell.

6. Pineapple-fish balls

Number of servings: six

Nutrition facts
One serving size: 203 g

Amount per serving
Energy: ..... 1408 kJ (335 kcal)
Fat: ..... 19.8 g
Carbohydrate: ..... 20.8 g
Protein: ..... 18.8 g
Iron: .....1.3 mg
Sodium: ..... 645 mg

750 g (1½ lb) fish
1 small onion, chopped
1 small unripe pawpaw
1 cup pineapple pieces
1 head Chinese cabbage
4 tablespoons cooking oil, margarine or butter
½ inch ginger chopped or crushed
½ teaspoon sugar
1 teaspoon soya sauce
1 cup water
1 dessertspoon cornflour
Salt to taste

1. Peel the pawpaw, remove seeds and cut lengthwise.
2. Wash the cabbage and cut the leaves off the stalks. Cut the leaves up and chop the cabbage stalks lengthwise.
3. Using a spoon or shell or sharp knife, scrape the fish meat away from the bones and skin. Form into small balls.
4. Heat the oil and margarine or butter in a frying pan.
5. Gently fry the fish balls until cooked. Remove from the pan.
6. Fry the pawpaw and pineapple pieces.
7. Add the onion, cabbage stalks and lastly the cabbage leaves. Fry until just under-cooked.
8. Mix together the sugar, soya sauce, water and cornflour. Add to the vegetables and stir continuously until it boils.
9. Add the fish balls and stir.
10. Serve hot with cooked taro, breadfruit or rice.

7. Fresh fruit salad with coconut cream

Number of servings: six

Nutrition facts
One serving size: 441 g

Amount per serving
Energy: ..... 1462 kJ (348 kcal)
Fat: .....11 g
Carbohydrate: .....55 g
Protein: .....5.3 g
Iron: .....2.3 mg
Sodium: .....14 mg

1 cup thin coconut cream
1 large pineapple
6 ripe bananas
1 pawpaw
2 oranges
2 ripe mangoes
4 green limes or lemons
Sugar to taste

1. Cut the pineapple in half lengthwise. Scoop out the pineapple flesh, leaving the two halves of the skin intact.
2. Cut the pineapple fruit into small pieces.
3. Peel and prepare the other fruits and cut into small pieces.
4. Sprinkle very lightly with sugar.
5. Add the lime juice.
6. Pour on the coconut cream. Mix well and pile fruit salad into the pineapple skins.
7. Serve cool.

8. Pineapple chicken

Number of servings: six

Nutrition facts
One serving size: 226 g

Amount per serving
Energy: ..... 1970 kJ (469 kcal)
Fat: ..... 31.3 g
Carbohydrate: ..... 4.4 g
Protein: ..... 42.9 g
Iron: ..... 1.8 mg
Sodium: ..... 160 mg

1.5 kg (3 lb) chicken
2 tablespoons butter, margarine or cooking oil
2 cups pineapple pieces
Salt to taste

1. Wash and cut up the chicken into serving size pieces. Season with a little salt.
2. Fry in butter, margarine or oil until brown.
3. Cover and cook gently for about 20 minutes or until tender.
4. Drain off the fat and pour in the pineapple pieces.
5. Simmer uncovered for 5 minutes, spooning juice over the chicken from time to time.
6. Serve with taro, sweet potato or rice, and vegetables.

9. Cassava-pineapple savoury

Number of servings: two

Nutrition facts
One serving size: 601 g

Amount per serving
Energy: ..... 3512 kJ (836 kcal)
Fat: ..... 40 g
Carbohydrate: ..... 99 g
Protein: ..... 17 g
Iron: ..... 2.7 mg
Sodium: ..... 758 mg

2 cups grated cassava
½ cup grated coconut
2 cups crushed pineapple
1 cup grated cheese
½ cup chopped onion or spring onion

1. Mix the grated the cassava with the grated coconut and press thinly into a greased, flat baking dish or tray.
2. Spread the crushed pineapple, chopped onion and grated cheese on top of the cassava mixture.
3. Bake in a moderate oven for 20 minutes until cooked and the topping is brown.

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Legumes

Leaflet No. 15 - Revised 2012

Introduction

Legumes belong to the family of plants known as *Fabaceae*, formerly known as *Leguminosae* (*no'ei*). This nutritious and valuable group of food plants, many available in the Pacific region, includes peas, lentils and beans. Some can be eaten raw, others are best cooked. They can be eaten alone or with other foods, and they can be cooked, dried and stored for later use. The leaves, flowers and tubers of some legumes can also be eaten as a vegetable. Traditionally, beans are the main source of protein in vegetarian diets. In some parts of the world, legumes are regarded as a poor man's meat alternative and mainly prepared as a side-dish to add extra flavour and texture to the commonly eaten starchy staples. Legumes are not only grown for food; they can also help to improve the nutrition of the soil.

Major types of legumes and cultivation

Many different types of legumes are available, including peas, dhal, lentils and beans. They can grow on most soil types, depending on whether they are grown for food or for improving the soil. Some varieties, such as cowpeas, need deep, rich soil with plenty of moisture. Others, such as long beans, generally require well-drained soil with an open texture. Some beans can even be grown successfully under dry conditions (e.g. winged beans).
Legumes are usually grown together with other crops and rotated regularly with other vegetables because of their ability to add nutrients to the soil. Planting and harvesting of legumes does not require much work. For each of the legume crops, several improved

Design and layout: Muriel Borderie - SPC Publications Section

varieties with different characteristics are available. Characteristics include dwarfness or tall growth habit, early maturity, and disease and pest resistance. A number of bean varieties are available in the Pacific, including long beans, which are commonly eaten as immature pods rather than as mature beans. Sprouted mung beans, and alfalfa sprouts, are used in salads. Table 1 shows some legumes generally grown or available in the Pacific region with their respective uses, preparation and food values.

Seek the advice of agricultural officers in choosing the variety of beans or legumes that suit your needs and situation.

Table 1: Some legumes available in the Pacific

Common names (fill in your own local names)	Scientific name	Description	Food value, uses and preparation
1. Cowpea, black eyed bean, black eyed pea, marble pea	*Vigna sinensis* V. *unguiculata* 	Climbing or dwarf plant with three-lobed leaves with twining seeds.  Immature ponds	Good source of protein, young nodes used as vegetables and in salads, mature seeds cooked, eaten as vegetables and added to soups and stews.
2. French haricot, kidney or string bean	*Phaseolus vulgaris* 	Dwarf bushy plant; climbing varieties.  Immature ponds	Immature pods can be used in salads; maturer pods steamed and eaten as a vegetable; dried seeds cooked and eaten as a vegetable and added to soups and stews.
3. Green pea, blue pea, sugar pea, edible-podded pea	*Pisum sativum* 	Vines with many creeping varieties; round green seeds.  Immature ponds	Good source of protein and fibre; immature pods eaten fresh; maturer pods shelled and cooked.
4. Hyacinth or lablab bean	*Dolichos* sp. *Lablab niger* 	Short, twining plant with pale yellow pods, white flowers and seeds.  Immature ponds	Good source of protein and fibre; young pods eaten as a vegetable; mature pods soaked in water and dried.
5. Long bean, snake bean, asparagus bean, yardlong bean.	*Vigna sesquipedalis* 	Climbing plant with three-lobed leaves and long narrow pods.  Immature pods	Good source of protein; pods steamed or boiled and eaten as a vegetable.

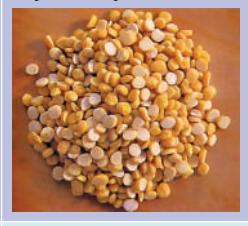
6. Mung bean, green gram, golden gram	*Phaseolus aureus* 	Erect or spreading plant bearing large, three-lobed leaves, yellow flowers; hairy pods.	Green pods eaten as vegetable; ripe seeds can be sprouted, boiled, eaten whole, or split as dhal; can be roasted, ground into flour and made into porridge, biscuits, bread, etc.
7. Mung bean, black gram	*Phaseolus mungo* 	Trailing plant with green stem bearing yellow or pale yellow flowers; seeds are in various shades of green and black.	Immature green pods used as vegetable; ground into flour, which can be used in biscuits; combined with rice flour to make a fermented batter.
8. Pigeon pea, yellow dhal, red gram.	*Cajanus cajan* 	Plant can grow from 2 to 8 feet in height; has tiny, light yellow-red seeds.	Good source of protein; when young can be eaten as vegetable; mature seeds soaked before cooking, boiled or steamed, then pounded into paste, mixed with seasoning, served as a sauce.
9. Soya bean, soybean	*Glycine max* 	Low, upright, small plant, producing small hard oval seeds.  Immature pods	Good source of protein, oil, B vitamins, minerals and fibre; seeds need to be soaked, then boiled for about 2 hours to become tender; used in soups and stews, used to make flour, soy sauce, soybean milk, soyabean curd (tofu) and soy paste (tempeh).
10. Winged beans	*Psophocarpus tetragonolobus* 	Strong-growing perennial; a four-angled bean with wings; white flowers.	Pods eaten at all stages of maturity; dried seeds soaked, then boiled, roasted or curried.
11. Snow peas, sugar snap peas	*Pisum sativum var.* macrocarpon. 	The pods are full, cylindrical with thick edible skin and round green seeds inside as in shelling peas.  	Good sources of vitamin C, fibre and protein. Snow peas are widely grown and are normally eaten as green immature pods, or used in salads or stir fries.

Table 1: Nutrient content of 100 g legumes

Food name	Energy	CHO	Protein	Fat	Fibre	Calcium	Iron	Vit A	Vit C	Vit E	Thiamin	Riboflavin	Niacin	Zinc
	(Kcal)	(g)	(g)	(g)	(g)	(mg)	(mg)	(ug)	(mg)	(mg)	(mg)	(mg)	(mg)	mg
Beans, broad, boiled	48	2.0	6.9	0.5	4.2	16	1.8	15	29	0.6	0.17	0.32	1.9	1.1
Beans, butter, boiled	25	0.2	2.3	0.2	3.1	15	0.4	7	11	0.2	0.05	0.09	1.0	1.4
Beans, green, boiled	22	2.2	1.5	0.2	2.8	30	1.1	38	13	0.1	0.03	0.07	0.3	0.8
Beans, green, frozen, boiled	24	2.8	1.4	0.2	2.9	33	0.8	30	3	0.1	0.02	0.06	0.2	1.9
Beans, katanaku, highlands, earth-oven	152	26.7	8.8	0.8	1.8	159	2.4	0	0	1.6	0.00	0.00	0.0	0.9
Beans, lima, dried, boiled	79	10.2	6.4	0.3	5.3	16	1.3	t	0	0.4	0.06	t	0.5	0.7
Beans, mung, dhal, cooked	112	10.4	6.4	4.2	3.9	34	2.6	64	t	0.9	0.09	0.04	0.4	0.9
Beans, red kidney, canned, drained	97	13.2	6.6	0.6	6.5	36	2.1	t	0	0.2	0.10	0.06	0.6	0.8
Beans, red kidney, dried, boiled	86	9.1	7.9	0.5	7.2	34	1.7	t	0	0.2	0.07	t	0.4	1.0
Beans, snake, boiled	30	1.6	3.3	0.3	3.8	22	0.5	36	22	0.5	0.03	0.10	0.6	0.4
Beans, soya, dried, boiled	142	1.4	13.5	7.7	7.2	76	2.2	t	0	1.1	0.10	0.07	0.8	1.6
Beans, sprouts, raw	26	1.6	3.1	0.1	3.0	10	0.4	2	11	0.1	0.03	0.11	0.5	0.6
Beans, yard-long, cooked	29	4.3	2.0	0.1	1.7	50	1.4	18	10	0.4	0.06	0.10	1.3	0.4
Lentil, dried, boiled	76	9.5	6.8	0.4	3.7	17	2.0	t	0	0.4	0.08	0.06	0.7	0.9
Peas, dried, fried	463	40.3	17.1	23.4	14.6	2	5.0	t	t	0.6	0.29	t	2.2	2.6
Peas, with edible pod, boiled	41	5.2	3.3	0.2	2.6	24	0.9	15	32	0.2	0.01	0.09	0.9	0.6
Peas, green, boiled	61	6.4	4.8	0.4	6.5	18	1.1	35	14	0.2	0.23	0.10	1.4	0.8
Peas, green, dried, boiled	56	5.9	5.0	0.3	4.9	34	1.1	23	3	0.3	0.01	0.06	1.1	1.0
Peas, green, frozen, boiled	61	5.8	5.8	0.4	5.8	27	1.6	45	11	0.2	0.20	0.09	1.5	1.8
Peas, split, dried, boiled	74	6.7	7.4	0.4	7.3	13	1.0	2	0	0.3	0.11	t	0.6	0.6
Winged beans, mature, baked, earth-oven	133	11.6	8.1	5.4	3.2	127	4.0	0	0	0.5	0.00	0.00	0.0	1.3
Winged beans, pods, young, earth-oven	47	5.4	3.2	0.9	2.7	62	1.7	0	0	0.3	0.00	0.00	0.0	0.4

Source: Dignan et al. 2004
Abbreviations: CHO, carbohydrate; t, trace; vit, vitamin.

Nutrient content

Legumes are good sources of protein, vitamin Bs and fibre. They have reasonable amounts of minerals and some vitamin C. Legumes belong to the body-building food group due to their high protein content. The human body needs protein to grow and stay healthy. People who do not eat meat or fish should include legumes in their daily meals as the major source of protein.

Most legumes are also very good sources of the vitamin B-complex, which not only helps to protect the body from disease but also helps to release energy from food that the body needs to be healthy and strong. Legumes and sprouted legumes are also good sources of fibre, which helps the intestines and bowels to work properly.

Legumes also contain useful amounts of *minerals*, particularly *iron, zinc* and *calcium*. Iron helps to make the blood strong. Zinc is needed for growth and wound-healing and calcium helps to make strong bones and teeth.

Although not all legumes contain vitamin C, fresh beans are high in this vitamin. The Vitamin C content of sprouted beans and peas has been found to be almost as high as that in lemon and orange juice. Vitamin C is very important because it helps to keep the body tissues strong, assists the healing of wounds and helps the body use iron properly. In areas where fresh vegetables and fruits are scarce, particularly in atolls, sprouted beans and peas can provide a valuable source of Vitamin C. Table 1 shows the various types of legumes and their nutritional values.

Functional properties

Apart from their nutritional content described above, legumes contain other functional properties, including antioxidants, polyphenols, carotenoids and flavonoids, which can protect cells from damage, lower the risk of cardiovascular disease and provide other health benefits. However, it is important to note that legumes have low glycemic index responses due to their low and limited carbohydrate content.

Table 2: Antioxidant, polyphenol, carotenoid and flavonoid contents of 100 g of legumes

Food name	Total Antioxidant Capacity* (mg)	Total Polyphenols (mg)	Total Carotenoids** (mg)	Total Flavonoids*** (mg)	Total Anthocyanin (mg)
Butter bean, steamed	31	57	nd	4	nd
French bean, steamed	27	54	1.5	7	t
Red bean, steamed	69	120	1.1	70	nd

Source: Lako et al., 2007
Notes: *TEAC (Trolox equivalent antioxidant capacity) method; **total of lycopene, a- and b-carotene; ***total of myricetin, fisetin, morin, quercetin, kaempferol and isorhamnetin, a-, ß-carotene (Dignan et al. 2004).
Abbreviations: nd, not detected, t, trace.

Antioxidants

The functional properties of legumes differ significantly, depending on the bioactive components present. The major colours associated with the functional properties of legumes are red, yellow and green, depending on the types of legumes. Eating foods rich in darker shades of these colours helps to protect against diabetes, heart disease and cancer. The yellow and dark green chlorophyll usually masks carotenoids and other associated antioxidants. Deeper shades of these colours provide an increased amount of antioxidants and thus greater health benefits. Carotenoids, polyphenols, flavonoids, anthocyanins and the total antioxidant capacity, are found in various legumes, as shown in Table 2.

Glycemic responses

Carbohydrate foods have been ranked according to their glycemic responses, i.e. the rate at which carbohydrates break down in our body. Carbohydrates that break down quickly during digestion have a high glycemic index (GI 70 and above). Their blood sugar response is fast and high. Carbohydrates that break down slowly, releasing glucose gradually into the blood stream, have a low glycemic index (GI 55 and less). Consuming low GI food, rather than high GI food, is associated with a lower risk of developing diabetes and coronary heart disease. Generally, the glycemic index of legumes is low due to low carbohydrate content. Table 3 shows the GI levels and glycemic load of some common legumes. There is some variation of the GI of the same food, according to how and where the GI analysis was conducted. Nonetheless, the GI levels of legumes are below 40, compared with white bread (GI 77), Jasmine rice (GI 109) and Calrose rice (GI 83), which have much higher levels. Thus, consuming legumes will not affect blood glucose levels when taken in moderation, and they are a much healthier option than bread and long grain Jasmine rice.

Table 3: Glycemic index and glycemic load of common legumes

Food item	Glycemic index (GI)	Glycemic load (GL) / serving size (¾ cup or 150 g)
Beans, dried, boiled	37	11
Blackeyed peas, Canada	33 ± 4	10
Butter beans, Canada	36 ± 4	7
Chickpea, Canada	36 ± 5	11
Kidney beans, red, Canada	29 ± 8	7
Lentils, green, dried, boiled, Australia	37 ± 3	5
Mung bean, soaked, boiled, Philippines	31	5
Mung bean, fried, Australia	37 ± 3	5
Mung bean, germinated, Australia	25 ± 4	4
Split peas, yellow, dried, soaked overnight, boiled	25 ± 6	3

Source: www.medosa.com/gilists.htm

Storage and preservation

Legumes can be stored and preserved in various ways, but the most common preservation technique is drying.

Drying

Dried leguminous seeds to be used in family meals need to be soaked for some time before cooking. Dried legumes have a very hard covering around them. By soaking, the covering can be easily removed. The seeds can be boiled whole or dried and ground into flour.

Uses

Leguminous seeds can be added to salads, curries, stews and soups. They make an excellent meal or snack for all the family.

A highly nutritious snack for children can also be made by grinding the seeds into flour. Mix the flour with water to make a dough or paste, and then cook with vegetables and spices.

Sprouted beans or peas can be eaten raw or with other vegetables. Sprouts can be lightly fried in oil and served as a vegetable with meat and root crops.

Care in preparation

Some types of legumes naturally contain harmful substances. Most of these harmful substances are present in the skin of mature seeds. It is therefore best that seeds be soaked before being cooked. Soaking removes the dirt and any toxic substances and softens the seeds (thus reduce cooking time).

Value addition

Legumes can be prepared in many ways. They can be canned, dried and fried. Fried beans and dhal make excellent snacks for children.

Preparation and cooking

Some legumes, such as peas and winged beans, can be cooked and eaten with their pods (seed cover), if picked when still very young, although most legume seeds are eaten after being removed from their pods. Peas can be eaten raw, while most other legumes should be cooked and eaten as a vegetable. Soya beans, dhal, lentils, mung beans, kidney beans and winged beans should be left to mature, then dried and stored for food. Winged beans can be a major food source, particularly in areas where other foods are in low supply, as the tuber (root), leaves and flowers can all be eaten, as well as the seeds and young pods.

Because of the high protein content of legumes, they can be used as meat alternatives in stews, soups and main dishes when little meat is available. To have a balanced protein meal, however, it is always best to combine the legumes with whole grain cereal. This will ensure that the types of protein found in legumes will combine with the different types of protein found in cereals to form a complete protein meal. Eaten together, a legume plus a cereal will make a protein rich meal, of equal value to one with meat or fish.

Sprouting

Germinating or sprouting the seeds is a very simple way of growing some legumes. Soak the dried seeds of, for example, the mung bean or pigeon pea for approximately 24 hours, rinse thoroughly and then spread them out on a damp cloth or dish for 48 hours. Try to keep the sprouts in a cool place and away from flies and insects. Another way is to use an empty jar or shallow container. Soak the dried seeds, and then cover the jar with a thin cloth. Rinse the water out regularly. This method will ensure that flies and other insects will not get into the sprouts. Most sprouts will grow to approximately 2.5 cm (1 inch) long.

Recipes

1. Dhal soup

Number of servings: four

Nutrition facts
One serving size: 98 g

Amount per serving
Energy: .....543 kJ (127 kcal)
Fat: .....7.5 g
Carbohydrate: .....6.2 g
Protein: .....6 g
Iron: .....1.2 mg
Sodium: .....11 mg

1½ cups split peas (dhal)
2 tablespoons oil
1 small onion
1 clove garlic
½ teaspoon turmeric
2 cups water

1. Soak the dhal for a few hours or overnight, change the water and boil the dhal until soft.
2. Heat the oil in a pan and fry the onion and garlic until soft.
3. Add the cooked dhal and mix well.
4. Add the water and turmeric and boil for a further 10–15 minutes.
5. Serve hot with rice or root crops.

Note: Spices or a little curry powder (¼ teaspoon) can be added with the onion and garlic to give a spicy flavour.

2. Vegetable hot pot

Number of servings: four

Nutrition facts
One serving size: 307 g

Amount per serving
Energy: .....987 kJ (235kcal)
Fat: .....7.6 g
Carbohydrate: .....33 g
Protein: .....6.6 g
Iron: .....1.9 mg
Sodium: .....77 mg

4 medium-sized sweet potatoes
½ cup dried beans
1 cup green leaves
2 tablespoons oil
2 small onions
2 tomatoes
1–2 cups water

1. Put the beans into a pot and cover with water. Leave to soak for at least 1 hour or overnight.
2. Wash and peel the sweet potatoes and cut into pieces.
3. Chop the onions and tomatoes and fry in oil until soft.
4. Add the beans, sweet potatoes and water.
5. Boil for approximately 30 minutes or until the beans are soft.
6. Add the green leaves and cook for 10 more minutes.
7. Serve hot.

3. Bean cake pudding

Number of servings: four

Nutrition facts
One serving size: 275 g

Amount per serving
Energy: ..... 2902 kJ (691 kcal)
Fat: .....37 g
Carbohydrate: .....74 g
Protein: ..... 14.8 g
Iron: .....4.4 mg
Sodium: .....24 mg

1 cup dried beans
2 cups diluted coconut cream
½ cup sugar
1 cup cassava flour
Softened banana leaves

1. Soak the beans overnight.
2. Pour off the water, and then boil the beans in the coconut cream and sugar until soft.
3. Remove the skins and mash.
4. Add the cassava flour and mix to a smooth paste or a soft dough.
5. Wrap in banana leaves and cook in a moderate oven (180°C or 350°F or) or an earth oven for 1 hour.
6. Cut into portion sizes and serve hot or cold with fresh coconut cream.

Note: You can use aluminium foil or a clean tin or a coconut shell instead of banana leaves.

4. Bean curry

Number of servings: four

Nutrition facts
One serving size: 314 g

Amount per serving
Energy: .....667 kJ (159 kcal)
Fat: .....10 g
Carbohydrate: .....8.4 g
Protein: .....5.2 g
Iron: .....4.6 mg
Sodium: .....23 mg

8 cups green beans, chopped
2½ tablespoons oil
1 clove garlic
2 small onions, chopped
½ teaspoon lemon juice (optional)
1½ tablespoons curry powder

1. Heat the oil in a shallow pan.
2. Fry the garlic and onions.
3. Add the curry powder and stir fry for 1 minute.
4. Add the beans and mix well.
5. Cook for 7–10 minutes until the beans are crisp and bright green.
6. Remove from the heat and serve hot with rice.
7. Sprinkle lemon juice on top.

5. Pacific chow mein

Number of servings: four

Nutrition facts
One serving size: 420 g

Amount per serving
Energy: ..... 1917 kJ (456 kcal)
Fat: .....31 g
Carbohydrate: .....9.7 g
Protein: .....32 g
Iron: .....3.2 mg
Sodium: ..... 416 mg

1 tablespoon soy sauce
1 egg-white beaten with 1 teaspoon of sugar
1 cup chicken (cut into thin strips)
6 tablespoons oil
1 onion
1 clove garlic
1 cup mung bean sprouts
1 cup sliced carrots
2 cups sliced beans (long or string beans)
1 cup Chinese cabbage
1 teaspoon cornflour
1 cup water or stock

1. Mix the soy sauce, sugar and beaten egg-white, and marinate the meat in the mixture for about an hour.
2. Pour off the marinade and set it aside.
3. Stir-fry the chicken, using 4 tablespoons of oil, until it is half-cooked.
4. Remove from the pan and fry the onion and garlic in the rest of the oil for 1 minute.
5. Add the carrots, sliced beans and Chinese cabbage.
6. Add the half-cooked chicken to the vegetables and toss-fry until the vegetables are crispy.
7. Add the bean sprouts and cook for a further minute.
8. Mix the cornflour and water or stock with the remaining soy sauce marinade to a smooth paste, and pour it over the vegetables. Stir for a few minutes until the cornflour mixture thickens.
9. Mix well and serve with root crops or rice.

Note: Chicken can be replaced by fresh fish or other fresh meat.

6. High-fibre scones

Number of servings: six

Nutrition facts
One serving size: 152 g

Amount per serving
Energy: ..... 1607 kJ (383 kcal)
Fat: ..... 9 g
Carbohydrate: .....62 g
Protein: .....13 g
Iron: ..... 0.95 mg
Sodium: ..... 752 mg

2 cups wholemeal flour
2 teaspoons baking powder
2 tablespoons butter or margarine
1 cup bean sprouts
2 tablespoons grated cheese
½ cups milk

1. Sift the flour and baking powder into a bowl.
2. Cut the butter into small pieces and rub into the flour mixture.
3. Stir in the bean sprouts and cheese.
4. Gradually add the milk and mix slowly, using a round-bladed knife, until the dough is soft.
5. Turn the dough onto a floured surface and knead lightly.
6. Cut into squares or rounds, place on a greased baking tray and bake in a hot oven (220°C or 425°F) for 12–15 minutes.
7. Leave to stand for 5 minutes.
8. Serve hot.

7. French beans au gratin

Number of servings: four

Nutrition facts
One serving size: 400 g

Amount per serving
Energy: .....580 kJ (138 kcal)
Fat: .....2.7 g
Carbohydrate: .....7.7 g
Protein: .....14 g
Iron: .....4.7 mg
Sodium: .....369 mg

4 cups French beans
3½ cups mushrooms (sliced)
6 tomatoes (sliced)
2 tablespoons grated cheese
Salt and pepper to taste

1. String the beans and cut them into halves.
2. Place them in a baking dish.
3. Sprinkle the sliced mushrooms over the beans and season with salt and pepper.
4. Add the tomatoes, cover with a lid and bake in a moderate oven (180°C or 350°F) for about 20 minutes.
5. Remove the lid, sprinkle with cheese and cook for a further 5 minutes without the lid.
6. Serve hot.

8. Bean stew

Number of servings: four

Nutrition facts
One serving size: 414 g

Amount per serving
Energy: ..... 1546 kJ (368 kcal)
Fat: .....15 g
Carbohydrate: .....49 g
Protein: ..... 8 g
Iron: .....2.4 mg
Sodium: ..... 112 mg

8 sweet potatoes
½ cup dried beans
1 cup green leaves
4 tablespoons dripping
4 spring onions
4 tomatoes
1 or 2 cups of water.
Salt to taste

1. Wash and peel the sweet potatoes. Cut into pieces.
2. Put the beans into a pot and cover with boiling water. Leave to soak for at least 1 hour.
3. Remove the skins from the beans.
4. Wash the spring onions and tomatoes. Chop into small pieces.
5. Fry the onions and tomatoes in the dripping until soft.
6. Add the beans, salt and sweet potatoes. Add the water.
7. Boil until the beans are soft (about 30 minutes).
8. Add the green leaves and cook for 10 more minutes.
9. Serve hot or cold.

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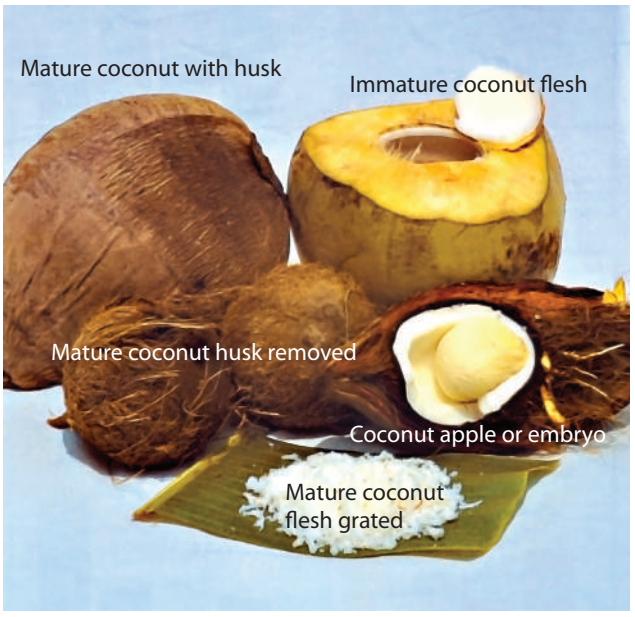
Coconut

Leaflet No. 16 - Revised 2012

Introduction

Coconut, or *Cocos nucifera* to give the scientific name, is also known as *niu* and *ben* and is a valuable staple food throughout the Pacific region, especially for atoll islanders. The coconut tree is tall, with a long trunk and a crown of leaves. These long, fan-shaped fronds surround the growing point of the tree, the heart of palm. Coconuts grow on stalks from inside the base of the leaves.



The tree is referred to as the 'tree of life' or 'divine tree' due to its value in society. Apart from its value as food, it also provides wood for building, material for weaving, leaves for shelter, oil for cooking and, when dried, copra. The tree is an important source of income for rural families. As coconut trees can survive with little care, have a long life (70 to 80 years), and grow throughout the Pacific, the coconut will continue to be valuable in the region.

Major types of coconuts and edible parts

There are many varieties of coconut trees — tall, dwarf and hybrid. Tall varieties often live for 70 years or more. Many varieties have local names that refer to their main use or appearance.

Design and layout: Muriel Borderie - SPC Publications Section

Figure 1: Coconuts *(Cocos nucifera)* and edible portions

a) Unhusked immature

b) Husked immature

c) Mature flesh or meat, cut open

d) Germinating, cut open

e) Virgin coconut oil

Dwarf varieties flower three or four years after planting and because they are low-bearing they are easy to harvest. The ***tall varieties*** flower after about eight years. Some varieties have large nuts, while others have many small ones. Other differences include outer surface colour and the amount of juice and flesh. One variety is known for its edible husk, which is chewed and sucked, both raw and cooked.

Generally, all varieties of coconut tree bear nuts all year round. The nuts grow from flowers produced in the axils of the leaves. They can be harvested when young or left to ripen and fall. It takes about a year after the tree flowers for the nuts to mature. Coconuts are mature when the juice inside can be heard when the coconut is shaken.

There is a close connection between the health of the leaves and the number of coconuts. Taking good care of coconut trees and not removing too many leaves for other uses will generally result in more coconuts.

Edible portions of coconuts
Coconuts are consumed at different stages (Figure 1) and in many different ways.

Immature (or drinking) coconut
The outer surface of the husk of these young nuts is either green or orange, as shown in Figure 1a.

Coconut juice
Coconut juice, or coconut water, is the liquid present inside the immature coconut, which is used as a drink.

Immature flesh or coconut jelly
This is the jelly-like white flesh inside the very young drinking coconut. It can be eaten as a snack or used in salads and other dishes. Older drinking coconuts have firmer, white flesh. Various local terms are used to describe the flesh of drinking coconuts at different stages.

Mature coconuts
These older coconuts have a brown outer surface on the husk.

Mature coconut juice
This is the small amount of liquid present in mature coconuts, which can be drunk.

Mature flesh
The flesh of mature coconuts is a thick layer of firm, white meat. It is eaten as a snack or grated and used in cooking.

Coconut cream
Coconut cream is the concentrated emulsion obtained from squeezing or pressing the mature, grated coconut flesh without adding water. This thick cream has a higher concentration of fat than coconut milk and is normally used in the cooking of *palusami* (refer to the recipe section of the Taro Leaflet).

Coconut milk
If water is added to the grated coconut, we get *coconut milk,* which has a lower concentration of fat than coconut cream, depending on the amount of water used.

Coconut cream and coconut milk are used in many popular recipes in the Pacific region.

Coconut oil and virgin coconut oil
Coconut cream and coconut milk are also made into *coconut oil* (CO) and *virgin coconut oil* (VCO) respectively which are used in cooking and some non-food uses. The difference between CO and

Immature coconuts

Mature coconuts

VCO is their colour, as a result of different method of production; VCO is usually colourless while CO is yellowish or brownish, because of the high temperatures used in production. VCO is commonly used in fried and baked products in place of vegetable oil and margarine. Apart from cooking, coconut oil is also used as a body oil, to which fragrance extracted from various local leaves and flowers is added. Traditionally, coconut oil is prepared by gently boiling coconut cream until only the oil remains. VCO is produced mechanically by drying grated mature coconut in the sun, or at a controlled temperature at very low heat, and then extracting the oil by using mechanical pressure. Another common method used to produce VCO is the wet method, in which the coconut milk is fermented.

Coconut meal

Coconut meal is the byproduct produced after coconut cream or milk is squeezed out. When dried and ground, the meal produces *coconut flour* (refer to dried grated coconut (page 7 and recipe 5). Wet coconut meal is used as animal feed or fermented into *kora* ,which is commonly used in traditional condiments. Unfortunately, the nutritional content of *kora* has not been analysed, but because it is produced through fermentation, it is believed to have high levels of the B vitamins, especially B_1, thiamine.

Another coconut product made from mature flesh is *copra.* Copra is made from dried mature flesh which is processed for sale, and used for commercial production of soap, detergent and other skin care products.

Sprouted coconut

When a coconut begins to sprout or germinate, it is called *sprouting* or *germinating coconut*. A spongy, sweet, white mass of tissue, the *coconut apple*, forms inside the nut cavity. It absorbs the endosperm or meat during germination**.** The coconut apple can be eaten raw, cooked as a snack, and cut up or mashed for use in different recipes.

Coconut toddy

Toddy is produced by binding and cutting a newly formed coconut bud. Paper-thin shavings are sliced off twice a day so that the dripping sap continues to flow. The sap (about half a litre each day) is collected in either a specially prepared coconut shell or a bottle, which must be kept very clean. The fluid may be drunk fresh, cold or heated. If concentrated by boiling it down, it becomes a syrup called *toddy*. It can also be fermented to make an alcoholic drink or vinegar. Fresh toddy is an excellent drink for both infants and older children. For infants, it can be used to complement breast milk after six months of age.

Heart of palm
The heart of palm is the central area of the palm (2–3 kg/palm), from which the leaves and flowers grow. Because removing it will kill the tree, it is eaten only rarely as coconut palms are so precious. It is eaten as a snack or made into a salad, sometimes called 'millionaire's salad'.

Other uses of coconuts
Other parts of coconut trees are used by people around the world. Oils pressed from copra are used in soaps, cosmetics, and hair oil. The husks are used for firewood, and cocopeat for potting mix. The fibres from coconut husks are used to make mats, mattresses and rope. Coconut shells are used for utensils, cups, bowls, bottles, lamps, buckles and ornaments. Coconut leaves are used to make mats, baskets, hats, brooms, fans and thatching. Palm mid-ribs make fences, walls, tongs, toys and whistles. The trunks are very hard wood that makes excellent timber for furniture and fence posts. Charcoal is made from any waste trunks and shells.

Nutrient content

The nutrient content of the coconut is different at each stage of development. The different parts consumed at various stages are: *immature* or drinking coconuts, including immature flesh (jelly) and immature coconut juice; *mature* coconuts, including mature flesh, coconut oil and mature coconut juice; *sprouted* coconuts, including coconut apple; and other parts or products made from coconuts, including *coconut toddy, heart of palm* and *fermented meal* .

Immature coconuts
The different parts of an immature coconut commonly consumed include the flesh (jelly) and coconut juice. They are both nutrient rich and contain Vitamin C, as shown in Table 1. The energy values are reasonably low due to the low fat contact, lower than that of their mature counterparts. Coconut juice is rich in important electrolytes such as sodium, potassium and phosphorous, and thus is an excellent drink for children and sportsmen.

Mature coconuts
The different parts of a mature coconut commonly consumed are the mature flesh from which coconut cream and coconut milk are extracted. As a coconut matures, the energy content of the flesh increases due to its increasing fat content. The high energy content enables the extraction and production of coconut oil.

Fat content
Coconut cream and coconut oil, especially VCO, contain primarily saturated fats (about 92%) and unsaturated fats (about 8%). However, 62% are medium chain fatty acids (MCFAs): the higher the MCFA content, the healthier the fat, even though it is saturated. More than 50% of these MCFAs comprises lauric acid. The body converts lauric acid into monolaurins, which are especially important in newborn babies for the development of their immune system. Monolaurins are found only in breast-milk and coconut oil. Because of its lauric acid content, coconut oil is used in the production of breast milk substitutes or formula milk, as it is easily digested, and is an important energy source for infants whose digestive systems are not yet fully developed.

Because much of the saturated fat of coconut oil is in the form of lauric acid, coconut oil may be a better alternative than partially hydrogenated vegetable oil when solid fats are required. In addition, virgin coconut oil is composed mainly of medium-chain triglycerides, which may not carry the same risks as other saturated fats. Virgin coconut oil has a different health risk profile. However, it is important to note that, because coconut oil is a rich source of dietary energy, consuming a large amount will provide a fair amount of calories, which will be stored as fat if not used by the body. Used in moderation, however, coconut oil, especially virgin coconut oil, may ultimately be shown to be a healthy food.

Sprouted coconut
The *coconut apple* (Table 1 and Figure 1d) is also nutrient rich, and includes vitamin C as it absorbs nutrients from the flesh or endosperm in order to germinate. It is thus a suitable food for children.

Coconut toddy
Toddy can be taken fresh or fermented. Fresh toddy is high in energy mainly due to its high carbohydrate content and high vitamin C levels. Fresh toddy makes a good drink for both infants and older children. For infants, it can be used to complement breast milk after six months of age.

Coconut toddy can also be fermented to make an alcoholic drink or vinegar that is rich in vitamins B_1 (thiamin), B_2 (riboflavin), and niacin. Yeast cells that grow in fermented food contain these vitamins. Vitamin B and niacin help the body to convert carbohydrates into energy and heat. Vitamin B_2 is necessary for normal growth and healthy eyes.

Heart of palm

The heart of palm is basically the young part of leaves and flowers. They have fair amounts of vitamin C. Vitamin C keeps the body tissues strong, helps the body use iron, and aids in chemical actions in the body.

Table 1: Nutrient content of 100 g of coconut products

Food name	Energy	CHO	Protein	Fat	Fibre	Calcium	Iron	Vit A	Vit C	Vit E	Thiamin	Riboflavin	Niacin	Zinc
	(Kcal)	(g)	(g)	(g)	(g)	(mg)	(mg)	(ug)	(mg)	(mg)	(mg)	(mg)	(mg)	mg
Coconut, flesh, immature	81	3.8	1.8	0.2	5.9	2	1.3	0	3.8	0.2	0.11	0.02	3.6	0.4
Coconut, flesh, mature	283	3.6	3.0	27.4	7.6	10	1.1	0	2.0	0.6	0.02	0.02	0.6	0.6
Coconut, flesh, fresh, mature	398	3.5	4.0	40	7.3	14	2.2	0	7.0	0.7	0.04	0.01	0.6	0.5
Coconut water only, immature	16	3.9	0.1	0.0	0.0	12	t	0	1.4	0.0	t	t	2.8	t
Coconut water, cavity fluid	22	4.9	0.3	0.2	0	29	0.1	0	2.0	t	0	0	0.1	0.2
Coconut, embryo germinating	74	8.5	1.3	3.6	1.8	19	0.7	0	6.0	na	0.02	0.16	0.9	na
Coconut cream, fresh, no water	325	4.7	4.4	32.3	1.7	15	1.8	0	1.0	0.6	0.02	0.01	0.5	1.0
Coconut cream, water added	254	5.2	3.2	24.9	t	16	1.6	0	3.0	0.2	0.03	0.01	0.8	0.7
Coconut oil, refined and deodorised	883	0	T	99.9	0	2	t	t	0	0.7	t	t	t	t
Coconut toddy, boiled	217	49.4	0.9	2.1	0	T	t	t	20.2	na	0.05	t	t	t
Coconut toddy, fresh	42	9.6	0.2	0.4	0	T	t	t	20.0	na	t	0.02	0.2	t
Coconut toddy, slightly fermented	27	6.0	0.2	0.3	0	T	t	t	26.0	na	t	t	0.5	t
Softdrink, cola	43	10.9	0	0	0	T	0	0	0	0	0	0	0	0

Sources: [1]Dignan et al. 2004, [2]Englberger et al. 2003a;[3] Englberger et al. 2005b.
Abbreviations: CHO, carbohydrate; na, not available; t, trace, T, ; vit, vitamin.

In general, drinking green coconuts and toddy is good for Pacific people, because they are inexpensive and contain other nutrients in addition to energy. High protein foods, such as meat, fish, eggs, beans, and leafy vegetables, should be eaten with coconut for a balanced diet. Eating coconuts as part of a balanced, healthy meal helps Pacific people to stay healthy. For example, people who are sick with diarrhoea can drink green coconut water to regain fluids and minerals that have been lost. In emergencies, doctors have used coconut water as an intravenous fluid. Fermented coconut is a good food for pregnant women because it supplies the vitamins they need. Also, coconut cream is an energy food; it is a good addition to baby foods because a small amount supplies much energy.

Functional properties

Coconut oil is regarded as a functional food which is attributed mainly to the high levels of lauric acid it contains and its potential antibiotic properties, which have been found to render some viruses, bacteria and fungi inactive. Capric acid is the other medium-chain fatty acid found in coconut oil. It contributes to the functional properties of coconut. Studies have also shown that VCO has higher levels of total phenolics than refined coconut oil.

Although many health claims have been made for coconut oil, we still have limited concrete scientific evidence to support these. This is an area of interest for further research, not only the health benefits of coconut oil but also its economic and commercial value. Early studies on the health effects of coconut oil used partially hydrogenated coconut oil, which creates trans fats.

Storage and preservation

Many food products are prepared from the edible portion of coconuts. Listed below are the major preparations and preservations.

Fresh toddy can be preserved by concentrating it through evaporation. The higher the concentration of sugar, the longer the shelf life. Fresh toddy is mixed with flour to form dough for making bread. Another product made from toddy is *vinegar,* which is prepared by fermenting the toddy to an acid stage. It is used in recipes requiring vinegar and to flavour foods.

Palm syrup, a sweetener, is made by boiling toddy until it is thick. It can be mixed — four parts water to one part palm syrup — to make a sweet drink. Using palm syrup makes buying expensive imported drink mixes unnecessary.

Caramel-like sweets can be made by boiling the toddy until it crystallises. Even though it is not a good idea to eat a lot of sweets, these can take the place of expensive sweets from the store.

Coconut cream is the rich liquid that is squeezed out of grated coconut. Squeezed grated coconut, with only a little added water, makes thick coconut cream. Thin coconut milk is made when more water is added to the grated coconut before squeezing. Coconut cream can be frozen or canned. Grated coconut flesh (meal) can be frozen. Pack tightly in plastic bags before freezing. Another way of preserving coconut meal is to dry it in a very slow oven, or by using the sun-drying method, described next.

Dried grated coconut

1. Grate a mature coconut.
2. Put the grated coconut onto a tray and put it in the sun to dry or use a solar dryer or dehydrator.
3. Dry it for 1 to 2 days, turning it regularly so that it dries evenly. It should feel dry.
4. Dried grated coconut will keep for several weeks if stored free from moisture. It can be used for baking or in fruit salads.
5. Pounded dried grated coconut makes coconut flour, which makes healthy scones and bread.

Value addition

Coconuts can be incorporated into many products, including *coconut flour* from dried grated matured coconut flesh. Coconut flour is rich in protein and makes very good scones and bread. *Virgin coconut oil* (VCO) is the healthy oil extracted from mature coconut flesh and now often replaces vegetable fats in cooking and baking. *Coconut spread* can also be made from immature flesh and VCO.

Issues about coconuts

When the heart of palm is removed and used in salads, the coconut tree dies, because the heart is the tree's growing centre. Likewise, making toddy reduces the production and development of coconuts to maturity. Similarly, eating coconut apples from the germinating nuts may hinder the growth of the young coconuts. Therefore, any commercial production of these edible coconuts parts needs to be carefully considered, in order not to risk over consumption.

Preparation and cooking

In some places the *heart of palm* is boiled for use in salads.

Toddy is made by binding and cutting a newly formed coconut flower bud in a special way, as explained above. It is drunk fresh, used as a flavouring, and saved for other uses. If allowed to ferment, an alcoholic beverage is made.

Part of the coconut *husk* of a variety of coconut tree found in some parts of the Pacific can be eaten. People chew the sweet, soft husk. The small nuts are also eaten. Children like this sweet-flavoured treat.

The juice from *green nuts* is used for drinking and making soups. If someone has diarrhoea, drinking coconut juice replaces fluids and minerals that the body has lost. The flesh of green nuts is soft and spongy, making an excellent baby food.

Half-ripe coconuts have a layer of soft, easily digested flesh. It is can be sliced and eaten, or chopped and used in other dishes.

Mature coconut flesh has many uses. It can be eaten plain. Dried, it makes a delicious snack. Fermented, it has vitamins that pregnant women need. Grated, it is cooked or squeezed to make coconut cream. Coconut cream flavours fish, seafood and vegetables cooked in it.

Fermented ripe nuts have a tough flesh that is sour and oily. People who eat it enjoy the special flavour.

Germinating nuts are ones that fall to the ground and sprout. The water becomes a cotton-like mass. It is eaten raw, alone, or with the flesh of the coconut. Sometimes it is scraped out, mixed with toddy, and eaten with fish. It may be removed and boiled or baked, or the husked nut may be baked whole. It makes a soft food for babies and elderly people.

Recipes

1. Prawns in coconut shells

Number of serving: four

Nutrition facts
One serving size: 313 g

Amount per serving
Energy: ..... 1545 kJ (368 kcal)
Fat: .....21 g
Carbohydrate: .....9.4 g
Protein: ..... 33.8 g
Iron: .....2.5 mg
Sodium: ..... 624 mg

500 grams (1 lb) prawns or shrimp (about 15)
1 small green pawpaw
2 mature coconuts
salt

1. Boil the prawns in 1 cup salted water for 5 minutes. Save the prawn water. Shell and remove the heads from the prawns. Chop the flesh.
2. Grate the coconuts and save the shells. Prepare the coconut cream, using the prawn water.
3. Wash the pawpaw thoroughly, about three times to remove the sticky sap. Grate or chop into small pieces after removing the seeds.
4. Put the pawpaw in the coconut shells with the prawns and coconut cream.
5. Cover with a banana leaf or grease-proof paper. Bake 1 hour in an earth oven or regular oven.
6. Serve in the same shell.

2. Toasted coconut chips

Number of servings: four to six

Nutrition facts
One serving size: 67 g

Amount per serving
Energy: ..... 1109 kJ (264 kcal)
Fat: .....27 g
Carbohydrate: .....2.3 g
Protein: .....2.7 g
Iron: .....1.5 mg
Sodium: .....11 mg

1 mature coconut

1. Cut the coconut in half.
2. Place the coconut in the hot sun, solar dryer or copra dryer.
3. When partially dry, remove the coconut flesh from the shell. Remove the thin brown peel.
4. Slice very thinly and spread on a shallow baking pan.
5. Place in the hot sun or in a solar dryer.
6. Dry for 1 or 2 days or until no moisture is left. Stir several times.
7. Keep in a container or wrapping that will keep it free from moisture.
8. Serve as a snack for children or as an appetiser.

3. Coconut sauce for fish

Number of servings: ten

Nutrition facts
One serving size: 65 g

Amount per serving
Energy: .....898 kJ (214 kcal)
Fat: .....20 g
Carbohydrate: .....1.8 g
Protein: .....5.6 g
Iron: .....1.2 mg
Sodium: .....81 mg

2 mature coconuts, finely grated
4 cooked prawns or shrimps
¼ cup seawater

1. Shell and remove the heads of the shrimp or prawns. Wrap them in a muslin cloth.
2. Crush the wrapped prawns or shrimps into the finely grated coconut, using a rock. Occasionally dip in seawater and continue to crush until nothing is left inside the cloth. Mix well.
3. Line a bowl with softened banana leaves. Pack the coconut mixture into the bowl and cover it with another banana leaf. Use the coconut shells to hold down the leaves.
4. Leave overnight.
5. Chillies may be used as flavouring.
6. Serve in the shells as a sauce with fish.

Note: This sauce must be used the day after it is made as it does not keep well.

4. Green coconut drink

Number of servings: ten

Nutrition facts
One serving size: 201 g

Amount per serving
Energy: ..... 136 kJ (32 kcal)
Fat: ..... 0.01 g
Carbohydrate: ..... 8 g
Protein: .....0.2 g
Iron: ..... 0.01 mg
Sodium: .....12 mg

6 green coconuts
4 lemon leaves

1. Halve the green coconuts.
2. Pour the coconut water into a bowl, saving the shells.
3. Scoop the flesh out of the coconuts into the bowl and mix it with the coconut water. Prepare fibres from the inside of the coconut palm mid-rib to whip it. Cut the fibres very thin. They are stiff and act like a blender to cut the coconut flesh. Whip the water and flesh until the flesh is cut into small pieces.
4. Put the mixture in a pot and bring to the boil. Add the lemon leaves and then simmer gently for 15 minutes.
5. Serve hot or cold, using the coconut shells as a cup.

Note: This is an excellent drink for nursing mothers and young babies.

5. Coconut flour pancakes

Number of pancakes: 12 large or 24 small

Nutrition facts
One serving size: 59 g

Amount per serving
Energy: .....626 kJ (149 kcal)
Fat: .....11 g
Carbohydrate: .....7.6 g
Protein: .....4.9 g
Iron: .....0.4 mg
Sodium: .....70 mg

½ cup coconut flour (see *Dried grated coconut* on page 7 for coconut flour method)
½ cup wheat flour
pinch salt
3 eggs
2 tablespoons butter, melted
1½ cups milk

1. Stir the coconut flour, wheat flour and salt together.
2. Beat the eggs into the flour mixture, one at a time, beating well after each addition.
3. Melt the butter, blend with the milk and slowly beat into the flour mixture. Leave to stand for 2 hours.
4. Lightly oil a very hot frypan (cast iron is best).
5. Pour ¼ cup of batter into a large pan or 2 tablespoons into smaller one.
6. Tilt the pan around until the batter is evenly distributed and ceases to run. When dry on top with fine bubbles, flip over with a spatula or fish slice.
7. Cook for 1 more minute. Remove to a wire rack to keep warm.

6. Coconut husk snack (Apior from Pingelap, Pohnpei, Federated States of Micronesia)

1 husk of a coconut variety with edible husks
1 coconut, grated with water into a bowl.

1. Remove the outside skin of the coconut.
2. Separate the coconut husk into bite-size pieces.
3. Put 1–2 tablespoons of grated coconut into each piece of coconut husk.
4. Wrap up and tie off each bite-size piece of filled husk.
5. Chew the pieces, sucking the husk.

7. Sprouted and drinking coconut salad
(Dalok from Pingelap)

Nutrition facts
One serving size: 475 g

Amount per serving
Energy: .....898 kJ (214 kcal)
Fat: .....11 g
Carbohydrate: .....23 g
Protein: .....3.8 g
Iron: .....2.3 mg
Sodium: ..... 257 mg

sprouted coconuts
juice of 2 drinking coconuts
soft flesh of 2 drinking coconuts

1. Remove the embryo inside the sprouted coconut and place it in a bowl or plastic container.
2. Add the coconut juice.
3. Spoon out the soft flesh of the young coconut and add to the embryo and coconut juice.

Note: Some people add sugar and condensed milk. However, it is best to avoid these sweet foods because excessive refined sugar is not healthy.

8. Mayonnaise - Coconut
(RMI Wellness Centre)

Nutrition facts
One serving size: 102 g

Amount per serving
Energy: .....864 kJ (206 kcal)
Fat: .....18 g
Carbohydrate: .....8.7 g
Protein: .....1.2 g
Iron: ..... 0.86 mg
Sodium: .....24 mg

2 cups young coconut flesh (from 2 young coconuts)
2 tablespoons coconut water
2 tablespoons lemon or lime juice
2 tablespoons coconut toddy or honey
½ teaspoon salt
¼ cup oil

1. Put all the ingredients, except the oil, into a high-powered blender and blend until smooth.
2. Add the oil in a steady stream, while continuing to blend until emulsified.
3. Store in an airtight container in the refrigerator for up to one week.

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Nuts and Seeds

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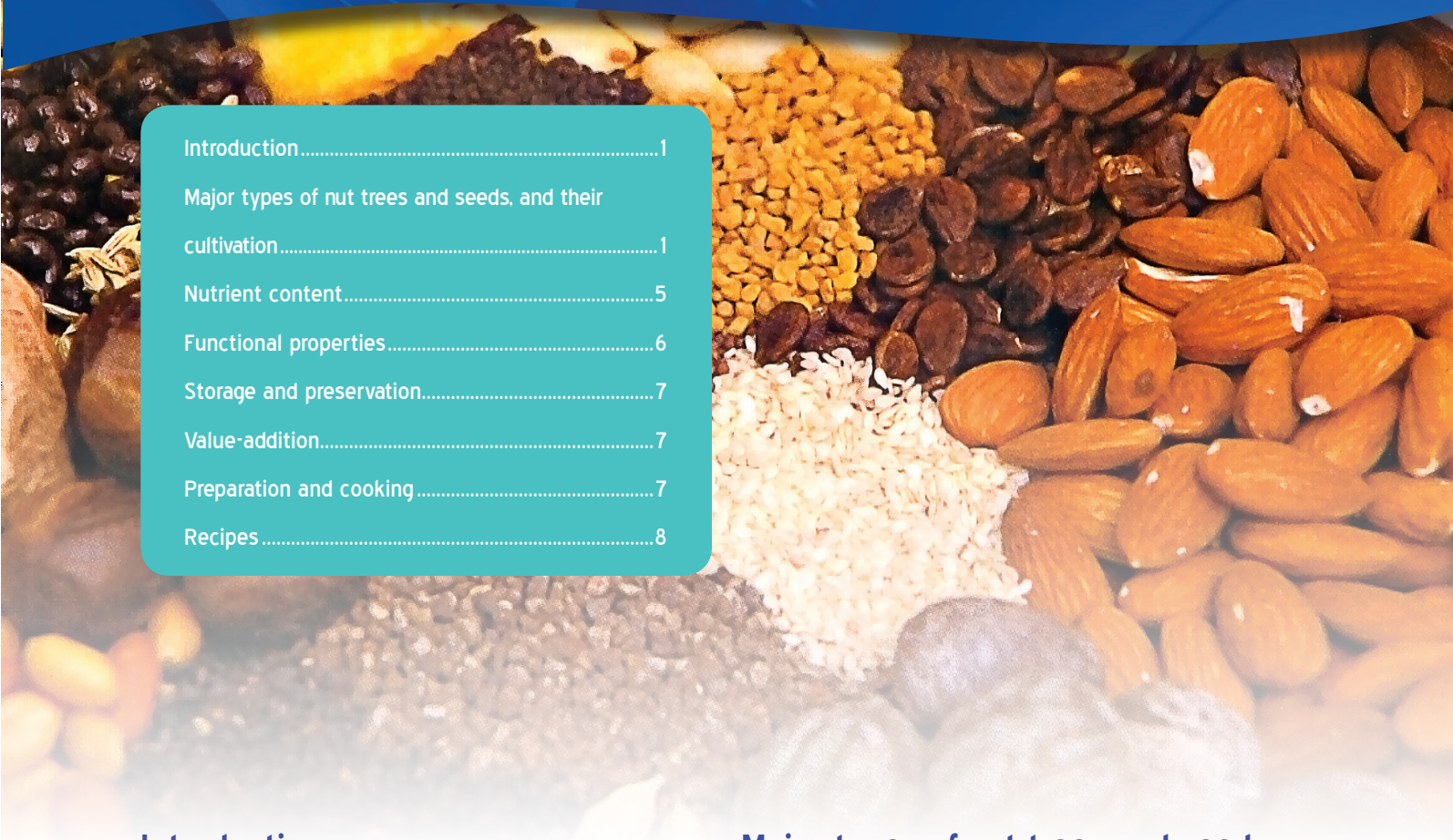


Introduction

Many varieties of nuts and seeds are grown and eaten in the Pacific. They range from the most common and widely used nuts, such as coconuts, to others such as kauris (*Agathis* species) eaten in certain areas of New Caledonia, ngali nuts (*Canarium* species) in the Solomon Islands, navele (*Barringtonia* species) in Vanuatu, Tahitian chestnut (*Inocarpus edulis*) in Fiji and several varieties of pandanus in Papua New Guinea and on atolls such as Marshall Islands, Kiribati, Tokelau and Tuvalu.

Some nuts and seeds can be eaten raw, such as pandanus nuts and ngali nuts, while others need to be soaked in water or cooked before eating. Whatever the method of preparation used, edible nuts and seeds are an excellent food resource for family meals and snacks, and are very useful in times of food shortages.

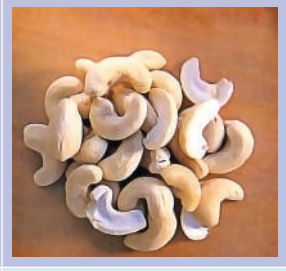
Major types of nut trees and seeds, and their cultivation

Many different types of edible nuts and seeds are available in the Pacific Island countries as shown in Tables 1 and 2. Nut trees and seeds are easy to grow and harvest. They do not need a lot of care while growing. Some can be grown from seeds, others from stem, branch or root cuttings. Many grow 'wild' throughout the Pacific, but unfortunately are often removed during bush clearing. Traditional methods of growing nut trees are still practised in some areas. Some trees may take a long time to mature, but once they are ready, they can provide food for a very long time. Large trees such as the Tahitian chestnut may also provide shade to other crops in the garden.

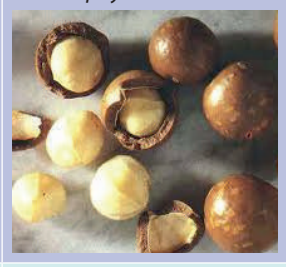
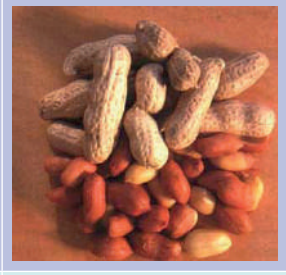
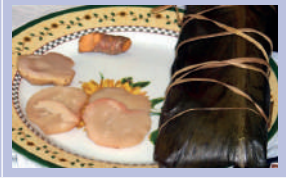
Nuts trees are particularly useful because they are more resistant to bad weather conditions and pests than other types of plant foods.

Design and layout: Muriel Borderie - SPC Publications Section

Table 1: Some edible nuts found in the Pacific

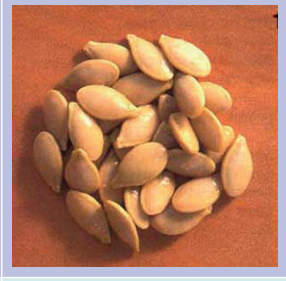
Common names	Scientific name	Description	Food value, preparation, uses
1. Candlenut *Cook Islands,* tuti; *Fiji,* sikeci; *French Polynesia, Tonga,* tuitui; *New Caledonia,* tai; *Papua New Guinea,* kemiri.	*Aleurites moluccana* 	Large tree, with pale green leaves and small, greenish-white flowers; fruit contain shelled seed.	Good source of oil, protein, calcium and vitamin E; nut roasted and eaten as a snack or added to desserts, cakes and pies.
2. Cashew nut *Cook Islands,* aratita popaa; *Northern Marianas, Samoa,* apuinitia.	*Anacardium occidentale* 	Medium or small tree with yellowish to purplish fruit containing a single seed or nut.	Good source of oil, protein, iron, zinc and vitamin B complex; roasted and eaten as snack or added to cakes, desserts, etc.
3. Coconut *Cook Islands,* nu; *Fiji, Niue,* niu; *French Polynesia,* hakari; *Guam, Northern Marianas,* niyog; *Kiribati,* ben te-ni; *Marshall Islands*, mere; *Palau,* lius; *Ponape,* mangas; *Samoa,* popo; *Truk.,* spun, nu; *Tuvalu,* fuaniu.	*Cocos nucifora* 	Tall palm-tree with long trunk and crown of leaves, with nuts growing on stalks from inside base of leaves.	Good source of oil, vit E and fibre; processed food: biscuits, cakes, pastries; good snack, fresh, or grated; cream extracted and used with Pacific foods--root crops and vegetables.
4. Cut nut *Fiji,* vutu; *Niue,* ʻai; *Papua New Guinea,* pau; *Solomon Islands,* fala; *Tonga,* ʻai; *Vanuatu,* navels; *Wallis & Futuna,* vutu kai.	*Barringtonia edulis* 	Large fruit-bearing tree mostly grown in coastal areas; oval fruit, green or dark purple on outside with edible nut when mature.	Good source of energy, fat, fibre and vit C; good snacks for children, mostly eaten raw but can be cooked.
5. Indian almond, Java almond, beach almond *Cook Islands*, kauriki; *Fiji,* tavola; *Kiribati,* te kunikuna, te tarin; *Kosrae,* sarf; *Niue,* telie; *Northern Mariana Islands*, talisai; *Palau,* miich; *Papua New Guinea,* klis; *Samoa*, *Tuvalu,* talie; *Solomon Islands,* talise; *Tonga,* telie; *Tuvalu,* talie; *Vanuatu,* natavoa; *Yap,* kal.	*Terminalia catappa* 	Large branching tree, leaves usually red; fruit contains small edible nut.	Good source of energy, fat, protein, fibre, vit E, calcium and zinc; outside part of fruit can be eaten when ripe; seed used as a snack or added to cakes and desserts.

Nuts and Seeds

6. Macadamia nut*	*Macadamia integrifolia, M. tetraphylla* 	Large tree with round, hard, thick-shelled nuts.	Good source of energy, fat and calcium; eaten raw or roasted.
7. Pandanus nut *Cook Islands*, *French Polynesia,* 'ara; *Kiribati,* te-kaina*; Niue,* fa; *Papua New Guinea,* karuka; *Ponape,* fahs; *Solomon Islands*, fau; *Tokelau,* fala; *Tonga*, fa; *Tuvalu, Wallis & Futuna,* fala.	*Pandanus tectorius P. julianetii, P. conoideus, P.* spp 	Spiky-leaved palm trees, commonly growing on atolls.	Good source of energy in the form of fat, vitamin A and niacin; nuts eaten raw, cooked, roasted or smoked.
8. Peanut, monkey nut, *Cook Islands, French Polynesia,* aratita.	*Arachis hypogaea* 	Low-growing, small plant bearing seed pods underground.	Very good source of fat, protein, fibre, calcium and niacin; roasted and eaten as snack; used in soups and stews; ground and added to cakes and desserts; excellent snack food for children.
9. Pill nut *Papua New Guinea,* galip nut, kanari; *Samoa,* lama; *Solomon Islands*, ngali; *Vanuatu,* nangai.	*Canarium* species 	Large forest tree bearing fruit with fairly large, hard-shelled seed inside.	Good source of energy in the form of fat, protein, calcium and vitamin E; eaten raw, roasted or baked in earth oven; can be stored for a long time.
10. Tahitian or Polynesian chestnut* *Cook Islands,* I'i; *Fiji,* ivi; *French Polynesia,* ifi; *Kosrae,* clark, hi; *Papua New Guinea,* 'aila; *Ponape,* marap; *Samoa,* ifi; *Solomon Islands*, ipie; *Vanuatu,* namambe.	*Inocarpus edulis; I fagiferus* 	Very large tree, bearing kidney-shaped fruit with edible kernel or seed.	Good source of energy, carbohydrate, calcium and vitamin C; can be boiled and baked in earth ovens.

Source: *Food Technology in Australia 34(10) October 1982.
Notes: Common names are those of the plant, not the seed.

Table 2: Some edible seeds found in the Pacific

Common names	Scientific name	Description	Food value, preparation, uses
1. Breadfruit seeds *Cook Islands*, kuru; *Fiji,* uto; *French Polynesia,* maiore uru; *Kiribati*, mai; *Niue,* me; *Ponape,* mai kole; *Samoa,* 'ulu; *Tonga, Tuvalu*, *Wallis & Futuna,* mei; *Yap,* su.	*Artocarpus edulis* 	Large evergreen tree up to 20 metres high. Some varieties bear fruit containing the edible seeds.	Roasted or boiled. Good source of carbohydrate, calcium, vitamin C and niacin.
2. Red bead *Cook Islands,* matako-viriviri; *Niue,* poumea; *Samoa*, lopa; *Tonga,* lopa.	*Adenanthera pavonina* 	Large tree with tiny, pale green leaves.	Good food value; mature seeds eaten raw or roasted and used as a children's snack.
3. **Pawpaw seeds, papaya** *Cook Islands*, vi ninita; *Fiji,* maoli, weleti; *French Polynesia,* i'ita; *Kiribati,* tebabaia; *Kosrae,* es; *Marshall Islands,* geinapu, keinabu, mohmiyap; *Papua New Guinea,* paipai; *Tokelau,* esi; *Tonga,* lesi; *Tuvalu,* olesi.	*Carica papaya* 	Erect, tall palm-like tree with large green leaves on long stalks; fruit containing the seed grow on short stalks at base of leaves.	Good food value; freshly chopped or mashed can be used in salad mixtures.
4. Pumpkin seeds *Cook Islands,* motini; *Guam,* amasa; *New Caledonia,* wajei; *Tonga*, hina.	*Cucurbita maxima* 	Trailing or climbing herbs with flat oval shaped seeds inside pumpkin fruit.	Good source of oil, carbohydrate, protein, calcium, vitamin E and zinc; cooked; deep- fried and used in soups, sauces; give a nutty flavour.
5. Watermelon seeds *New Caledonia,* kavé paaka.	*Citrullus vulgaris* 	Trailing or climbing vines with small yellow flowers.	Seeds contain edible oil; eaten raw or ground and added to desserts, cakes. High in fat, carbohydrate, protein, calcium, vitamin E and zinc.

Source: *Food Technology in Australia 34(10) 1982.
Notes: Common names are those of the plant, not the seed.

Nutrient content

Nuts and seeds are nutritious and can be regarded as a complete food because they usually contain enough of the essential nutrients that we need — energy from oils and fats, proteins, vitamins and minerals.

They are an excellent source of *energy* which the body needs to stay active. This energy is mainly in the form of fats and oils. Nuts and seeds can help supplement the starchy roots and tubers that make up a large part of the traditional Pacific Island diet. In some areas, such as the remote New Guinea highlands, nuts and seeds are highly valued and are often eaten as a staple food, providing the major source of energy in the diet.

Nuts and seeds are also very good sources of *protein*. When mixed with other fruits and vegetables, nuts and seeds help to improve the quality of meals, particularly when there is very little meat or fish available. Protein is needed to help the body grow and stay healthy.

Most edible nuts and seeds provide very good sources of vitamins, particularly the B vitamins — *vitamin* B_1 (thiamin), *vitamin* B_2 (riboflavin) and *niacin*. These vitamins are very important, as they help to release the energy from food so that it can be used by our body.

Nuts and seeds also contain lots of minerals, particularly *calcium* and *iron*. Calcium helps to make strong bones and teeth and iron helps keep our blood strong and healthy.

Table 2 shows the nutritional values of different types of nuts and seeds. Selection of nuts and seeds should be based on nutritional requirements.

Table 3: Nutrient content of 100 g of nuts and seeds

Food name	Energy	CHO	Protein	Fat	Fibre	Calcium	Iron	Vit A	Vit C	Vit E	Thiamin	Riboflavin	Niacin	Zinc
	(Kcal)	(g)	(g)	(g)	(g)	(mg)	(mg)	(ug)	(mg)	(mg)	(mg)	(mg)	(mg)	mg
Beach almond, Fiji, raw, *Terminalia catappa*	433	0.2	15.9	39.9	7.5	230	4.6	t	4.0	17.3	0.09	0.05	0.6	4.9
Beach almond, Vanaatu, raw, *T. catappa*	272	2.4	9.6	24.0	5.9	83	0.2	1	11.0	12.0	0.11	t	0.8	0.4
Betel nut, kernel, raw	352	52.8	5.2	10.3	16.6	400	4.9	0	t	6.4	0.19	0.52	1.1	3.1
Brazil nut, kernel, raw	690	2.4	14.4	68.5	8.5	150	2.2	1	0	7.2	0.60	0.43	0.6	4.1
Breadfruit, seeds, boiled	155	27.3	5.3	2.3	3.0	69	0.7	0	6.1	na	0.34	0.19	6.0	0.8
Breadfruit, seeds, roasted	191	34.1	6.2	2.7	3.7	86	0.9	0	7.6	na	0.41	0.24	7.4	1.0
Candlenut, kernel, raw	648	3.3	18.2	62.3	5.2	154	3.4	0	0	6.4	0.08	0.06	0.4	3.0
Cashew, roasted, salted	633	26.3	16.7	51.3	4.3	32	6.3	1	0	1.3	0.49	0.22	2.0	5.3
Chestnut, Tahitian, boiled	153	27.4	3.4	0.8	4.7	38	1.4	t	11	0.9	0.08	t	1.8	0.8
Chestnut, Tahitian, roasted	225	39.5	5.9	4.2	4.2	29	1.3	0	2.0	1.4	0.26	0.09	0.9	1.3
Cut nut, Fiji, raw, *Barringtonia edulis*	262	25.1	9.7	11.8	10.2	11	2.4	3	7.0	na	0.15	0.02	2.6	2.3

Cut nut, Vanaatu, raw, *Barringtonia edulis*	433	7.1	11.6	38.2	10.4	48	2.7	17	6.0	na	0.12	0.04	2.9	3.0
Jakfruit, seeds, boiled	155	32.8	5.0	0.2	2.0	37	0.7	0	8.0	na	0.08	0.05	0.4	na
Macadamia nut, kernels, raw	734	4.5	7.6	76.2	6.0	48	1.8	0	1.0	1.5	0.28	0.10	2.0	1.2
Java almond, Ngali, raw, *Canarium indicum*	461	0.5	8.2	45.9	10.6	44	3.5	14	8.0	na	0.13	0.06	1.7	2.4
Melon seeds, seeds coat removed	590	8.4	25.8	49.7	6.7	53	7.4	t	t	na	0.10	0.12	1.4	4.0
Pandanus nut, sauce	172	3.9	1.4	16.7	1.5	134	5.7	15	2.0	6.5	0.04	0.06	2.5	3.4
Pandanus nut, kernel, dried	533	18.7	11.7	43.8	13.0	12	t	32	0	6.4	0.48	0.13	5.0	2.9
Pandanus nut, kernel, raw	380	11.4	15.0	30.0	4.6	10	t	25	0	1.0	0.38	0.10	4.0	2.4
Pandanus nut, kernel, roasted	195	6.8	4.1	16.3	3.7	4	t	11	0	0.4	0.16	0.04	1.7	4.2
Peanut, kernel and skin, roasted, salted	629	14.4	24.4	51.7	8.3	50	2.4	t	0	0.7	0.35	0.15	18.0	3.0
Peanut, kernel, roasted, salted	636	14.1	25.1	52.8	6.2	40	1.2	t	0	0.7	0.35	0.15	18.0	3.0
Pili nut, PNG, kernel, dried	591	18.5	12.1	51.8	5.5	115	2.5	2	0	6.0	0.92	0.10	0.4	2.8
Pili nut, PNG, kernel, raw, ripe	588	3.3	10.2	59.3	4.8	100	2.2	2	0	5.2	0.80	0.10	0.3	2.4
Pistachio nut, kernels, raw	572	6.8	19.1	50.6	9.0	90	3.9	11	0	5.3	0.58	0.29	1.5	2.3
Pumpkin seeds, raw	565	19.8	29.4	40.4	5.4	39	10.0	19	0	20.0	0.23	0.32	1.7	6.6
Watermelon, seeds, dried	566	25.8	22.7	41.2	4.2	82	7.7	1	t	16.6	0.22	0.10	2.6	7.0

Source: Dignan et al. 2004
Abbreviations: na, not available; PNG, Papua New Guinea; t, trace; vit, vitamin.

Roasted peanuts are nutritious and better as a snack than flavoured snack foods such as cheese-flavoured snacks sold in shops. Children should be encouraged to eat foods made from nuts and seeds as a snack or part of their main meal.

Functional properties

Most nuts are rich in fats and oils, especially omega-3 and omega-6. However, it is important to note that a balance in the consumption between omega-3 and omega-6 is important in maintaining good health.

Glycemic responses

Nuts and seeds differ in their ratio of carbohydrate, fat and fibre compositions and these affect their glycemic responses. The lower the carbohydrate, the higher the fat and fibre content, and the lower the glycemic index (GI), which indicates how much the food will raise a person's blood glucose level after eating it.

Nuts have a low GI, compared to white bread (GI 77). Consuming low GI food is associated with a lower risk of developing developing diabetes and coronary heart disease.

Table 4: Glycemic index of common nuts

Food item	Glycemic index (GI)
Cashew nuts, salted (Australia)	22 ± 5
Cashew nuts (UK)	25 ± 6
Mixed nuts, roasted and salted	24 ± 10
Peanuts, crushed (South Africa)	7 ± 4
Peanuts (Canada)	13 ± 6
Peanuts (Mexico)	23

Source: www.medosa.com/gilists.htm
Note : Serving size = 50 grams.

Storage and preservation

Drying is the best way to preserve nuts and seeds. Pick them fresh and then dry them in the sun to remove as much water as possible. The more water that is removed, the longer they will keep. To store most nuts, place them in a basket and leave in a cool, dry place. They will keep for months if free of insects and disease. Peanuts, pumpkin and breadfruit seeds can also be baked or roasted and then stored in airtight containers for a long time. Roasting will also help remove water faster and make the nuts more tasty and crunchy to eat.

To roast peanuts over the fire, place whole peanuts in their shells on a tray or frying pan. Put this over the fire until the peanuts are cooked. Turn occasionally for even roasting or mix sand with the peanuts before putting them onto the tray or frying pan. This will keep them from burning and help them to roast evenly.

To roast peanuts in an oven, place shelled peanuts one layer deep in a shallow pan. Roast the shelled nuts at or 180°C (350°F) for 15–20 minutes until golden brown. Stir occasionally for even roasting.

Dried nuts and seeds can be ground into flour and used in different recipes. For example, they can be added to soups or mixed with a cooked, mashed staple food for the baby. Flour made from peanuts is a very good food for babies.

Value-addition

Popular and nutritious food products can be made using dried nuts and seeds. One such product is peanut butter. To make it, use shelled, dried and roasted peanuts. Remove their skins and then grind the nuts. Add a little salt and oil to the peanut mixture and grind well. When the mixture is ready, store it in clean, airtight containers. Peanut butter is a good food for children's school lunches. Do not store for longer than one week if not stored in the refrigerator.

Dried nuts and seeds can be ground into flour and used in baking, as garnishes, in soups and other dishes.

Preparation and cooking

Freshly picked, some nuts and seeds are delicious when eaten raw, while others need to be dried, roasted or cooked. They can be boiled with other vegetables, then mashed, strained and added to soups, stews and casseroles. After being cooked, roasted or dried, they can be chopped or ground finely. This makes an excellent addition to cooked mashed vegetables, breadfruit and bananas,. The ground nuts/seeds can also be added to starch such as sago, to make puddings and desserts.

Older children can eat nuts whole, as snacks or in salads. Some edible nuts and seeds (e.g. red bead [*Adenanthera pavonina*], cashew nuts and peanuts) can be dried, roasted and then used as snacks for the whole family.

Most nuts and seeds need to be prepared in such a way that eating them is easy for young children and old people who may have no teeth.

Peanuts must be cooked

Some nuts (e.g. peanuts) must be cooked either by roasting or by boiling. Raw peanuts contain a substance that prevents our bodies using the protein in the peanuts. Cooking destroys this substance. Cooked nuts provide protein that the body needs for growth.

Recipes

1. Polynesian breakfast

Number of servings: four

Nutrition facts
One serving size: 288 g

Amount per serving
Energy: ..... 2114 kJ (503 kcal)
Fat: ..... 14 g
Carbohydrate: ..... 80 g
Protein: ..... 10 g
Iron: ..... 4.2 mg
Sodium: ..... 22 mg

4 cups grated raw chestnut kernel
½ cup thick coconut cream
½ cup water
2 softened banana leaves

1. Place the grated chestnut kernel in a bowl.
2. Add the coconut cream.
3. Wrap the mixture in softened banana leaves and bake in an earth oven or steam until cooked.
4. Serve as a breakfast dish for the family.

2. Healthy nut bars

Number of servings: eight to ten

Nutrition facts
One serving size: 108 g

Amount per serving
Energy: ..... 2097 kJ (499 kcal)
Fat: ..... 39 g
Carbohydrate: ..... 19 g
Protein: ..... 17 g
Iron: ..... 2.6 mg
Sodium: ..... 165 mg

3 eggs, beaten
¼ cup sugar
1 cup wholemeal flour
¼ cup skim milk
½ teaspoon baking powder
3 cups chopped mixed nuts
½ cup grated coconut

1. Mix the eggs and sugar, then add the flour, skim milk and baking powder.
2. Add the chopped nuts and coconut. Mix well.
3. Spread onto a well-oiled 20 cm square baking pan.
4. Bake in a moderate oven (180°C or 350°F) for 30 minutes.
5. Cut into squares while still warm. Cool and store in an airtight container.

Note: This is a delicious and nutritious snack for children, but make sure they clean their teeth well after eating it.

3. Mixed nut bread

Number of servings: six

Nutrition facts
One serving size: 173 g

Amount per serving
Energy: ..... 3614 kJ (860 kcal)
Fat: .....61 g
Carbohydrate: .....54 g
Protein: .....24 g
Iron: .....3.1 mg
Sodium: ..... 632 mg

½ cup butter or margarine
¾ cup sugar
2 eggs
2 cups sifted flour
1 teaspoon baking soda
½ cup mixed nuts
¼ teaspoon salt
1 tablespoon lime or lemon juice
½ cup mango pulp

1. Cream the butter or margarine and sugar together.
2. Beat in the eggs gradually.
3. Stir in the dry ingredients.
4. Mix the mango pulp and lime juice and add to the butter mixture.
5. Put into a greased loaf tin or other baking dish.
6. Cook in a moderate oven (180°C or 350°F) for 1 hour.
7. Mango nut bread is better if it is cut 2 or 3 days after baking.

4. Pawpaw seed dressing

Nutrition facts
One serving size: 78 g

Amount per serving
Energy: ..... 1558 kJ (371 kcal)
Fat: .....37 g
Carbohydrate: .....9.7 g
Protein: .....1.7 g
Iron: 0.8.....4 mg
Sodium: ..... 5 mg

1 cup white vinegar
½ cup sugar
1 teaspoon seasoned salt
1 teaspoon dry mustard
2 cups oil
1 small onion, chopped
2 tablespoons fresh pawpaw seeds

1. Place the vinegar and dry ingredients in a bowl. Whisk or beat very hard with a fork and gradually add the oil to make a smooth sauce.
2. Add the chopped onion and beat well.
3. Finely chop or mash the pawpaw seeds with a fork.
4. Add the seeds and beat the mixture well.
5. Use as desired as a dressing for fruits or green salads.

Note: A much smoother dressing can be made by using a blender instead of whisking or beating by hand.

5. Surprise salad dressing

Nutrition facts
One serving size: 94 g

Amount per serving
Energy: ..... 1711 kJ (407 kcal)
Fat: .....30 g
Carbohydrate: .....31 g
Protein: .....4.3 g
Iron: .....0.41 mg
Sodium: .....82 mg

¼ cup peanut butter
¼ cup honey
½ cup mayonnaise or salad dressing
½ cup chopped ripe fruits such as pawpaw, pineapple and mango

1. Mix the peanut butter with the honey.
2. Fold in the mayonnaise or salad dressing.
3. Add the chopped fruits.

Use as a salad or coleslaw dressing.

6. Peanut salad

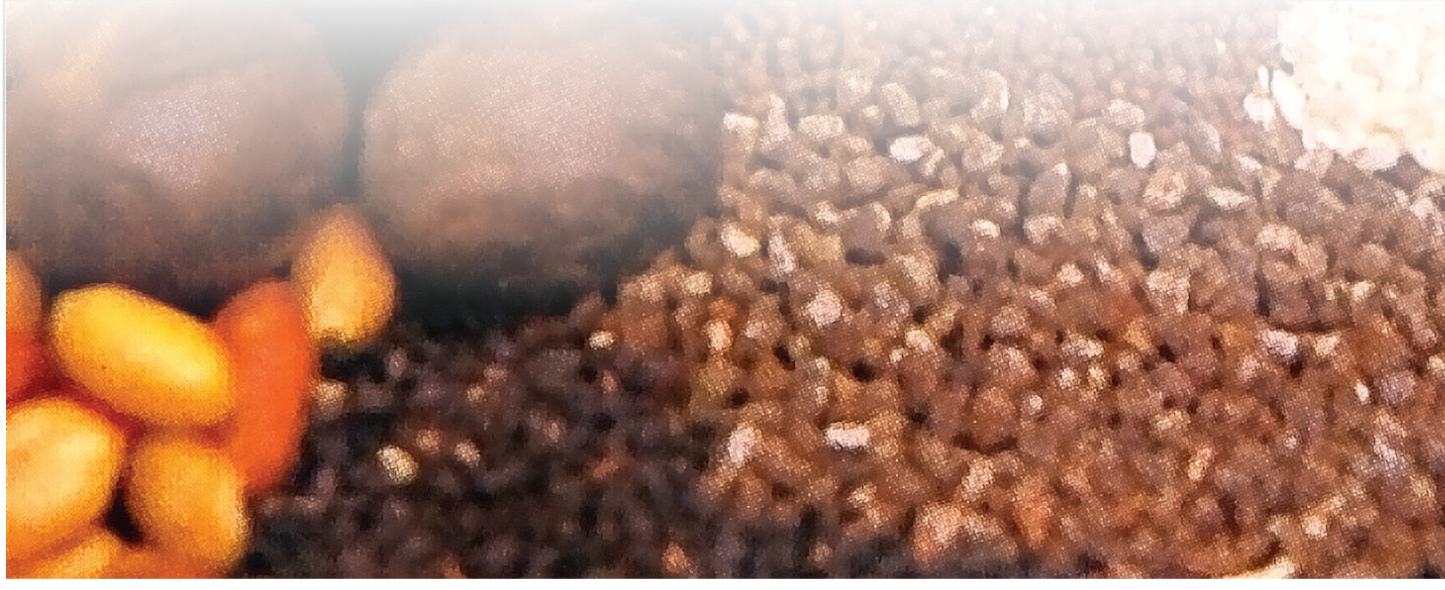
Number of servings: two

Nutrition facts
One serving size: 120 g

Amount per serving
Energy: ..... 1244 kJ (296 kcal)
Fat: .....18 g
Carbohydrate: .....25 g
Protein: .....7 g
Iron: .....0.83 mg
Sodium: .....123 mg

1 peeled ripe banana
½ cup coarsely chopped peanuts or 2 tablespoons peanut butter
2–4 lettuce leaves
2 tablespoons mayonnaise or Surprise salad dressing

1. Make a cut all the way along the top of the banana, being careful not to cut all the way through.
2. Spread the cut slightly and fill with coarsely chopped peanuts.
3. Serve on a lettuce leaf with mayonnaise or Surprise salad dressing.



7. Peanut stew

Number of servings: four

Nutrition facts
One serving size: 420 g

Amount per serving
Energy: ..... 1965 kJ (468 kcal)
Fat: .....25 g
Carbohydrate: .....50 g
Protein: .....10 g
Iron: .....2.5 mg
Sodium: ..... 178 mg

8 small sweet potatoes
4 spring onions
4 tomatoes
4 tablespoons oil
½ cup roasted peanuts
½ cup water
1 cup green leaves
1 or 2 cups water

1. Wash and peel the sweet potatoes, then cut them into pieces.
2. Wash the spring onions and tomatoes, then chop them into small pieces.
3. Fry the onions and tomatoes in the oil until soft.
4. Add the roasted peanuts and sweet potatoes. Add the water.
5. Boil for about 30 minutes or until the peanuts and sweet potatoes are soft.
6. Add the green leaves and cook for 5 more minutes.
7. Serve hot or cold.

Note: This is a very nutritious and tasty dish for children.

8. Tahitian chestnut cake

Number of servings: four

Nutrition facts
One serving size: 233 g

Amount per serving
Energy: ..... 2473 kJ (589 kcal)
Fat: .....18 g
Carbohydrate: .....90 g
Protein:.....16 g
Iron: .....3.5 mg
Sodium: .....61 mg

1 cup grated chestnut
3 eggs
½ cup coconut cream
½ cup sugar
2 cups flour
2 tablespoons baking powder
1 softened banana leaf

1. Mix all ingredients (except the banana leaf) to a moist consistency.
2. Wrap in prepared banana leaf.
3. Bake in an earth oven for 1 hour.
4. Serve with hot lemon-leaf tea.

Note: Mashed banana can be added for extra flavour. Aluminium foil can be used instead of banana leaf.

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Fish

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Introduction

Fish is a major source of food in the Pacific, mostly eaten with the traditional staples — root crops, breadfruit and bananas. It is often cooked with green leaves and coconut cream, providing an appetizing, delicious and nutritious meal for the whole family.

In the past, fish was available mainly to communities living near the sea. Today, with modern methods of fishing, transport, storage and preservation, fish and its by-products are available to many more people. Fishery activities provide a major source of income to many Pacific Islanders.

Major types of fish

Fish belong to the group of marine animals that live in the sea, on coastal reefs and shores, and in lagoons, lakes and rivers. The two basic types, fresh-water fish and sea fish, can be further classified into lean and fatty fish.

The Pacific Ocean contains a dazzling variety of fish, with many variations in colour, shape, size and habitat. Some common fresh-water fish include eel, perch, zander, carp and river trout. Sea fish can be divided into reef fish and deep-sea fish. Some common reef fish include parrotfish, spinefoot, emperor, grouper, goatfish, milk fish, snapper, surgeonfish and unicornfish. Common deep-sea fish include tuna, marlin, swordfish, wahoo, Spanish mackerel and barracuda.

Design and layout: Muriel Borderie - SPC Publications Section

Fishing activity

Because the Pacific is a maritime region, fishing is an integral part of Pacific life and culture. It is a source of livelihood as well as a means of gathering food for survival. In the early days, fish were caught by many traditional methods, some of which (such as ocean fishing in canoes, fence traps built on reefs or out from the shore-line to catch migrating coastal fish) are still in use today. Modern fishing practices, methods and techniques include monofilament longline fishing and gill nets, the use of out-boat engines, the use of aggregated fishing devices (FADs) to attract fish, trawling, and bottom and midwater handling. By far the largest fishing activity in the Pacific today is the harvesting of tuna by ships using longlines that can stretch up to 50 kilometres (30 miles), poles and lines, and purse seines, which are large nets that surround and enclose the fish. Many of the fish caught by this fishing industry are exported to countries outside the Pacific. The overfishing of deep-sea fish and, more especially, of reef fish is a problem, which is compounded by climate change. Because fish are an important source of protein food and a source of livelihood in the Pacific, they must be protected.

Whatever the method used, the art of catching fish depends on the skill and experience of the fisherman. For more detailed information, contact your nearest fisheries officer.

Nutrient content

Fish is an excellent food for people of all ages, but particularly for babies and young children.

Fish is a high protein food, rich in amino acids, especially essential amino acids. The protein in fish is of high quality and is more digestible than the protein in beef and pork. This makes it one of the best body-building foods.

Some fish are very good sources of calcium. Calcium is needed by the body to make strong bones and teeth. Useful amounts of other minerals, such as iodine and fluoride, not normally found in meat, are found in fish. Most of these minerals help the body to function properly. Iodine prevents goitre, a disease of the thyroid gland, and fluoride helps to prevent tooth decay.

Fish also contain vitamins A, B and D (see Table 1). Oily fish, such as mackerel and tuna are especially good sources of vitamins A and D. Vitamin A is needed for proper growth, healthy eyes and skin, and protection from infections. Vitamin D assists in normal bone growth,

Lean fish contain very low amounts of fats and oils.

When small fish are cooked, the bones become soft and can be eaten. They are good sources of calcium and vitamin D.

Table 1: Nutrient content of 100 g fish

Food name	Energy	CHO	Protein	Fat	Fibre	Calcium	Iron	Vit A	Vit C	Vit E	Thiamin	Riboflavin	Niacin	Vitamin B12	Zinc	Sodium	cholesterol
	(Kcal)	(g)	(g)	(g)	(g)	(mg)	(mg)	(µg)	(mg)	(mg)	(mg)	(mg)	(mg)	mg	mg	mg	mg
Eel fish	73	t	16.1	0.9	0	330	0.8	829	3.0	3.2	0.12	0.03	2.8	2.40	1.3	41	100
Fish, *L. xanthophilus,* baked, earth-oven	139	0	29.1	2.4	0	6	0.5	t	0	1.0	t	t	5.8	3.23	0.5	51	98
Fish, dried and salted	185	0.4	42.0	1.5	0	174	1.7	0	0	2.4	0.06	0.31	4.6	12.0	1.2	1730	90
Fish, battered, commercial, deep-fried	252	13.9	14.2	15.7	0.5	24	0.7	0	0	0.2	0.09	0.04	3.6	0.91	0.5	470	25
Fish, finger, frozen, grilled	224	19.1	11.6	11.3	1.0	35	1.0	410	0	1.5	0.07	0.05	1.5	0.80	0.5	320	31
Mackerel, fried	187	0.0	21.5	11.3	0	28	1.2	52	0	0.4	0.09	0.38	8.7	4.20	0.5	152	68
Mackerel, frigate, boiled	147	0.4	27.2	3.9	0	44	6.3	6	1.8	1.4	0.11	0.30	21.6	3.67	0.8	82	95
Mackerel, Spanish, *Scomberomorus niphonius,* cooked	180	0.1	21.6	10.4	0	14	0.9	13	0	1.4	0.09	0.36	9.7	7.50	0.7	70	75
Mackerel, canned in natural oil	182	0.1	18.6	12.0	0	297	2.5	160	1.1	1.2	0.05	0.26	7.6	8.50	1.3	466	97
Mullet, fried	206	2.9	23.2	11.3	0	26	0.6	7	1.6	1.3	0.00	0.11	5.1	2.00	1.2	162	85
Mullet, steamed	134	0	22.0	5.0	0	40	0.6	8	0	0.6	0.00	0.13	4.7	2.00	1.1	144	95
Reef fish, composite, baked/grill	130	0.4	24.1	3.4	0	24	0.7	17	1.3	1.0	0.08	0.11	4.0	1.70	0.7	85	55
Reef fish, composite, steam/poach	109	0.3	21.4	2.4	0	29	0.4	4	0.5	0.8	0.07	0.09	3.4	2.50	0.6	108	76
Salmon, pink, solids & liquid, can	134	0	19.8	6.1	0	213	0.8	17	0	1.7	0.02	0.19	6.5	4.40	0.9	554	55
Sardines, canned in oil, drained	227	0	21.8	15.7	0	381	2.7	65	0	0.3	0.00	0.25	8.2	11.4	1.8	608	114
Shark, blue, boiled	123	0.1	23.9	2.9	0	6	0.5	11	t	1.1	0.11	0.13	1.0	4.00	0.4	266	70
Shark, temperate, flesh, steamed	125	0	30.3	0.2	0	8	0.3	t	0	1.1	0.00	0.07	6.5	1.64	0.4	94	55
Snapper, steamed	122	0	24.2	2.7	0	30	0.3	8	t	0.7	0.09	0.05	5.2	3.20	0.6	102	89
Tuna, canned in brine	109	0	22.1	2.2	0	8	1.0	15	0	0.6	t	0.10	7.4	3.80	0.9	390	43
Tuna, canned in oil	290	0	20.8	23.2	0	5	0.6	19	0	0.6	t	0.09	8.1	4.80	0.8	417	33
Tuna, composite, flesh, baked	204	0.3	24.7	11.6	0	9	1.4	111	0.3	0.4	0.05	0.03	2.1	0.70	0.7	48	56
Tuna, composite, flesh, steamed	208	0.3	25.2	11.8	0	9	1.4	113	0.3	0.4	0.05	0.03	2.2	0.70	0.8	49	58
Tuna, yellowfin, smoked	152	2.1	27.2	3.7	0	2	t	28	t	0.4	0.06	t	8.3	0.61	0.6	40	98

Source: Dignan et al. 2004
Abbreviations, CHO, carbohydrate; t, trace; vit, vitamin.

Functional properties

Apart from the nutritional content described above, fish contain other functional properties including omega-3 fatty acids and antioxidants, which can protect cells from damage, lower the risk of cardiovascular disease and provide other health benefits. Omega-3 fatty acids are unsaturated fatty acids, which are essential for normal growth and functions. Because they are not produced by the body, they can only be obtained through the food we eat.

Omega-3 fatty acids

Functional properties of fish differ significantly depending on the bioactive components present in fish. The most important omega-3 fatty acids found in seafood (especially fatty fish) **are eicosapentaenoic acid** (EPA) and **docosahexaenoic acid** (DHA). Both are polyunsaturated fatty acids.

The main health benefit provided by these omega-3 fatty acids is their effect in reducing the risk of coronary heart diseases. This influence was first discovered by researchers who studied the health of a Greenland Inuit tribe who consumed high levels of omega-3 fatty acids from eating fatty fish, but who had very low prevalence of cardiovascular diseases. Consumption of these omega-3 fatty acids has also been found to provide additional defences against other degenerative diseases such as asthma, arthritis, diabetes, multiple sclerosis, hypertension, migraine headaches, cancer and some kidney diseases. More research is needed to confirm these claims, however.

Post-harvest fisheries

Fish is a perishable food and spoils quickly,. It needs to be handled carefully to avoid spoilage.

Fish spoilage is caused by:

- autolysis and bacterial spoilage;
- oxidation and rancidity of fats and protein denaturation;
- micro-organisms of fish and fishery products;
- rigor mortis – pre-rigor, rigor and post-rigor conditions.

Accelerated spoilage is enhanced by breaking the cold chain — i.e. exposing fish to room temperature — and poor hygiene practices.

Fish poisoning

A common type of fish poisoning in the tropics is *ciguatera poisoning*. This is caused by eating fish that contain concentrated amounts of ciguatoxins, which fish get from ingesting certain kinds of marine algae. As the toxins progress up the food chain, they accumulate and by the time humans consume infected fish, the toxins are concentrated. Ciguatera poisoning can be fatal, especially if the toxin is ingested in large amounts. The toxin tends to be accumulated in the fish liver and other organs rather than in the flesh. When ingested by humans, the toxin also tends to accumulate in the liver, so the effect is cumulative over time, i.e. the symptoms intensify each time the person eats infected fish. When in doubt about the quality of the fish, contact the local fishery officer or public health inspector in your area.

Fish selection

Fresh fish is best. Fish bought from the local fisherman or market may be a few days old or may not have been chilled properly. It is important to know what to look for when judging the freshness..

Generally the freshness of fish can be judged by its appearance and smell. Make sure that the eyes are moist, bright and full, and that the skin is shiny and has the right colour for that type of fish. The flesh must be firm, not soft and slimy, and when pressed with a finger it should bounce back. The gills should be bright red, free from slime and have no strong smell.

Storage and preservation

It is always wise to clean the fish and remove the stomach and gills soon after catching. This will help the fish to stay fresh for some time.

Ways of preserving fish include icing, freezing, curing, drying and smoking.

Table 2: Amount of omega-3 fatty acid per 85 g cooked edible portion of different types of fish

Fish with 0.5–1 g omega-3 fatty acids	Fish with > 1 g omega-3 fatty acids
Swordfish, rainbow trout and bluefish	Herring, mackerel (Pacific, Jack, Spanish), salmon (Atlantic, King, Pink), Tuna (Bluefin), whitefish

Icing or chilling

Chilling in the refrigerator is one way of keeping fish fresh for a short period of time. Fish can be kept fresh this way for only 7–14 days, as the temperature is approximately 4°C, which is not cold enough to stop spoilage for long.

Freezing

Freezing is storing fish at a temperature below –18°C in the freezer. If cleaned and packed well, fish can be preserved this way for 3–6 months.

Other methods

Other preservation methods include drying, salting, smoking, canning, pickling and fermentation. The most common traditional methods of preserving fish in the Pacific are drying, smoking and salting.

Drying is an important method of preserving fish. First, remove the insides and the scales and clean the fish thoroughly. Medium-sized or large fish should be split in half length-wise through the stomach and head. Small fish can be left whole. The fish should be treated with salt before they are dried. There are two ways of doing this:

Method 1: Fill a basin with sea-water and keep adding salt until the fish start to float in the water. Leave the fish in the salt water for 2–6 hours, depending on how long you want to store them.

Method 2: Place the fish on a clean, wooden board. Using a clean, sharp knife, make shallow cuts in the flesh so that the salt can penetrate it. Mix three parts water salt to one part salt until nearly all the salt has dissolved. Add the fish, making sure they are covered and kept under the salt and water mixture. Soak for 1–2 hours. Then wash in fresh water.

The fish should be put out to dry in a sunny, windy spot. Either lay them on a wire mesh or hang them up. Drying will take 3–5 days.

Fish can also be dried by smoking after being soaked in salt water. Smoking is exposing fish to smoke from a slow-burning hardwood fire or an electrical or liquid smoke oven. Two methods of smoking fish are: hot smoking (at temperatures of 80°–90°C), and cold smoking (lightly brining and smoking at temperatures not exceeding 30°C). If smoking over a fire, thread the fish on a wire or a bamboo and hang them about three

feet (1 metre) above the fire. The fire should be kept low so that the fish dry slowly but do not cook. There should be smoke, but no flame. After drying, store the fish in clean, dry plastic containers or tightly-wrap them in dry banana leaves until required.

Salting is the use of either dry salt (kenching) or wet salt (brining) to preserve fish in which at least 6% of salt concentration is used. Salt is also a major ingredient in the processes of pickling and marinating. Whatever method is used, make sure to:

- use clean water;
- use the correct amounts of fish, salt and water;
- consider the thickness of the fish;
- consider the type of salt.

Canning is a preservation method in which cooked or uncooked fish is sealed in a plated and lacquered steel can and sterilised by heat treatment under high pressure. The temperature required for effective sterilisation varies with the pH of food. With low pH foods such as fish, the temperature is usually as high as 121°C in order to destroy the heat-resistant microorganism, *Clostridium botulinum*. Canned fish sold in supermarkets is processed in this way.

Value addition

Dried, smoked, pickled and fermented fish can be made into different pastes or spreads. Other interesting products include surimi, fish cakes and burgers.

Preparation and cooking

Fish preparation always requires plenty of fresh clean water, a scraper or instrument to scale the fish (for those with scales), a sharp knife and a clean surface or board. It is always wise to wash fish in plenty of fresh clean water before cooking. Make sure the scales, gills and all the organs inside the stomach are removed.

Because fish can spoil very quickly, care must be taken during storage. If the fish is not to be used straight away, keep it in a cold place (refrigerator) or on ice until required. Make sure the fish is covered and protected from flies.

When fish is stored in a refrigerator, make sure the temperature is kept below 4°C (40°F) . Keep fish away from other foods to avoid contamination. If buying frozen fish, make sure it is kept frozen until it is needed. Once thawed, do not refreeze it; use it straight away.

Certain types of fish (e.g. tuna, walu and mullet) can be marinated and eaten raw. Raw fish is a delicacy and many Pacific cultures have their own way of preparing it (see Tahitian salad and Sashimi recipes). Always use very fresh fish.

Cooking

Fish should be cooked as quickly and for as short a time as possible. This will keep the flesh of the fish moist, firm and tasty. Several methods are used to make fish tasty and appetizing.

Boiling, baking and grilling are common methods of cooking fish in the Pacific Islands. Fish can be boiled in water alone or together with coconut cream and green leaves. Lemon juice can be used for additional flavour. The cooking water can be used to make fish soup or sauces. Boiled fish meat without the bones can also be mashed together with sweet potatoes and coconut cream as food for babies aged six months and older.

Baking keeps the goodness inside the fish. Big fish, particularly fatty ones like tuna and mackerel, are best baked. The fish is cleaned and put on clean coconut leaves, which are woven together, keeping the fish inside. The wrapped fish is then baked in an earth oven for an hour. When cooked, the fish can be served with coconut sauce or lemon juice, and cooked root crops.

Grilling is a quick and easy method. The fish is cleaned and prepared before cooking it on top of hot charcoal, hot firewood, or a grill plate. It cooks very quickly in its own natural juices. Make sure that the fish does not burn.

Recipes

1. Grilled fish

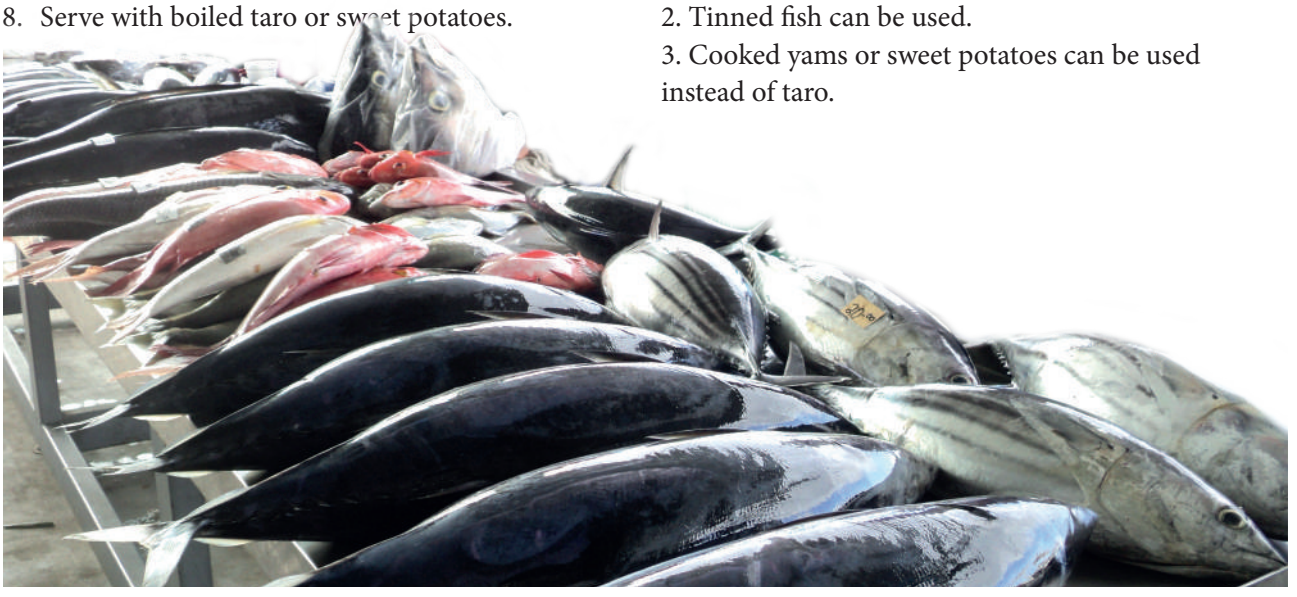
Number of serves: four

Nutrition facts
One serving size: 244 g

Amount per serving
Energy: ..... 1159 kJ (276 kcal)
Fat: .....14 g
Carbohydrate: ..... 6 g
Protein: .....32 g
Iron: .....1.8 mg
Sodium: ..... 115 g

1 medium whole fish (500 grams or about 1 lb)
2 tomatoes
1 small onion
½ cup coconut cream
½ lemon
banana leaf

1. Start the fire or grill plate and then prepare the food.
2. Clean the fish thoroughly.
3. Soften the banana leaf on the fire and prepare by folding in half.
4. Put the fish on the banana leaf and scatter the sliced tomatoes and onion over the top.
5. Add the coconut cream and sprinkle the lemon juice over the top.
6. Wrap everything together and place the parcel on the hot wood, charcoal or grill plate.
7. Cook for 15–20 minutes.
8. Serve with boiled taro or sweet potatoes.



2. Fish cakes

Number of serves: four

Nutrition facts
One serving size: 292 g

Amount per serving
Energy: ..... 1597 kJ (380 kcal)
Fat: .....14 g
Carbohydrate: .....34 g
Protein: .....31 g
Iron: .....2.1 mg
Sodium: ..... 160 mg

2 cups cooked fish
2 cups cooked taro
1 egg
1 small onion (chopped)
salt and pepper (optional)
flour for coating
oil for frying

1. Remove the bones from the fish.
2. Mash the taro.
3. Mix together the fish, taro, egg, chopped onion, salt and pepper.
4. Shape the mixture into flat cakes.
5. Dip the fish cakes in flour.
6. Fry in hot oil.

Note: Makes a delicious snack for young children.

Variations:
1. A few herbs can be added to improve the flavour.
2. Tinned fish can be used.
3. Cooked yams or sweet potatoes can be used instead of taro.

3. Tasty fish snacks

Number of serves: 12 to 15

Nutrition facts
One serving size: 239 g

Amount per serving
Energy: ..... 1782 kJ (424 kcal)
Fat:.....23 g
Carbohydrate: ..... 3 g
Protein: .....52 g
Iron: .....3.5 mg
Sodium: .....1989 mg

2 cups soya sauce
juice of 3 lemons
1 tablespoon sugar
1 teaspoon salt
garlic (ground) (optional)
pepper (optional)
chillies (ground) (optional)
ginger (ground) (optional)
fillet of 1 large fish (approximately 3 kg or 6½ lbs)

1. Prepare a marinade for soaking the fish by mixing the soya sauce, lemon juice, sugar, salt, garlic, pepper, chillies and ginger.
2. Wash, clean and fillet the fish. Remove the skin and carefully cut out any dark red muscle.
3. Cut thin slices of flesh along the length of the fillet, about or 5 mm (¼ inch) thick.
4. Wash, drain and place the slices in the marinade. Cover and place in a refrigerator or on ice to keep cool for approximately 12 hours. Mix occasionally.
5. Remove the fish from the marinade and wash it to get rid of the brown colour of the sauce.
6. Lay the fish pieces out to dry, either on a clean wire-mesh tray in a sunny place for 1 to 2 days, or in a warm oven for 2 hours (40°C or 100°F) until the flesh is completely dry. Turn the strips over regularly.
7. The fish snacks are ready when the flesh is dry and has a tough, chewy texture.
8. Store in clean, dry plastic containers or plastic bags, in a cupboard or cool place.

Note: This is a good snack for children and an excellent way of preserving fish. The slices can also be cooked by soaking in water and cooking with onions and coconut cream.

4. Fish salad

Number of serves: four to six

Nutrition facts
One serving size: 170 g

Amount per serving
Energy: ..... 1384 kJ (330 kcal)
Fat: .....27 g
Carbohydrate: .....1.3 g
Protein: .....22 g
Iron: .....1.0 mg
Sodium: ..... 131 mg

2 cups flaked fish, canned or freshly cooked
½ cup mayonnaise or salad dressing
½ cup celery, diced (optional)
½ cup cooked peas or beans
2 tablespoons chopped onion
3 hard-boiled eggs
6–8 lettuce leaves

1. Combine all the ingredients except the eggs and lettuce, being careful not to break the fish into pieces that are too small.
2. Serve on lettuce leaves.
3. Garnish with the sliced eggs.

5. Raw fish salad (Tahitian style)

Number of serves: six

Nutrition facts
One serving size: 306 g

Amount per serving
Energy: ..... 1297 kJ (309 kcal)
Fat: .....16 g
Carbohydrate: ..... 8 g
Protein: .....32 g
Iron: .....2.7 mg
Sodium: .....99 mg

4–5 slices fresh fish fillet (approximately 600 grams or 1 lb 5 oz)
6 lemons or limes
1 medium onion
2 cloves garlic
1 small piece ginger
3 hard-boiled eggs
2 medium-sized tomatoes
3 spring onions
2 medium-sized carrots
1 cucumber
½ cup coconut cream
salt and pepper

1. Slice the fish and place it in a bowl.
2. Squeeze the limes or lemons and pour the juice over the chopped fish.
3. Slice the onion thinly, crush the garlic and ginger, and mix with the fish.
4. Leave the mixture to marinate for 15 to 20 minutes.
5. Cut the eggs in half along their length, and cut the tomatoes into quarters.
6. Soak the spring onions in water with a little lemon juice added to it.
7. Prepare the carrots and slice or grate them.
8. Peel the cucumber and cut in half. Remove the seeds. Cut into thin slices.
9. After 15–20 minutes, strain the fish quickly to drain off the excess lemon juice. Add the vegetables and coconut cream, salt and pepper to taste, and decorate the top with tomato and hard-boiled eggs.

6. Curried fish with coconut cream

Number of serves: four

Nutrition facts
One serving size: 217 g

Amount per serving
Energy: ..... 2089 kJ (497 kcal)
Fat: .....36 g
Carbohydrate: ..... 8 g
Protein: .....35 g
Iron: .....10 mg
Sodium: ..... 125 mg

1 onion
2 tablespoons margarine or oil
3 tablespoons curry powder
2 cups fish (cubed)
2 cups green pawpaw (peeled and cubed)
1 cup undiluted coconut cream
salt
pepper

1. Cut up the onions and fry in the margarine or oil.
2. Mix together the salt, pepper and curry powder.
3. Add the green pawpaw to the curry mixture. Mix thoroughly.
4. Add this to the onions and stir fry until just soft.
5. Add the fish and continue to stir fry for about 2 minutes.
6. Add the coconut cream and simmer over low heat for about 20 minutes, taking care not to overcook the coconut cream.
7. Serve hot with boiled root crops or brown rice.

7. Baked banana fish

Number of serves: two to four

Nutrition facts
One serving size: 375 g

Amount per serving
Energy: ..... 2940 kJ (700 kcal)
Fat: .....32 g
Carbohydrate: .....71 g
Protein: .....31 g
Iron: ..... 3 mg
Sodium: ..... 147 mg

2 large cooking bananas
1 cup coconut cream
1 tomato, chopped
2 pieces fish fillet (240 grams or ½ lb)
1 small onion, chopped
salt to taste
chillies or shake of pepper (optional)
softened banana leaf

1. Peel and slice the cooking bananas lengthwise. Place them on the softened banana leaf.
2. Add the fish and the rest of ingredients.
3. Wrap everything together and bake in an earth oven for an hour.

Note: Half-ripe cooking bananas give a better flavour.

8. Fresh fish in soya sauce (Sashimi)

Number of serves: four

Nutrition facts
One serving size: 177 g

Amount per serving
Energy: .....797 kJ (190 kcal)
Fat: ..... 6 g
Carbohydrate: ..... 3 g
Protein: .....32 g
Iron: ..... 2 mg
Sodium:.....1818 mg

4 slices of fish fillet (450 g or 1 lb)
½ cup soya sauce
½ teaspoon salt
1 clove garlic
1 onion
2 lemons
1 small piece ginger
2 tablespoons grated radish (optional)

1. Clean the fish and slice thinly.
2. Arrange around a serving dish.
3. Mix the rest of the ingredients in a small bowl and place it in the centre of the serving dish.
4. Using your fingers or cocktail sticks, pick up a piece of fish, dip it in the sauce and eat.

Note: Deep-water fish, e.g. walu or yellowfin tuna, is best for this dish.

9. Fish and yam pie

Number of serves: Four

Nutrition facts
One serving size: 419 g

Amount per serving
Energy: ..... 2318 kJ (552 kcal)
Fat: .....24 g
Carbohydrate: .....34 g
Protein: .....48 g
Iron: ..... 5 mg
Sodium: 99mg

500 grams (1 lb 2 oz) yam
3 onions, peeled and sliced
2 green peppers, seeded
700 grams (1½ lbs) fish fillets
450 grams (1 lb) tomatoes, skinned and sliced
1 lemon
oil

1. Peel and slice the yams and cook immediately in boiling water until just tender; drain.
2. Heat the oil and add the onions, fry gently until clear, then add the sliced peppers and cook for 2 more minutes.
3. Cut the fish into small squares.
4. Lightly oil a shallow dish. Place half the yams in a layer on the bottom, cover with the fish and top with the onion and pepper mixture, seasoning well with salt and pepper. Finish with the remaining yams and the tomatoes. Brush the top with oil and sprinkle with lemon juice.
5. Bake in the centre of the oven for 25–30 minutes.

Note: canned fish may be substituted.

10. Fish in taro leaves

Number of serves: six

Nutrition facts
One serving size: 251 g

Amount per serving
Energy: ..... 1377 kJ (328 kcal)
Fat: .....23 g
Carbohydrate: ..... 6 g
Protein: .....23 g
Iron: ..... 3 mg
Sodium: ..... 103 mg

1 medium fresh fish
24 tender young taro leaves
2 coconuts
3 cups water
2 small chillies
1 small onion
6 cocktail sticks or sharpened fronds from coconut leaf (6 inches long)
salt to taste

1. Grate the coconuts. Add the water, squeeze out the cream. Strain and salt.
2. Scale and clean the fish thoroughly.
3. Cook and remove the flesh from the bones.
4. Chop the onion and chilli finely.
5. Place 3 or 4 taro leaves on top of each other in the palm of your hand. Make a hollow and put in the fish, onions, chillies and coconut cream. Parcel neatly, using coconut fronds or cocktail sticks.
6. Place in a pot. Continue making parcels until all the ingredients are used.
7. Cover the parcels with coconut cream and steam until cooked.
8. Serve with root crops.

11. Savoury fish hash

Number of serves: four to five

Nutrition facts
One serving size: 210 g

Amount per serving
Energy: ..... 1707 kJ (406 kcal)
Fat: .....28 g
Carbohydrate: .....15 g
Protein: .....24 g
Iron: .....1.7 mg
Sodium: ..... 453 mg

2 cups cooked flaked fish or canned fish
1 cup cooked diced taro or sweet potatoes
1 hard-boiled egg, chopped (optional)
2 tablespoons chopped green pepper
½ cup milk
1 teaspoon Worcestershire sauce
2 tablespoons oil

1. Combine all the ingredients except the oil and mix.
2. Heal the oil in a large frying-pan; add the fish mixture and flatten out.
3. Cover and cook over heat until bottom is brown.
4. Fold over and serve.

12. Baked fish loaf

Number of serves: four

Nutrition facts
One serving size: 219 g

Amount per serving
Energy: .....894 kJ (213 kcal)
Fat: ..... 8 g
Carbohydrate: ..... 3 g
Protein: .....31 g
Iron: .....1.7 mg
Sodium: ..... 545 mg

2 cups cooked flaked fish or canned fish
1 egg
½ cup milk
2 teaspoons lemon juice
1 tablespoon melted butter
3 tablespoons minced onions
2 tablespoons chopped green pepper

1. Combine all the ingredients and mix until thoroughly blended.
2. Put the mixture into a buttered baking dish and bake at 200°C (400°F) for 25 minutes.

13. Fish stew

Number of serves: one

Nutrition facts
One serving size: 370 g

Amount per serving
Energy: ..... 2109 kJ (502 kcal)
Fat: ..... 31 g
Carbohydrate: ..... 3 g
Protein: ..... 54 g
Iron: ..... 4.7 mg
Sodium: ..... 146 mg

½ cup water
1 small piece fish fillet
2 tablespoons mixed vegetables, fresh or frozen
1 tablespoon coconut cream

1. Prepare the vegetables and put them in a saucepan with just enough water to cover them.
2. Clean and cut the fish into even pieces. Add to the vegetables. Bring to the boil.
3. Turn the heat down. Add the coconut cream and simmer until the fish is cooked.
4. Mash everything together before serving.

Note: A nutritious meal for infants.

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Seafood

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Photo: Jacob Applebaum

Introduction

In this leaflet, the term 'seafood' refers to anything edible obtained from the sea, apart from fish. It includes different types of shellfish, sea cucumbers, marine mammals, turtles and seaweeds. These are popular foods for Pacific Islanders because of their availability, abundance, excellent flavours and high nutritional value.

Pacific seafoods range from huge turtles to shellfish such as oysters, clams, lobsters, and the tiny edible sea-shells that can be found on sandy beaches. Highly prized for their delicious flavours, many different kinds of seafood are eaten daily in snacks and meals, and as delicacies on special occasions.

In some Pacific Island countries, certain kinds of seafood (including marine mammals and turtles) are becoming hard to find due to over fishing or over harvesting, often as a result of an increased demand, particularly for certain kinds of seafood such as lobster and crab. Some countries have laws, including traditional customary laws, to control fishing and to ensure a sustainable supply for future generations.

For more information on seafood in your country, please contact your local fishery officer.

Major types of seafood

This leaflet concentrates on invertebrate seafood (shellfish, sea cucumber, turtles), seaweeds and sea mammals (the only vertebrates). Different types of seafood are shown in Table 1.

Shellfish can be divided into two groups: molluscs and crustaceans. Molluscs make up the largest group of marine animals and include oysters, mussels, clams, octopus and squid. Some of these, such as clams, mussels and oysters, are filter feeders. This means they get their food by filtering the surrounding water

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and retaining any microscopic plants and animals. Crustaceans include crabs, crayfish, lobsters, shrimps and prawns.

Because of the man-made waste in the sea nowadays, especially in lagoon areas, shellfish must be thoroughly cleaned and kept cold or alive, or cooked, before being eaten. They should be collected from waters that are clean and free from pollution.

Some shellfish (e.g. oysters and mussels) can be farmed, which ensures a high-quality, clean, safe supply throughout the year.

Sea cucumbers, also known as *bêche-de-mer*, live in reef areas. They can be collected at low tide or by diving. When processed by smoke-drying, they are considered by the Chinese to be a delicacy. They are also used in many Micronesian and Polynesian dishes.

Sea mammals include dugongs (sea-cows), porpoises and — largest of all — whales. The smaller sea mammals have traditionally been used by Pacific Islanders for food and other purposes, such as tourist attractions and jewellery.

Turtle meat used to be a popular food in the Pacific, and still is in some islands. They were often caught when they came up to the beach to lay their eggs. Like sea mammals, turtles are becoming less common in some Pacific Island countries. Their harvesting is strictly limited by traditional or customary laws in some countries.

Seaweeds are the 'green leaves' of the sea. Different edible varieties are popular with Pacific Islanders. Some are green with tiny bubbles along their stems (sea grapes). Others are dark, greenish-brown with long, soft strands joined together. They are easily collected at low tide.

Nutrient content

Seafood is an excellent source of protein, vitamins and minerals, and contains minute, or trace, amounts of carbohydrates, as shown in Table 1.

Protein in seafoods

Protein is needed to build up tissues and repair the body. Compared with other meat products, seafood is easier to digest because it has softer muscle fibres. Seafood is particularly important for those who do not eat meat, because it provides protein, minerals and vitamins. Seafood mixed with vegetables such as legumes and green leaves provides a good, healthy nutritious meal.

Fats in seafood

Seafood contains small amounts of essential fats and oils; omega-3 fatty acid is thought to protect against heart disease. These oils assist in lowering blood cholesterol, the type of fat that contributes to heart disease. However, people need to be careful in the selection and choice of seafood because some have high levels of cholesterol. Refer to Table 1.

Certain molluscs (clams, oysters and mussels) were thought to be high in cholesterol, but are now known not to be. They contain sterols, which were originally thought to be cholesterol. The presence of these sterols may actually reduce the amount of cholesterol by interfering with the movement of cholesterol within the body.

Vitamins in seafood

Seafood is an important source of the vitamin B complex. It is rich in a type of B vitamin called *pyridoxine,* which helps the body to make proper use of protein. It is also a good source of niacin, the vitamin that helps release energy from carbohydrate foods.

Minerals in seafood

Seafood, especially molluscs such as clams, mussels and oysters, is a good source of iron, which is needed for healthy blood. Seafood, particularly molluscs and crustaceans, is also a good source of many trace mineral elements that the body needs in very small amounts, such as zinc, selenium, fluoride and iodine. Zinc is an essential component of enzymes involved in the release of energy in the body and helps with tissue repair after injury. Selenium assists with certain chemical reactions in the body and helps reduce the toxic effects of some chemicals in the body. Fluoride helps prevent tooth decay, and iodine prevents goitre, a disease of the thyroid gland.

Table 1: Nutrient content of 100 g seafood

Food name	Energy	CHO	Protein	Fat	Fibre	Calcium	Iron	Vit A	Vit C	Vit E	Thiamin	Riboflavin	Niacin	Vitamin B12	zinc	cholesterol
	(Kcal)	(g)	(g)	(g)	(g)	(mg)	(mg)	(µg)	(mg)	(mg)	(mg)	(mg)	(mg)	(ug)	(mg)	(mg)
Ark shell, boiled	164	7.0	31.4	1.0	0	80	9.0	78	0	0.8	0.40	0.30	3.8	107.3	5.3	190
Clam, giant, *Tridacna maxima*, raw	81	t	14.7	2.4	0	2	2.3	11	t	0.4	t	0.09	1.4	57.1	1.5	57
Clam, 'kai', *B. violocea*, meat only, raw	110	0.2	18.6	3.8	0	2	26.8	t	0	0.5	t	t	1.0	70.6	3.8	125
Clam, 'kaikoso', raw, *Anadara sp*	66	t	14.3	0.9	0	2	21.0	9	t	0.3	t	0.13	1.4	51.6	1.6	59
Cockles, boiled	44	1.3	8.5	0.5	0	49	7.9	87	0	1.8	0.02	0.10	1.6	42.1	2.0	136
Cockles, fresh	62	0.6	12.0	1.2	0	238	13.2	117	0	2.5	0.01	0.77	2.8	54.3	1.6	68
Crab, mud, flesh, boiled	109	0.1	24.2	1.2	0	77	2.3	2	5.0	2.3	0.06	0.03	2.6	7.0	5.2	103
Crab, swimming, boiled	102	0.9	19.2	2.3	0	226	1.0	75	3.8	3.6	0.06	0.3	0.9	8.37	4.8	125
Crabmeat, canned in brine	54	1.1	11.1	0.5	0	153	0.9	3	0	2.3	0	0	0	0.15	8.1	74
Cutletfish, fresh	76	0.1	15.9	1.3	0	23	1.8	26	2.0	2.2	0.01	0.10	1.9	1.9	1.7	109
Fish, roe, red	151	0	19.3	8.2	0	29	0.9	67	0	4.5	0.11	0.24	0.1	8.3	1.4	358
Lobster, mangrove, raw, *T. anomala*	78	t	18.2	0.5	0	116	2.3	12	t	1.4	t	0.02	2.4	2.2	5.0	12
Lobster, cooked	97	0	22.0	0.9	0	49	0.2	2	0	1.7	0	0.06	2.1	3.2	3.4	116
Mussel, raw	116	2.4	20.1	2.8	0	64	3.8	189	3.6	0.7	0.06	0.2	3.5	15.5	2.3	33
Mussel, smoked, canned in oil, drained	194	4.4	20.8	10.4	0	68	9.4	96	0	0.7	t	0.48	2.3	18.0	3.7	92
Octopus, cooked	77	0.1	17.3	0.7	0	17	0.6	45	0	0.7	0.03	0.09	2.2	18.0	1.7	95
Oyster, flesh, raw	73	0.6	12.2	2.4	0	134	3.9	23	2.0	0.9	t	0.37	2.0	17.0	65.6	81
Prawn, cocktail	122	6.0	8.1	7.4	0.1	25	1.5	15	3.0	2.9	0.03	0.05	2.3	2.74	0.8	86
Prawn, greater tiger, boiled	115	0	26.3	0.9	0	61	0.9	t	t	1.7	0.08	0.04	3.2	5.0	2.0	244
Prawn, king, cooked	104	0	23.7	0.9	0	135	0.8	1	0	3.5	0.05	0.06	2.1	8.0	1.8	188
Scallop	74	1.8	13.8	1.2	0	49	1.0	13	2.6	0.8	0.02	0.29	2.1	1.32	0.8	40
Scallop, cooked	78	1.9	14.5	1.3	0	52	1.1	22	0	0.8	0.02	0.24	2.1	0.94	2.2	42
Sea cucumber, edible muscle	53	t	12.8	0.1	0	87	1.2	t	2.0	na	t	0.03	t	0	0.2	na
Sea hare, intestines, raw, *Dolabella auricularia*	49	t	9.4	1.2	0	184	3.8	24	t	na	t	0.11	1.2	na	2.5	94
Sea hare, skin, raw, *D. auricularia*	104	t	23.1	1.2	0	2273	4.1	16	t	na	t	0.05	0.6	na	1.1	na
Sea urchin, raw, *Tripneusters gratilla*	91	t	8.2	6.5	0	50	0.9	t	t	na	t	0.11	2.9	na	0.4	na
Sea urchin, flesh, boiled	189	2.6	20.3	10.9	0	24	2.3	467	t	na	0.35	0.38	2.4	na	0.8	372
Seaweed, dried	179	t	18.3	1.2	49.2	235	21.7	0	2.3	4.5	0.07	0.59	0	0	5.3	0
Seaweed, agar	147	t	0.5	0.1	75.2	470	5.4	0	0	1.9	0	0	0	0	5.2	0
Seaweed, *Lumi*, raw, *C. demersum*	11	t	0.8	0.2	3.1	56	7.5	15	t	0.4	t	t	t	0	t	0
Seaweed, *Nama*, raw, *Caulerpa* sp.	7	t	0.4	0.4	0.7	56	8.5	84	t	0.2	t	t	t	0	t	0
Sici-shell, meat, raw, *P. aemingiana*	116	t	26.6	0.9	0	2	2.3	9	t	na	t	t	0.7	na	1.5	na
Squid, fried	205	6.8	23.5	9.4	0	14	1.4	0	0	3.9	0.09	0.06	1.8	1.27	1.4	200
Sting ray, raw	101	0	24.2	0.3	0	10	0.7	12	0	0.9	0.04	0.06	2.9	1.35	0.4	46
Turtle, cooked	91	0	16.4	2.7	0	8	4.9	7	0	0.7	0.10	0.60	3.1	0.67	2.0	32

Source: Dignan et al. 2004
Abbreviations: CHO, carbohydrate; t, trace; vit, vitamin; na, not available

Functional properties

Apart from the nutritional content described above, seafood may also contain other functional properties, including omega-3 fatty acids and antioxidants, which can protect cells from damage, lower the risk of cardiovascular disease and provide other health benefits. It is important to note that seafood has no glycemic index responses because of its limited carbohydrate content, and thus has no or limited effect on the blood glucose level.

Seafood collection

Gathering seafood is part of traditional food harvesting practices in the Pacific and is predominantly carried out by women and children. Certain cultures have their own specialised skills in this kind of activity, such as diving for clams or turtles. These skills are normally shared among members of the family or a particular group. Other activities, such as gathering shells in lagoons or on the reef, do not need a lot of traditional knowledge.

Buying seafood

Seafood is sold in many forms. It is best bought fresh. In areas where fresh seafood is not available, it is sold frozen, canned, dried, smoked or in other preserved forms. Whether fresh, cooked or preserved, sea food must have the right colour. Frozen seafood should be thawed and carefully checked before cooking to find out if the flesh is fresh.

To retain flavour and texture, some seafood, such as oysters, mussels and crabs, must be sold live. A good way of checking if shellfish are alive is by tapping their shells. They should close tightly when tapped. Avoid those that do not close quickly. They should also open quickly when steamed or cooked, if they are fresh.

The appearance of fresh seafood should be bright. The flesh must be translucent or white, firm and springy to the touch. It should not be soft or mushy in texture. Smell is also a reliable guide to the quality of seafood. Fresh seafood has a mild and distinctive seaweed odour. It should taste pleasant and have a mild flavour.

Storage and preservation

Different kinds of seafood are preserved in ways that are suited to their chemical structure, composition and end use. For example, sea cucumber are best dried under the sun or solar drier, or smoked over a very low heat and packed in dry, clean plastic bags, cans or sacks and stored in a cool dry place. Other seafood, such as shellfish and turtle meat, can be smoked, salted and cured. With the availability of freezers, seafood can easily be stored in the cooler and freezer, depending on the storage length required. Cool storage provides a shorter shelf life of 1–2 weeks while freezer storage gves a shelf-life of 3–6 months.

Value addition

Seafood can easily be cured and salted, then used in salad and other seafood dishes.

Preparing and cooking seafood

There are many ways to prepare seafood. Almost all are quick and easy. It is best to slightly undercook seafood, so that it remains tender and moist. Some seafood, such as seaweed and a few varieties of shellfish, can be eaten raw. However, we should be aware of the possible dangers associated with raw seafood, particularly the filter feeders, such as oysters and mussels. If shellfish grow in areas where there is human or animal sewage, they may contain large numbers of harmful viruses and bacteria, which can cause food poisoning. Most of the harmful viruses and bacteria are destroyed by normal cooking.

Most seafood can be steamed whole, baked, barbecued, grilled and fried. Because it has a low fat and high water content, seafood can easily be overcooked. Overcooking dries out and toughens the meat. It also destroys much of the flavour. Extra care must be taken when grilling or barbecuing low-fat seafood such as lobsters, so as not to overcook it.

Molluscs

- Wash thoroughly to remove dirt and slime. Then choose one of these methods.

1. Boil with the shells on or remove the flesh and steam or boil in coconut cream.
2. Remove flesh, season, wrap in soft banana leaves, and then steam in the pot, bake in the earth oven or grill on hot charcoal. Serve with lemon juice.
3. Remove the flesh and boil with coconut cream and green leafy vegetables.

4. Remove half the shell and boil with coconut cream and chopped onions.
5. Remove the flesh, lightly grill and serve with lemon juice or coconut sauce.

Octopus and squids

- Wash thoroughly to remove dirt and blue-black ink.
- Add sufficient water and boil until tender.
- Serve sliced, with thick coconut cream and lemon juice.

Note: Raw octopus can be softened by beating with a stick, although this is not necessary if the octopus has been frozen. You can also leave the meat wrapped in pawpaw leaves for 30 minutes before boiling it, or put one or two wine bottle corks in the cooking water (remove them before serving!).

Steamed octopus wrapped in leaves

- Place sliced, boiled or smoked octopus in softened banana leaves.
- Tie the parcel and steam for 40 minutes to 1 hour. Serve with cooked taro and boiled green leafy vegetables.

Smoked octopus

- Octopus to be dried or smoked should be prepared by beating or pounding with a stick or by freezing for a few days.
- Hang about 1 metre or 3 feet from the ground.
- Make a smoky fire under the meat. The fire should not be too hot.
- Leave the meat until it is evenly smoked and cooked.
- Store in a cool place away from flies. It keeps for about two days.
- Slice and serve with coconut sauce (thick coconut cream and lemon juice), or boil with coconut cream, chopped onions, tomatoes and a little curry powder (if desired). Simmer until the octopus is tender.

Crabs, crayfish, lobsters, prawns

- Clean and scrub thoroughly to remove dirt and mud. Then choose one of these methods:

1. Crabs: Boil crab meat with coconut cream, chopped onion and tomatoes. Serve with lemon juice and parboiled green leaves such as fern, or edible hibiscus leaves (*bele*, Fiji; *aibika*, PNG; *pele*, Tonga; *kabis aelan*, Vanuatu).
2. Cook crabs or prawns in coconut cream with chopped onions and a teaspoon of curry powder. Simmer until ready (when the claws come off easily with a slight pull).
3. Place seafood meat in a pot of slightly salted, boiling water. Bring back to the boil, and then simmer until the claws come off easily when pulled slightly. (Crabs from mangrove swamps near towns and villages need to be cooked longer to kill germs.) Serve the boiled meat with lemon juice or coconut sauce (coconut cream flavoured with lemon juice).
4. Crabs: Remove the flesh without breaking the top of the shell. Clean the shell carefully. Mix the crab meat with chopped onion, salt, tomatoes, and enough thick coconut cream to moisten the mixture. Fill the shells with the mixture and either boil using thin coconut cream or bake for about 30 minutes in a drum oven or a modern oven.

Sea cucumber

- Clean thoroughly to remove any dirt or slime.
- Drop into a saucepan of boiling water and boil for 5–15 minutes. At this stage, they will swell up and, if left too long, will burst, so watch them carefully.
- Cut open lengthwise and clean the inside.
- Clean the surface by rubbing lightly on a grater, or scrape with a shell until the sandy layer is removed.
- Boil again for 3-4 hours until tender.
- Store in plastic bags or clean plastic containers, in a refrigerator or a cool dry place, and use as required. They will keep for a long time if stored correctly.

Sea cucumber in lemon juice or coconut cream

- Arrange boiled sea cucumber in a saucepan.
- Add lemon juice or coconut cream, salt and chopped onion.
- Bring to boil and cook gently until tender.

Turtle meat

- Clean the turtle meat thoroughly to remove dirt.
- Cut the meat into cubes (the same size as for stewing)
- Chop some onion and chilli (if desired)
- Heat oil and fry chopped onion and chilli.
- Add the turtle meat and fry until all the juice has dried out.

- Season with salt to taste.
- Place the fried mixture in softened banana leaves carefully so that the leaves do not tear. Add two or three tablespoons of water.
- Wrap and tie well.
- Steam for one approximately one hour.

Seaweeds

- Clean thoroughly by washing several times in clean, fresh water to remove all dirt and sand.
- Leave seaweed to soak in a basin of water for about half an hour, and then pour off the water. This helps remove sand.
- Arrange neatly on a dish and serve with lemon juice and chopped onions or fermented grated coconut (*kora*, Fiji), lemon juice and salt to taste. Adding a small tin of fish or the chopped flesh of cooked or raw shellfish will improve the protein content and flavour of the dish.

Recipes

1. Shellfish with coconut cream

Number of serves: six

Nutrition facts
One serving size: 163 g

Amount per serving
Energy: ..... 1096 kJ (261 kcal)
Fat: ..... 20 g
Carbohydrate: ..... 6 g
Protein: ..... 15 g
Iron: ..... 2 mg
Sodium: ..... 228 mg

Approximately ½ bucket cockles, mussels or scallops
2 cups coconut cream
1 tablespoon oil
1 onion (sliced)
1 clove garlic (crushed)
1 teaspoon coriander (crushed)
Salt and pepper (optional)

1. Clean the shellfish with their half-shells on and place in a pot.
2. Pour coconut cream over and cook for 10 minutes.
3. Fry onion, garlic and coriander in oil.
4. Pour over shellfish and cook gently for 10–20 minutes or until the liquid starts to boil.
5. Serve hot with boiled taro or sweet potato.

Variation:
At Step 4, add ½ teaspoon minced fresh ginger, ½ teaspoon turmeric, and 1 teaspoon soya sauce for a spicier flavour.

2. Shellfish salad

Number of serves: four

Nutrition facts
One serving size: 471 g

Amount per serving
Energy: ..... 1991 kJ (474 kcal)
Fat: ..... 24 g
Carbohydrate: ..... 26 g
Protein: ..... 39 g
Iron: ..... 4.8 mg
Sodium: ..... 921 mg

2 cups cooked shellfish
3 cups chopped potatoes (cooked)
2 cloves garlic, crushed
1 teaspoon pepper
⅔ cup oil
⅓ cup vinegar
½ cup chopped parsley
3 tomatoes (chopped)
1 onion (chopped)
6 lettuce leaves
2 lemons

1. Prepare dressing by mixing the crushed garlic, pepper, oil and vinegar until well blended.
2. Line a bowl with the lettuce leaves. Mix the cooked shellfish with the potatoes and the remaining ingredients and place in bowl. Add the dressing.
3. Serve topped with slices of lemon.

3. Seafood pancakes

Number of pancakes: twelve

Nutrition facts
One serving size: 311 g

Amount per serving
Energy: ..... 2217 kJ (528 kcal)
Fat: ..... 27 g
Carbohydrate: ..... 29 g
Protein: ..... 40 g
Iron: ..... 4 mg
Sodium: ..... 796 mg

Filling
3 cups cooked shrimps or prawns (without shells)
1 cup cooked scallops or other shellfish
1 cup thick coconut cream
1 tablespoon oil
1 medium green pepper (diced)
1 small onion (chopped)
grated cheese

Pancakes
1 egg
1 cup milk
2 cups wholemeal flour
3–4 tablespoons oil

1. Cut the cooked seafood into small pieces.
2. Combine with the coconut cream.
3. Lightly fry the onions. Add the green peppers and the seafood mixture. Stir fry for 1 minute. Set aside.

4. Beat the egg in a bowl, add the milk and then gradually add this mixture to the flour. Mix until you have a smooth batter. Leave for half an hour.
5. Add 1 tablespoon of oil.
6. Heat an omelette pan, add just enough oil to coat the base, and then add just enough batter to thinly coat the bottom of the pan.
7. Allow to cook for a few seconds until lightly browned on the bottom.
8. Turn the pancake and brown the other side.
9. Spoon filling on top of pancake, leaving about two inches around the edge.
10. Sprinkle with cheese. Roll into a cigar shape and serve.

4. Seafood salad with avocado

Number of serves: four

Nutrition facts
One serving size: 378 g

Amount per serving
Energy: ..... 1581 kJ (376 kcal)
Fat: ..... 17 g
Carbohydrate: ..... 6 g
Protein: ..... 49 g
Iron: ..... 5 mg
Sodium: ..... 880 mg

500 grams cooked prawns
125 grams white fish fillets, sliced
125 grams scallops
125 grams mussel meat
2 tablespoons lime juice
1 tablespoon chopped shallots
4 small tomatoes
1 small lettuce

Avocado dressing
1 medium avocado
1 small onion, chopped
1½ tablespoons lime juice
2 teaspoons oil

1. Shell the prawns, leaving the tails intact.
2. Combine the lime juice and shallots in a small frying-pan, bring to the boil, reduce heat, add the fish, scallops and mussels. Simmer for about 2 minutes or until seafood is just cooked.
3. Drain (discard liquid) and keep covered in a cool place or in a refrigerator before completing the salad.
4. Prepare the avocado dressing by blending all the ingredients until smooth.
5. Combine the seafood, chopped tomatoes and lettuce in bowl, toss lightly, top with dressing just before serving.

5. Seafood salad

Number of serves: six

Nutrition facts
One serving size: 146 g

Amount per serving
Energy: ..... 980 kJ (233 kcal)
Fat: ..... 15 g
Carbohydrate: ..... 1.8 g
Protein: ..... 23 g
Iron: ..... 2.2 mg
Sodium: ..... 598 mg

3 cups shellfish meat (any shellfish)
juice of 1 lemon
juice of 1 orange
parsley (chopped)
½ cup oil
½ cup vinegar
2 tablespoons chopped red pepper
1 onion (diced)

1. Cook the shellfish.
2. Mix the rest of the ingredients together in a bowl and add the shellfish meat.
3. Leave in bowl for half an hour.
4. Drain off excess liquid.
5. Serve with the chopped lettuce and tomatoes.

Photo: Jacob Appelbaum

6. Crab salad

Number of serves: four

Nutrition facts
One serving size: 308 g

Amount per serving
Energy: ..... 1082 kJ (258 kcal)
Fat: .....14 g
Carbohydrate: .....13 g
Protein: .....17 g
Iron: .....1.9 mg
Sodium: ..... 544 mg

1 cup cooked crab meat
3 cups sliced English cabbage
1 cup grated carrots
½ cup mayonnaise
8 lettuce leaves

1. Mix together the crab meat and prepared vegetables.
2. Add the mayonnaise
3. Mix thoroughly and serve on lettuce leaves.

Serve as a side dish or as a main course.

Photo: Emmanuel Tardy

7. Seafood kedgeree

Number of serves: two

Nutrition facts
One serving size: 466 g

Amount per serving
Energy: ..... 2689 kJ (640 kcal)
Fat: .....19 g
Carbohydrate: .....62 g
Protein: .....56 g
Iron: .....5.5 mg
Sodium: .....1862 mg

2 cups shellfish meat (any shellfish)
2 tablespoons oil
1 onion (sliced)
1 clove garlic (crushed)
2 cups cooked rice
1 hard-boiled egg (chopped)
1 tablespoon soya sauce

1. Lightly cook the shellfish.
2. Heat oil in a saucepan, add the onion, garlic and shellfish meat. Lightly fry for 1 minute, then add the cooked rice and chopped hard-boiled egg.
3. Add soya sauce and mix thoroughly until hot.
4. Serve hot with cooked green leaves or salad.

Note: A good dish when there is left-over rice or cooked shellfish meat in the house.

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Pacific Islands Food leaflets:

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No. 3	-	Sweet potato
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No. 6	-	Banana
No. 7	-	Pumpkin
No. 8	-	Green leaves
No. 9	-	Citrus
No. 10	-	Guava
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No. 12	-	Pandanus
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